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U.S. COAST AND GEODETIC SURVEY

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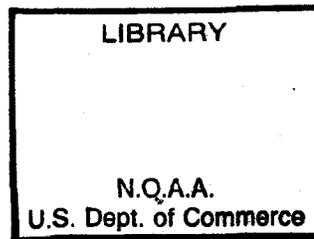
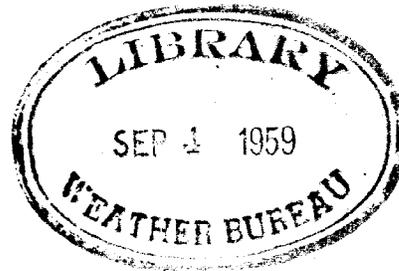
February 21, 1959

# UNITED STATES COAST PILOT 7

## PACIFIC COAST

California, Oregon,  
Washington, and Hawaii

Eighth (1959) Edition



VK  
947  
.N3  
8th ed  
(1959)

United States Government Printing Office, Washington : 1959

For sale by the Coast and Geodetic Survey and its sales agents, \$3.00

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## Preface

This eighth edition of United States Coast Pilot 7, Pacific Coast, includes Hawaii, which formerly was covered in a separate volume. The text is based on the work of the Coast and Geodetic Survey and includes the results of Coast Pilot field inspections made in 1957. Much information also has been obtained from the Weather Bureau, the Corps of Engineers, the Coast Guard, and from local authorities.

This edition is corrected through Notice to Mariners 8 of February 21, 1959, and cancels the 1951 edition of Coast Pilot 7, Pacific Coast, and the 1950 edition of Coast Pilot 10, Hawaiian Islands.

Supplements to this Coast Pilot, containing changes from various sources, usually are issued early each year. Each supplement is complete in itself and cancels all previous issues. The latest supplement, together with Notices to Mariners subsequent to it, will correct the book to date. Supplements may be obtained from the Coast and Geodetic Survey or its sales agents.

Mariners and other interested parties are requested to send to the Director, Coast and Geodetic Survey, U.S. Department of Commerce, Washington 25, D.C., any information affecting this Coast Pilot that may come to their attention.

H. ARNOLD KARO, *Director.*

FEBRUARY 21, 1959.

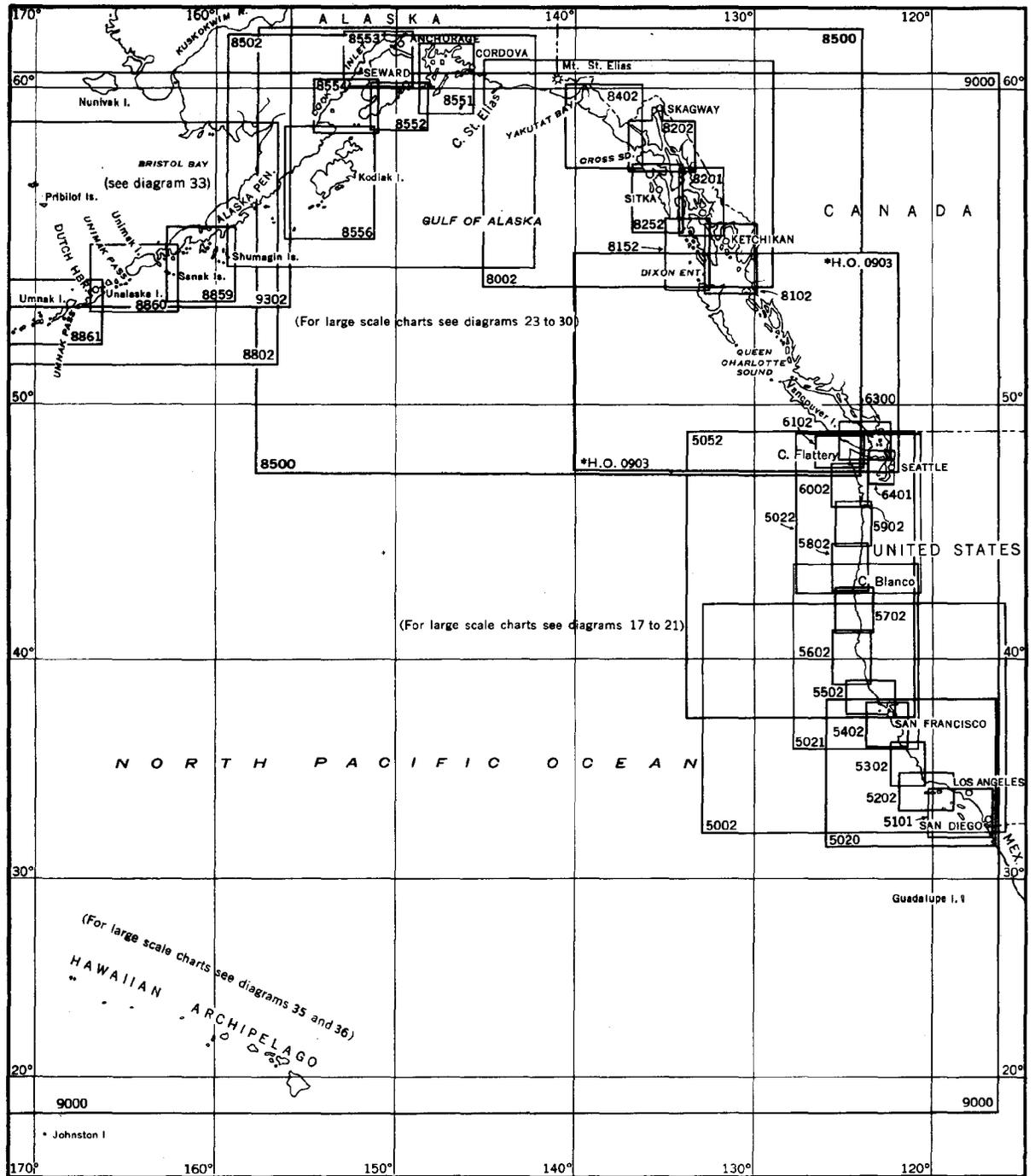


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SAILING AND GENERAL CHARTS - PACIFIC COAST

June 1955



## SAILING AND GENERAL CHARTS—PACIFIC COAST

No.	Price	TITLE	State	Scale	Paper size (inches)
<b>SAILING CHARTS</b>					
5002	\$1.00	San Diego to Point St. George		1:1,412,349	34 X43
†5020	1.00	San Diego to San Francisco Bay		1:868,003	36 X44
†5021	1.00	Monterey Bay to Coos Bay		1:811,980	33 X45
†5022	1.00	Cape Blanco to Cape Flattery		1:736,560	33 X42
5052	1.00	San Francisco to Cape Flattery		1:1,200,000	35 X43
†8002	.75	Dixon Entrance to Cape St. Elias		1:969,756	33 X42
†8500	1.00	Gulf of Alaska—Strait of Juan de Fuca to Kodiak Island		1:2,100,000	33 X44
†8502	1.00	Cape St. Elias to Shumagin Islands		1:969,761	35 X44
†8802	1.00	Alaska Peninsula and Aleutian Islands to Segoum Pass		1:1,023,188	36 X43
†9000	1.00	San Diego to Aleutian Islands and Hawaiian Archipelago		1:4,860,700	36 X44
†9302	.75	Bering Sea—eastern part		1:1,534,076	31 X40
<b>GENERAL CHARTS</b>					
5101	1.00	San Diego to Santa Rosa Island	California	1:234,270	35 X50
5202	1.00	Point Dume to Purisima Point	"	1:232,188	33 X43
5302	1.00	Point Conception to Point Sur	"	1:216,116	33 X46
†5402	1.00	Point Sur to San Francisco	"	1:210,668	33 X42
†5502	1.00	San Francisco to Point Arena	"	1:207,840	34 X42
†5602	1.00	Point Arena to Trinidad Head	"	1:200,000	33 X43
†5702	1.00	Trinidad Head to Cape Blanco	Calif. & Oregon	1:196,948	33 X43
†5802	1.00	Cape Blanco to Yaquina Head	Oregon	1:191,730	33 X43
†5902	1.00	Yaquina Head to Columbia River	Oreg. & Wash.	1:185,238	33 X44
†6002	1.00	Columbia River to Destruction Island	"	1:180,789	33 X41
†6102	1.00	Approaches to Strait of Juan de Fuca—Destruction Island to Amphitrite Point	Wash. & B.C.	1:176,253	35 X44
6300	1.00	Strait of Georgia and Strait of Juan de Fuca	"	1:200,000	31 X44
6401	.75	Admiralty Inlet and Puget Sound	Washington	1:150,000	32 X41
8102	1.00	Hecate Str. to Etolin I., including Behm & Portland Canals	Alaska	1:229,376	34 X43
8152	1.00	Dixon Entrance to Chatham Strait	"	1:229,376	33 X45
8201	1.00	Etolin Island to Midway Islands, including Sumner Strait	"	1:217,828	34 X45
8202	1.00	Midway Islands to Cape Spencer, including Lynn Canal	"	1:209,978	34 X45
8252	1.00	Coronation Island to Lisianski Strait	"	1:217,828	35 X45
8402	.75	Cross Sound to Yakutat Bay	"	1:300,000	33 X42
8551	1.00	Prince William Sound	"	1:200,000	36 X46
8552	.75	Point Elrington to East Chugach Island	"	1:200,000	31 X39
8553	1.00	Cook Inlet—northern part	"	1:194,154	35 X44
8554	1.00	Cook Inlet—southern part	"	1:200,000	34 X42
8556	1.00	Kodiak Island	"	1:350,000	35 X46
8859	1.00	Shumagin Islands to Sanak Islands	"	1:300,000	35 X42
8860	1.00	Unimak and Akutan Passes and approaches	"	1:300,000	35 X44
8861	1.00	Unalaska I. to Amukta I.	"	1:300,000	36 X48

\* H.O. 0903 For sale by the U.S. Navy Hydrographic Office, Washington 25, D.C., and its sales agents.

† Includes Loran Lines of Position

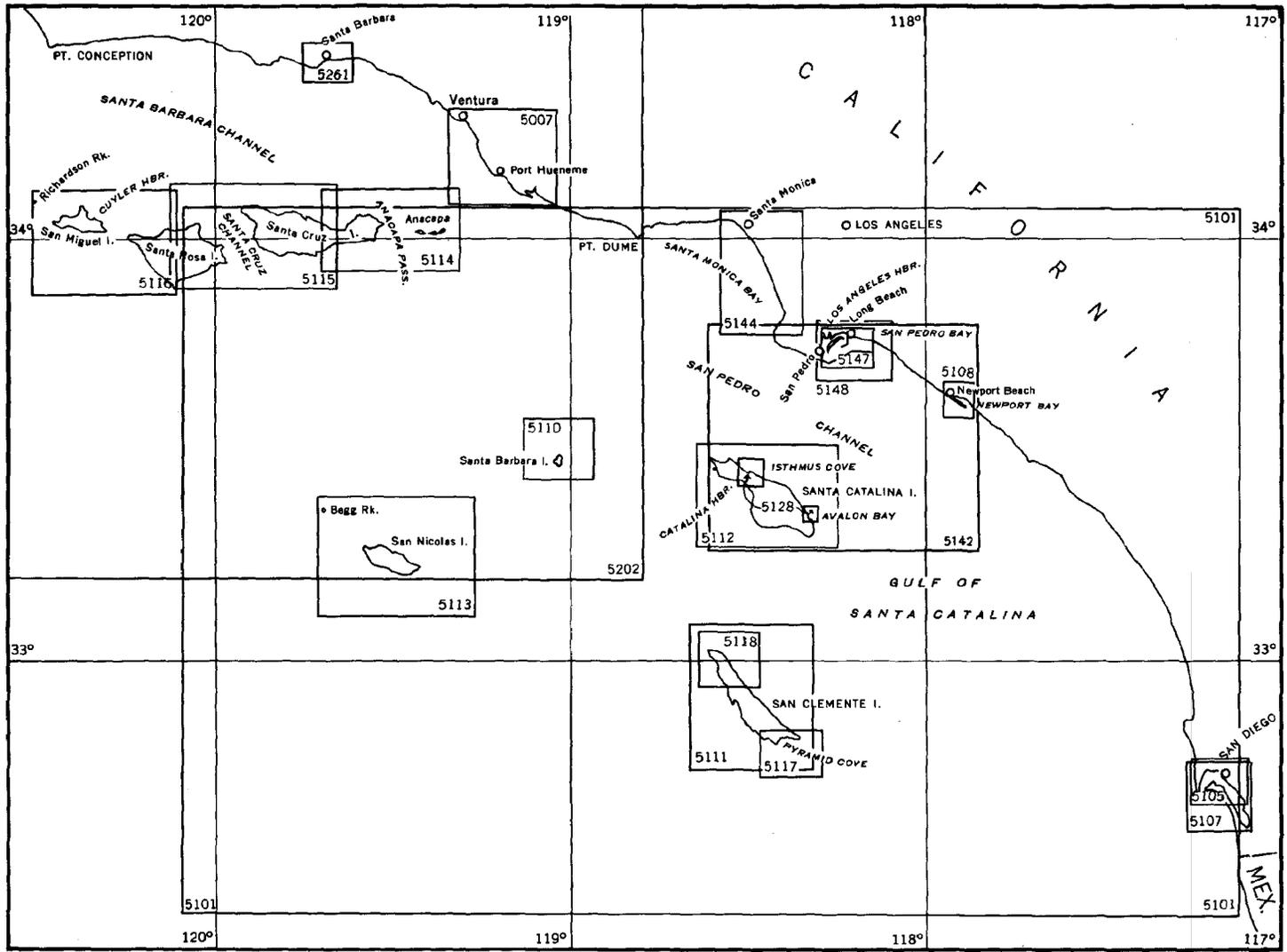


Diagram No. 17  
December 1958

**GENERAL, COAST AND HARBOR CHARTS - PACIFIC COAST  
SAN DIEGO TO POINT CONCEPTION, CALIFORNIA**

GENERAL, COAST AND HARBOR CHARTS—PACIFIC COAST  
SAN DIEGO TO POINT CONCEPTION, CALIFORNIA

No.	Price	TITLE	State	Scale	Paper size (inches)
<b>GENERAL CHARTS</b>					
5101	\$1.00	San Diego to Santa Rosa Island	California	1:234,270	35X50
5202	1.00	Point Dume to Purisima Point	"	1:232,188	33X48
<b>HARBOR CHARTS</b>					
5007	.50	Pt. Mugu to Ventura Ventura Port Hueneme	California	1:40,000 1:20,000 1:10,000	27X30
5105	1.00	North San Diego Bay	"	1:12,000	36X46
5107	.75	San Diego Bay	"	1:20,000	35X39
5108	.75	Newport Bay	"	1:10,000	30X40
5110	.75	Santa Barbara Island	"	1:20,000	34X39
5111	1.00	San Clemente Island	"	1:40,000	35X41
5112	.75	Santa Catalina Island	"	1:40,000	29X40
5113	.75	San Nicolas Island	"	1:40,000	33X43
5114	.50	Anacapa Passage Prisoners Harbor	"	1:40,000 1:20,000	25X39
5115	.75	Santa Cruz Channel	"	1:40,000	33X44
5116	.75	San Miguel Passage Cuyler Harbor	"	1:40,000 1:20,000	30X41
5117	1.00	Pyramid Cove and approaches, San Clemente Island	"	1:15,000	35X46
5118	.75	San Clemente Island—northern part Wilson Cove	"	1:20,000 1:5,000	33X34
5128	.50	Catalina Harbor, Isthmus Cove and Avalon Bay, Santa Catalina Island	"	1:10,000	24X30
5142	1.00	San Pedro Channel	"	1:80,000	34X45
5144	.50	Santa Monica Bay	"	1:40,000	24X36
5147	1.00	Los Angeles and Long Beach Harbors	"	1:12,000	35X46
5148	1.00	San Pedro Bay	"	1:18,000	32X47
5261	.25	Santa Barbara	"	1:20,000	22X28



**GENERAL, COAST AND HARBOR CHARTS—PACIFIC COAST  
SAN DIEGO TO SAN FRANCISCO BAY, CALIFORNIA**

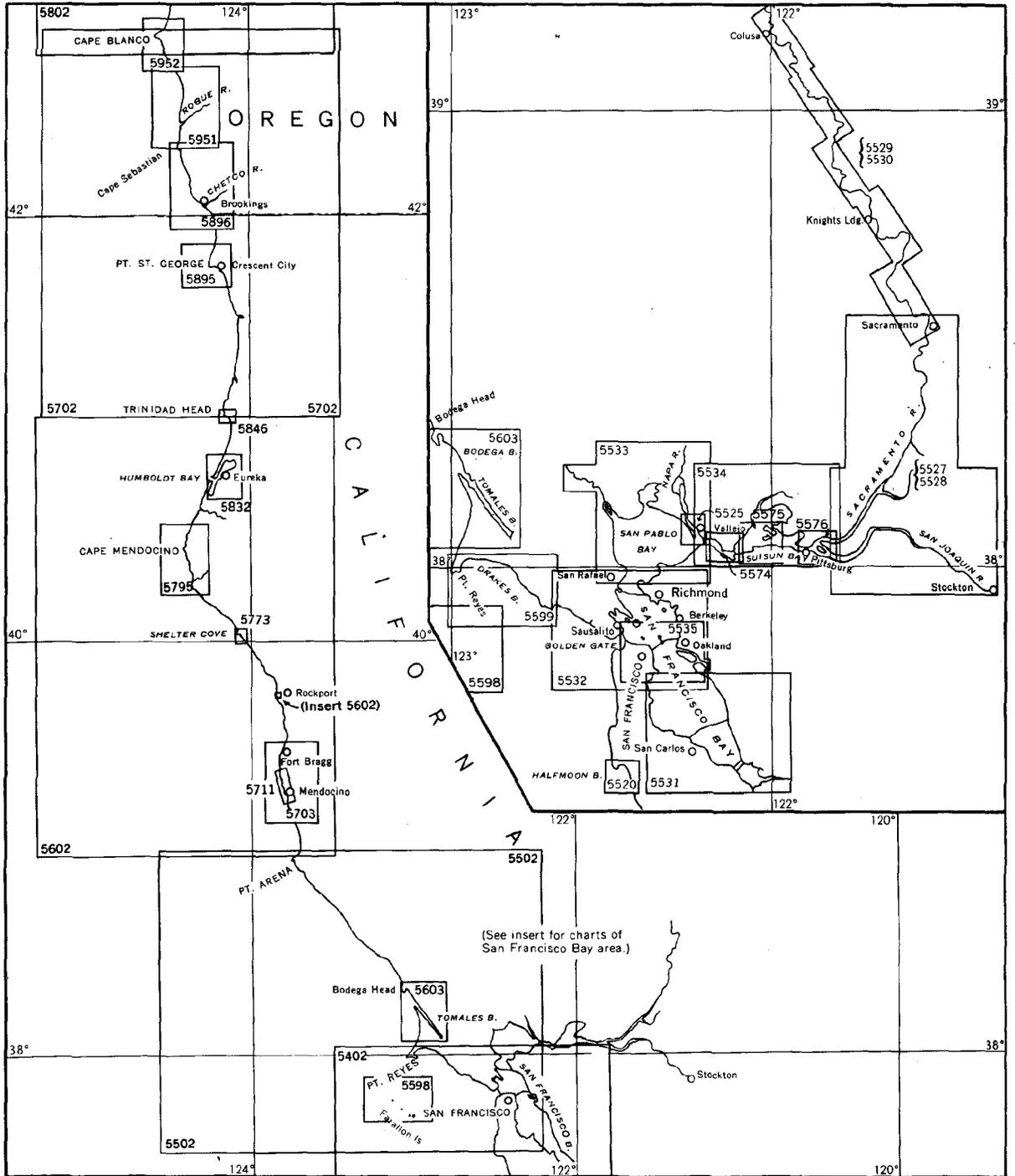
No.	Price	TITLE	State	Scale	Paper size (inches)
<b>GENERAL CHARTS</b>					
5101	\$1.00	San Diego to Santa Rosa Island	California	1:234,270	35X50
5202	1.00	Point Dume to Purisima Point	"	1:232,188	33X48
5302	1.00	Point Conception to Point Sur	"	1:216,116	33X46
†5402	1.00	Point Sur to San Francisco	"	1:210,668	33X42
†5502	1.00	San Francisco to Point Arena	"	1:207,840	34X42
<b>HARBOR CHARTS</b>					
5386	.25	San Luis Obispo Bay, Port San Luis	California	1:20,000	20X28
5387	.75	Estero Bay	"	1:40,000	30X39
		Morro Bay		1:10,000	
5403	.75	Monterey Bay	"	1:50,000	31X40
		Moss Landing Harbor		1:10,000	
		Monterey Harbor		1:10,000	
5476	.75	Pfeiffer Point to Point Cypress	"	1:40,000	28X44
5520	.25	Halfmoon Bay	"	1:20,000	21X22
5598	.75	Farallon Islands	"	1:40,000	31X40
5603	1.00	Bodega and Tomales Bays	"	1:30,000	35X44
<b>INLAND CHARTS</b>					
5001	.75	Lake Tahoe	Calif. & Nev.	1:40,000	30X45
{ 5457A	.25	Lake Mead, Boulder Basin	Ariz. & Nev.	1:40,000	21X25
{ 5457B		Lake Mead, Virgin Basin		1:40,000	
{ 5458A	.25	Lake Mead, Overton Arm, southern part	"	1:40,000	18X25
{ 5458B		Lake Mead, Overton Arm, northern part		1:40,000	
{ 5459A	.25	Lake Mead, Temple Bar Area	"	1:40,000	21X25
{ 5459B		Lake Mead, Iceberg Canyon to Lower Granite Gorge		1:40,000	

†Includes Loran Lines of Position.

Numbers in brackets represent charts printed back to back.

GENERAL, COAST AND HARBOR CHARTS-PACIFIC COAST  
SAN FRANCISCO BAY, CALIFORNIA TO CAPE BLANCO, OREGON

December 1958



**GENERAL, COAST AND HARBOR CHARTS—PACIFIC COAST  
SAN FRANCISCO BAY, CAL. TO CAPE BLANCO, OREGON**

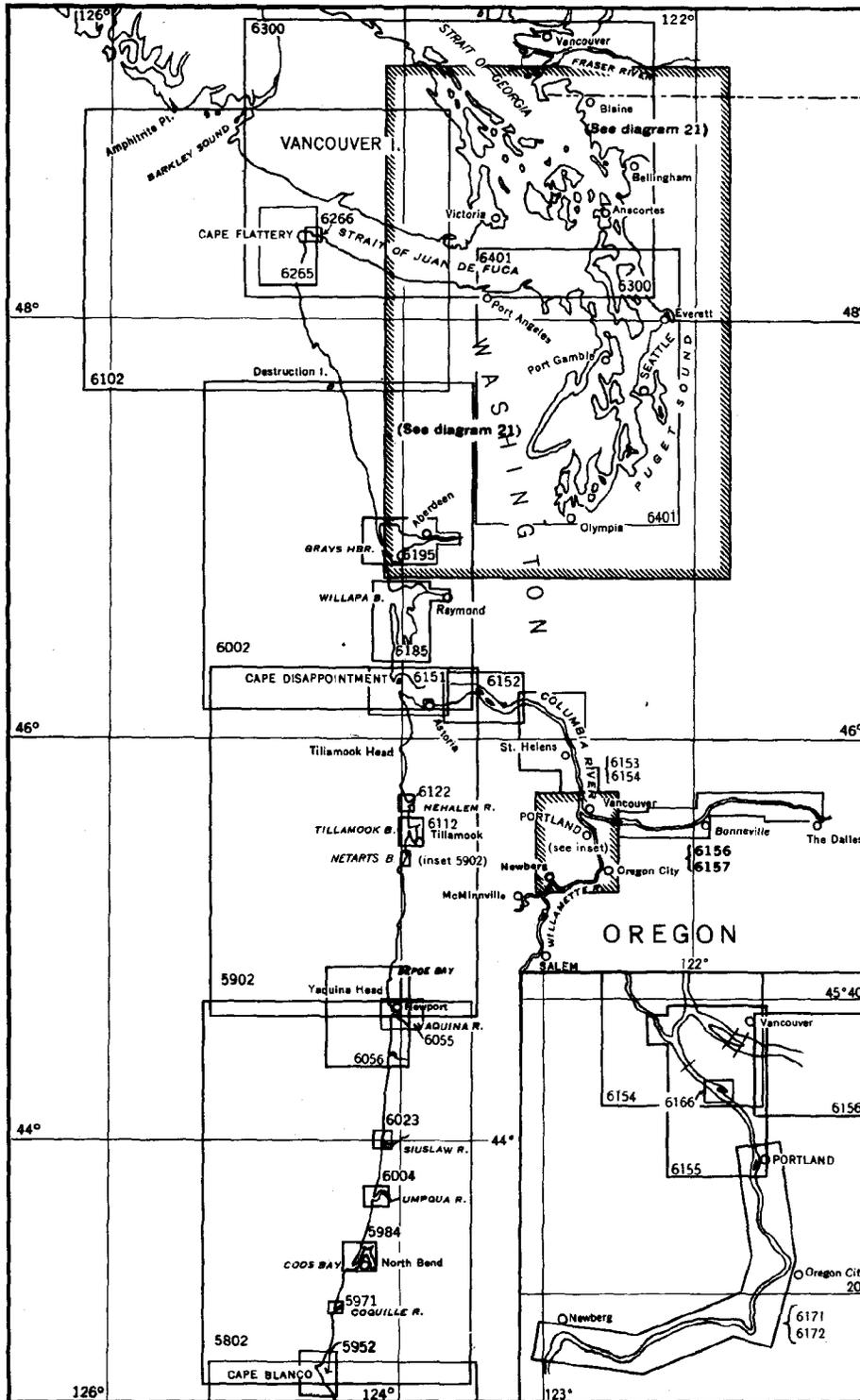
No.	Price	TITLE	State	Scale	Paper size (inches)
<b>GENERAL CHARTS</b>					
†5402	\$1.00	Point Sur to San Francisco	California	1:210,688	33 X 42
†5502	1.00	San Francisco to Point Arena	"	1:207,840	34 X 42
†5602	1.00	Point Arena to Trinidad Head Rockport Landing	"	1:200,000	33 X 48
†5702	1.00	Trinidad Head to Cape Blanco	Calif. & Oreg.	1:196,948	33 X 43
<b>HARBOR CHARTS</b>					
5520	.25	Halfmoon Bay	California	1:20,000	21 X 22
5525	.50	Mare Island Strait	"	1:10,000	25 X 37
{ 5527	1.00	San Joaquin River	"	1:40,000	36 X 48
{ 5528		Sacramento River—Andrus Island to Sacramento	"	1:40,000	
{ 5529	1.00	Sacramento River—Sacramento to Fourmile Bend	"	1:20,000	35 X 43
{ 5530		Sacramento River—Fourmile Bend to Colusa	"	1:20,000	
5531	1.00	San Francisco Bay—southern part	"	1:40,000	36 X 43
5532	1.00	San Francisco Entrance	"	1:40,000	36 X 45
5533	1.00	San Pablo Bay	"	1:40,000	35 X 43
5534	.75	Suisun Bay	"	1:40,000	31 X 43
5535	1.00	San Francisco Bay—Candlestick Point to Angel Island	"	1:20,000	36 X 46
5574	1.00	Carquinez Strait	"	1:10,000	33 X 43
5575	1.00	Suisun Bay—Port Chicago and vicinity	"	1:10,000	36 X 44
5576	1.00	Suisun Bay—Mallard Island to Antioch	"	1:10,000	34 X 44
5598	.75	Farrallon Island	"	1:40,000	31 X 40
5599	.50	Drakes Bay	"	1:40,000	25 X 32
5603	1.00	Bodega and Tomales Bays	"	1:30,000	35 X 44
5703	1.00	Elk to Fort Bragg Fort Bragg and Noyo Anchorage Elk	"	1:40,000 1:10,000 1:10,000	32 X 45
5711	.75	Albion to Caspar	"	1:10,000	29 X 40
5773	.25	Shelter Cove	"	1:15,000	15 X 19
5795	.75	Cape Mendocino and vicinity	"	1:40,000	28 X 40
5832	.75	Humboldt Bay	"	1:25,000	33 X 39
5846	.25	Trinidad Harbor	"	1:15,000	17 X 23
5895	.50	St. George Reef and Crescent City Harbor Crescent City Harbor	"	1:40,000 1:10,000	29 X 29
5896	1.00	Pyramid Point to Cape Sebastian Chetco Cove Hunter Cove	Calif. & Oreg. Oregon "	1:40,000 1:10,000 1:10,000	34 X 45
5951	.75	Cape Sebastian to Humbug Mountain	"	1:40,000	31 X 43
5952	.50	Port Orford to Cape Blanco	"	1:40,000	24 X 29

† Includes Loran Lines of Position  
Numbers in brackets represent charts printed back to back

GENERAL, COAST AND HARBOR CHARTS - PACIFIC COAST  
CAPE BLANCO, OREGON TO CAPE FLATTERY, WASH.

Diagram No. 20

December 1958



**GENERAL, COAST AND HARBOR CHARTS—PACIFIC COAST  
CAPE BLANCO, OREGON TO CAPE FLATTERY, WASH.**

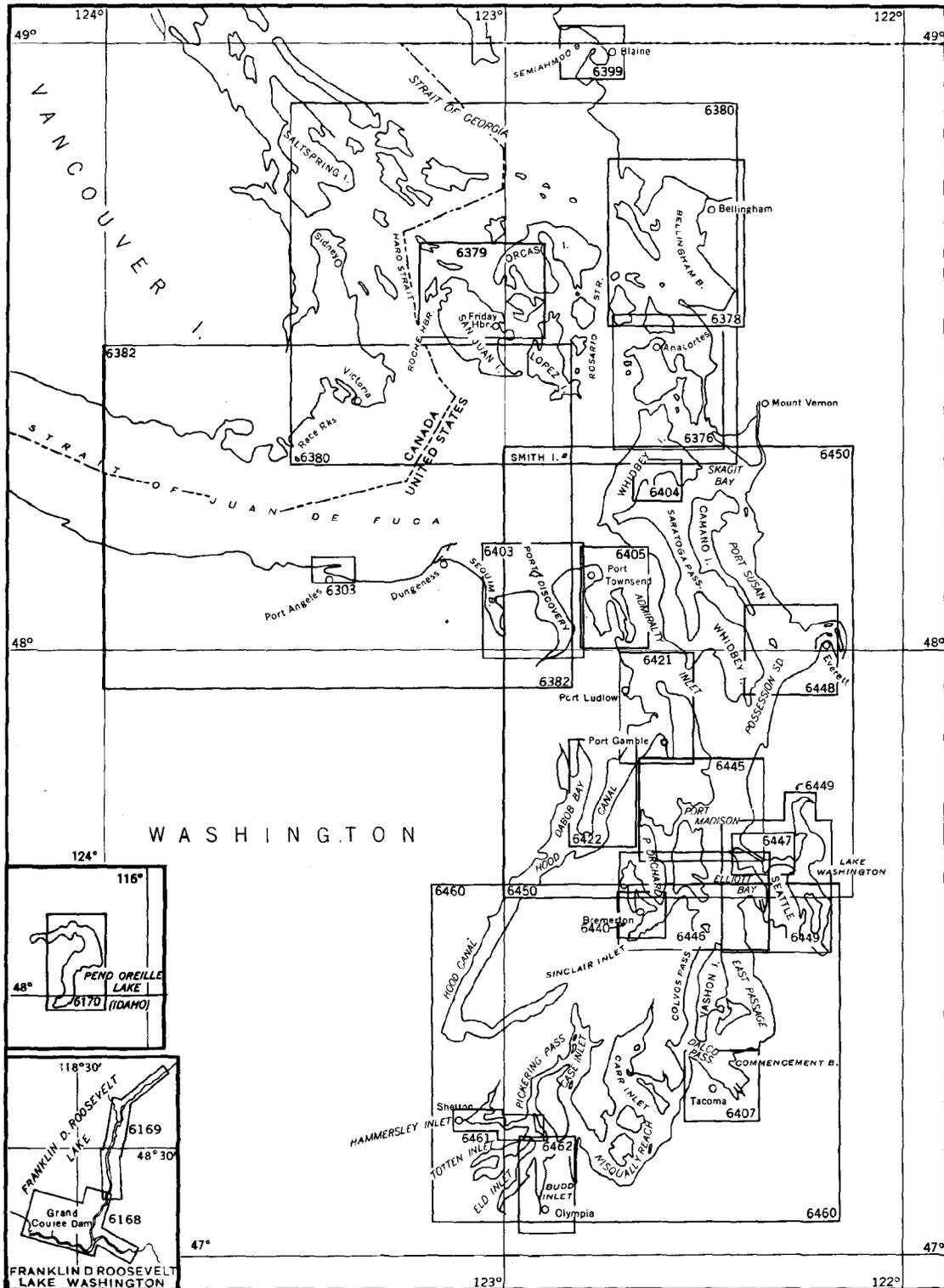
No.	Price	TITLE	State	Scale	Paper size (inches)
<b>GENERAL CHARTS</b>					
†5802	\$1.00	Cape Blanco to Yaquina Head	Oregon	1:191,730	33 X48
†5902	1.00	Yaquina Head to Columbia River Netarts Bay	Oreg. & Wash. Oregon	1:185,238 1:30,000	33 X44
†6002	1.00	Columbia River to Destruction Island	Oreg. & Wash.	1:180,789	33 X41
†6102	1.00	Approaches to Strait of Juan de Fuca—Destruction Island to Amphitrite Point	Wash. & B.C.	1:176,253	35 X44
6300	1.00	Strait of Georgia and Strait of Juan de Fuca	"	1:200,000	31 X44
6401	.75	Admiralty Inlet and Puget Sound	Washington	1:150,000	29 X41
<b>HARBOR CHARTS</b>					
5952	.50	Port Orford to Cape Blanco	Oregon	1:40,000	24 X29
5971	.50	Coquille River Entrance	"	1:10,000	24 X29
5984	.75	Coos Bay	"	1:20,000	32 X43
6004	.50	Umpqua River—Pacific Ocean to Reedsport	"	1:20,000	26 X33
6023	.25	Siuslaw River	"	1:20,000	20 X20
6055	1.00	Yaquina Bay and River Continuation of Yaquina River	"	1:10,000 1:25,000	36 X42
6056	1.00	Approaches to Yaquina Bay Depoe Bay	"	1:50,000 1:10,000	36 X41
6112	.50	Tillamook Bay	"	1:20,000	28 X35
6122	.25	Nehalem River	"	1:20,000	18 X22
6151	.75	Columbia River—Pacific Ocean to Harrington Point	Oreg. & Wash.	1:40,000	27 X43
6152	.75	Columbia River—Harrington Point to Crims Island	"	1:40,000	28 X44
{6153	.75	Columbia River—Crims Island to Saint Helens	"	1:40,000	23 X36
{6154	.75	Columbia River—Saint Helens to Vancouver	"	1:40,000	
6155	.75	Port of Portland, including Vancouver Multnomah Channel—southern part	"	1:20,000 1:10,000	27 X46
{6156	.75	Columbia River—Vancouver to Bonneville Bonneville Dam	"	1:40,000 1:10,000	32 X36
{6157		Columbia River—Bonneville to The Dalles The Dalles	"	1:40,000 1:10,000	
6166	.50	Willamette River—Swan Island Basin	Oregon	1:5,000	29 X31
{6171	.75	Willamette River—Portland to Walnut Eddy	"	1:15,000	32 X41
{6172	.75	Willamette River—Walnut Eddy to Newberg	"	1:15,000	
6185	1.00	Willapa Bay	Washington	1:40,000	33 X45
6195	.75	Grays Harbor Westhaven Cove	"	1:40,000 1:10,000	27 X40
6265	.75	Cape Flattery	"	1:40,000	31 X41
6266	.50	Neah Bay	"	1:10,000	24 X30

Numbers in brackets represent charts printed back to back.

† Includes Loran Lines of Position.

GENERAL, COAST AND HARBOR CHARTS - PACIFIC COAST  
PUGET SOUND AREA

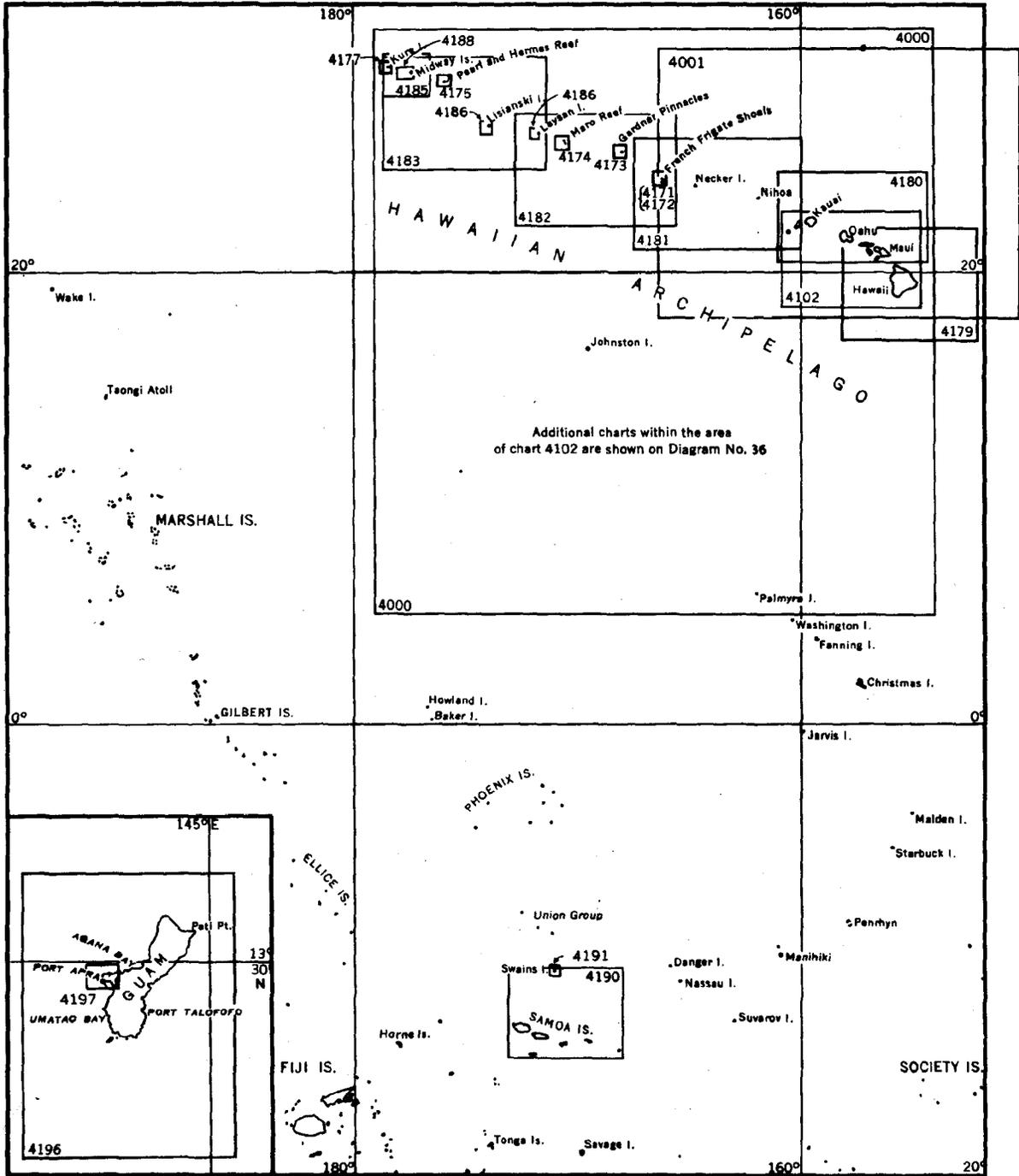
Diagram No. 21  
December 1958



**GENERAL, COAST AND HARBOR CHARTS—PACIFIC COAST  
PUGET SOUND AREA**

No.	Price	TITLE	State	Scale	Paper size (inches)
<b>COAST CHARTS</b>					
6380	\$1.00	Strait of Juan de Fuca to Strait of Georgia	Wash. & B.C.	1:80,000	36X44
6382	1.00	Strait of Juan de Fuca—eastern part	"	1:80,000	34X46
6450	1.00	Admiralty Inlet and Puget Sound to Seattle	Washington	1:80,000	35X44
6460	.75	Puget Sound—Seattle to Olympia	"	1:80,000	34X41
<b>HARBOR CHARTS</b>					
6303	.50	Port Angeles	Washington	1:10,000	22X29
6376	1.00	Anacortes to Skagit Bay (shows Swinomish Slough and connecting waterways on large scale)	"	1:25,000	35X41
6378	.50	Bellingham Bay	"	1:40,000	28X33
6379	.75	San Juan Channel—Friday and Roche Harbors	"	1:20,000	34X48
6399	.25	Semiahmoo Bay	"	1:30,000	17X18
6403	.25	Port Discovery and Sequim Bay	"	1:40,000	21X24
6404	.75	Oak and Crescent Harbors	"	1:10,000	33X38
6405	.75	Port Townsend	"	1:20,000	28X38
6407	.75	Tacoma Harbor	"	1:15,000	28X38
6421	.75	Hood Canal—Port Ludlow to South Point	"	1:20,000	30X40
6422	.75	Hood Canal—South Point to Bangor	"	1:20,000	30X40
6440	.50	Sinclair Inlet	"	1:10,000	25X34
6445	.75	Puget Sound—Apple Cove Point to Keyport Agate Passage	"	1:25,000 1:10,000	34X41
6446	1.00	Puget Sound—Seattle to Bremerton	"	1:25,000	32X48
6447	.75	Lake Washington Ship Canal—Puget Sound to Lake Washington	"	1:10,000	31X46
6448	.25	Everett Harbor and approaches	"	1:40,000	19X23
6449	1.00	Seattle Harbor and Lake Washington	"	1:25,000	34X43
6461	.75	Puget Sound—Hammersley Inlet to Shelton	"	1:10,000	30X38
6462	.50	Olympia Harbor and Budd Inlet	"	1:20,000	22X39
<b>INLAND CHARTS</b>					
6168	1.00	Franklin D. Roosevelt Lake, southern part	Washington	1:50,000	35X45
6169	.75	Franklin D. Roosevelt Lake, northern part	"	1:50,000	31X35
6170	.75	Pend Oreille Lake	Idaho	1:50,000	26X40

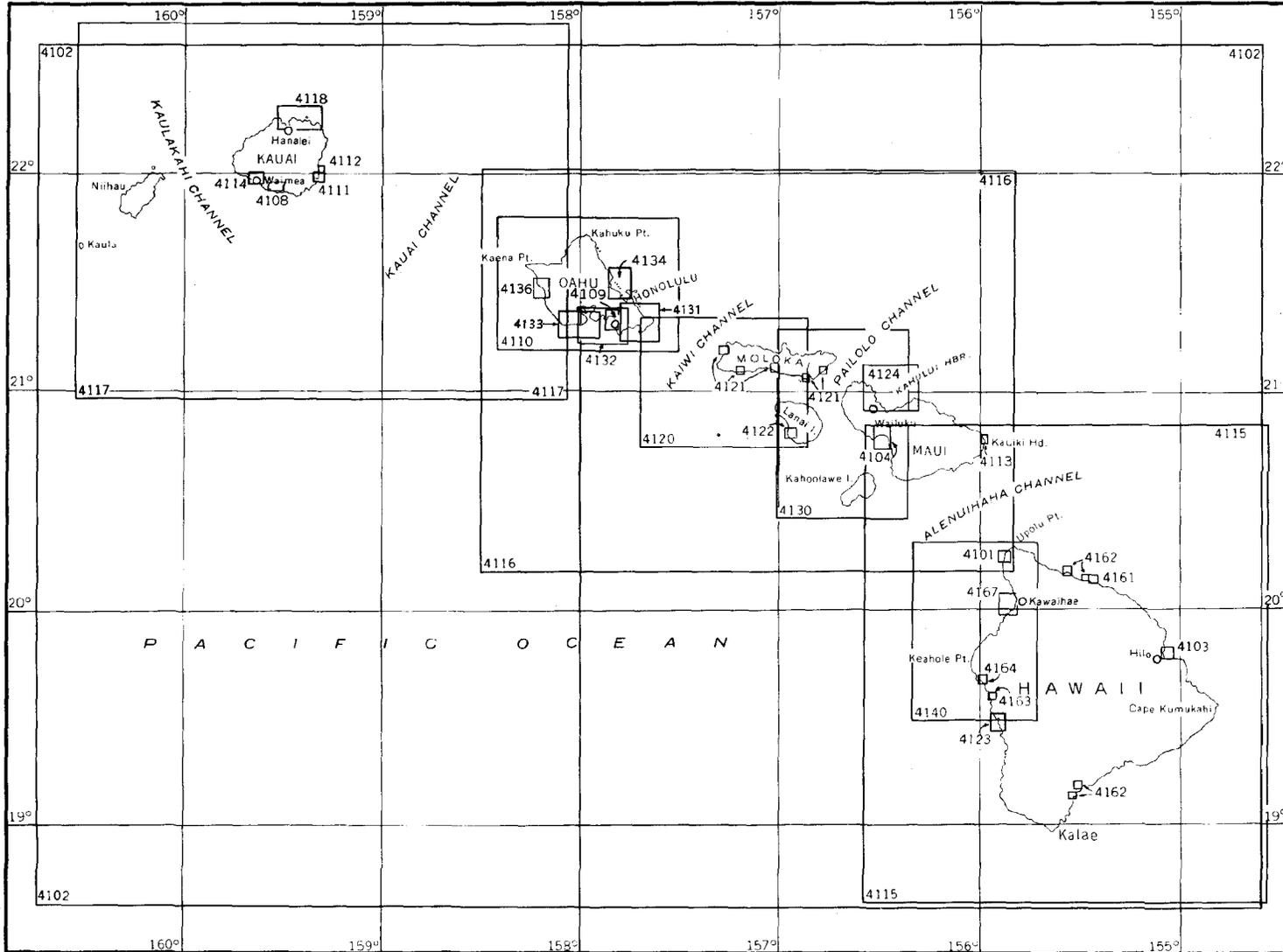
CHARTS OF THE HAWAIIAN ARCHIPELAGO, GUAM AND SAMOA



## CHARTS OF THE HAWAIIAN ARCHIPELAGO, GUAM AND SAMOA

No.	Price	TITLE	Scale	Paper size (inches)
<b>SAILING AND GENERAL CHARTS</b>				
4000	\$0.75	Hawaiian Archipelago	1:3,121,170	36X41
†4001	1.00	Hawaii to French Frigate Shoals—Hawaiian Archipelago	1:1,650,000	35X42
4102	1.00	Hawaiian Islands	1:600,000	32X46
4179	.75	Hawaiian Islands—southern part	1:675,000	35X39
4180	.75	Hawaiian Islands—northern part	1:675,000	30X46
4181	1.00	Niihau to French Frigate Shoals, Hawaiian Archipelago	1:663,392	34X48
		Necker Island	1:20,000	
		Nihoa	1:20,000	
4182	1.00	French Frigate Shoals to Laysan I., Hawaiian Archipelago	1:653,219	34X46
4183	1.00	Laysan Island to Kure Island, Hawaiian Archipelago	1:642,271	34X48
4185	1.00	Midway Islands and approaches, Hawaiian Archipelago	1:180,000	36X47
<b>COAST CHARTS</b>				
4172	1.00	French Frigate Shoals, Hawaiian Archipelago	1:80,000	35X48
4173	1.00	Gardner Pinnacles and approaches, Hawaiian Archipelago	1:100,000	32X48
		Gardner Pinnacles	1:20,000	
4174	.75	Maro Reef, Hawaiian Archipelago	1:80,000	30X37
4196	1.00	Island of Guam, Marianas	1:100,000	35X48
<b>HARBOR CHARTS</b>				
4171	1.00	French Frigate Shoals Anchorage, Hawaiian Archipelago	1:25,000	33X48
4175	1.00	Pearl and Hermes Reef, Hawaiian Archipelago	1:40,000	34X44
4177	.50	Kure Island, Hawaiian Archipelago	1:20,000	29X34
4186	1.00	Lisianski and Laysan Islands, Hawaiian Archipelago	1:40,000	36X46
		West Coast of Laysan I.	1:10,000	
4188	1.00	Midway Islands, Hawaiian Archipelago	1:32,500	32X47
4191	.75	Swains Island	1:20,000	29X40
4197	1.00	Apra Harbor, Marianas-Guam	1:10,000	34X47
<b>COMBINED GROUP CHART</b>				
4190	1.00	United States possessions in the Samoa Islands (5 plans)		35X41
		Manua Islands	1:80,000	
		Pago Pago Harbor, Tutuila Island	1:15,000	
		Samoa Islands	1:2,000,000	
		Rose Island	1:80,000	
		Tutuila Island	1:60,000	

†Includes Loran Lines of Position



CHARTS OF THE HAWAIIAN ISLANDS  
HAWAII TO NIIHAU

Diagram No. 36  
December 1958

**CHARTS OF THE HAWAIIAN ISLANDS  
HAWAII TO NIIHAU**

No.	Price	TITLE	Island	Scale	Paper size (inches)
<b>SAILING CHART</b>					
4102	\$1.00	Hawaiian Islands		1:600,000	32 X46
<b>GENERAL CHARTS</b>					
4115	1.00	Hawaii		1:250,000	36 X42
4116	1.00	Hawaii to Oahu		1:250,000	36 X47
4117	1.00	Oahu to Niihau		1:247,482	34 X44
<b>COAST CHARTS</b>					
4110	1.00	Oahu		1:80,000	36 X47
4120	1.00	Channels between Oahu, Molokai and Lanai		1:80,000	35 X47
4130	1.00	Channels between Molokai, Maui, Lanai and Kahoolawe		1:80,000	34 X46
4140	1.00	West Coast of Hawaii—Cook Pt. to Upolu Pt.		1:80,000	35 X48
<b>HARBOR CHARTS</b>					
4101	.25	Mahukona Harbor and approaches	Hawaii	1:5,000	19 X25
4103	.50	Hilo Bay	"	1:10,000	28 X28
4104	1.00	Maalaea Bay	Maui	1:10,000	33 X42
4108	.25	Port Allen	Kauai	1:5,000	22 X30
4109	.75	Honolulu Harbor	Oahu	1:5,000	32 X37
4111	.50	Nawiliwili Bay	Kauai	1:5,000	25 X33
4112	.75	Hanamaulu Bay	"	1:2,500	29 X35
4113	.25	Hana Bay	Maui	1:5,000	19 X20
4114	.75	Approach to Waimea and Makaweli Landings	Kauai	1:10,000	30 X37
4118	.75	Haena Point to Kepuhui Point	"	1:20,000	31 X46
4121	.75	Harbors of Molokai (5 plans) Kaunakakai Harbor Pukoo Harbor Kamalo Harbor Kolo Harbor Papohaku Roadstead	Molokai	1:5,000 1:5,000 1:5,000 1:5,000 1:5,000	31 X36
4122	.25	Kaumalapau Harbor	Lanai	1:2,500	17 X21
4123	.50	Kealakekua Bay to Honaunau Bay	Hawaii	1:10,000	27 X36
4124	.75	Kahului Harbor and approaches Kahului Harbor	Maui	1:30,000 1:10,000	30 X39
4131	1.00	Southeast Coast of Oahu—Waimanalo Bay to Diamond Head	Oahu	1:20,000	36 X46
4132	1.00	South Coast of Oahu—Diamond Head to Pearl Harbor Entrance	"	1:20,000	36 X45
4133	.75	South Coast of Oahu—Ahua Point to Barbers Point	"	1:20,000	30 X44
4134	1.00	Kaneohe Bay	"	1:15,000	32 X45
4136	.75	Port Waianae	"	1:10,000	30 X41
4161	.50	Paauhau Landing	Hawaii	1:5,000	22 X30
4162	.75	Harbors and Landings, Hawaii (4 plans) Punaluu Harbor Honuapo Harbor Honokaa Landing Kukuihaele Landing	"	1:2,500 1:2,500 1:2,500 1:2,500	32 X35
4163	.25	Keauhou Bay—West Coast of Hawaii	Hawaii	1:2,500	24 X26
4164	.25	Kailua Bay—West Coast of Hawaii	"	1:5,000	22 X22
4167	1.00	Kawaihae Bay—West Coast of Hawaii	"	1:10,000	36 X45



# 1. GENERAL INFORMATION

**EXPLANATORY.**—The **Coast Pilots** of the Coast and Geodetic Survey provide verbal description of United States coasts, harbors, and connecting waterways that is mostly impossible of presentation on the nautical charts. Subjects include landmarks, navigation regulations, channels, anchorages, dangers, routes, weather, ice, pilotage, customs, and port facilities.

**Bearings** are true, and when given in degrees are clockwise from 000° (north) to 359°. **Light-sector bearings** are toward the light.

**Courses** are true and are expressed in the same manner as bearings. The courses given are the courses to be made good.

**Depths** are in fathoms or feet below the low-water tidal datum of the charts unless otherwise stated.

**Distances** are in nautical miles unless otherwise stated. A nautical mile is 1 minute of latitude, or approximately 2,000 yards, and is about 1.15 statute miles.

**Current velocities** are in knots, which are nautical miles per hour; directions are the true directions toward which the currents set.

**Wind velocities** also are in knots, but directions are the true directions from which the winds blow.

**Overhead clearances** of bridges and cables are in feet above normal high water unless otherwise stated; clearances of drawbridges are for the closed position.

**Permit clearances** are the minimums authorized in the construction permits issued by the Corps of Engineers.

**Light and fog-signal characteristics** are not described, and light sectors are not usually defined. The Coast Guard Light lists should be consulted for complete information.

**Radio navigational aids** and radio weather services are not fully described. Coast Guard Light Lists and H. O. Publications 205 and 206 should be consulted.

The **COAST AND GEODETIC SURVEY** is charged with (1) the survey of the coasts of the United States and its possessions to insure the safe navigation of coastal and intracoastal waters; (2) the compilation and publication of nautical charts, Coast Pilots, tables of predicted tides and currents, and tidal current charts to meet the needs of the mariner; (3) the determination of geographical positions and elevations in the interior of the country to coordinate the coastal surveys and provide a framework for mapping and other engineering work; (4) the compilation and publication of aeronautical charts for use in air navigation; (5) observations of the earth's magnetism in all parts of the country to furnish magnetic information essential to the mariner, aviator, land surveyor, radio

engineer, and others; and (6) seismological observations and investigations to supply earthquake data required in designing structures.

**District Offices** of the Coast and Geodetic Survey are located at some of the principal ports in the United States; see Appendix. Files of charts, Coast Pilots, and other publications are maintained at these offices for the use of mariners, who are invited to avail themselves of the facilities afforded.

**Sales agents** for Charts, Coast Pilots, Tide Tables, Tidal Current Tables, and Tidal Current Charts of the Coast and Geodetic Survey are located in many ports of the United States and in some foreign ports. The charts and books also may be purchased from the Washington Office or from the District Offices. Orders mailed to Washington, D.C., should be accompanied by check or money order, made payable to C&GS, Department of Commerce. Indexes of charts and books will be furnished free, upon receipt of request designating areas of interest.

**Special signals for surveying vessels.**—Pilot Rules for Inland Waters, § 80.33, state that by day a surveying vessel of the Coast and Geodetic Survey, under way and employed in hydrographic surveying, may carry in a vertical line, one over the other not less than 6 feet apart where they can best be seen, three shapes not less than 2 feet in diameter of which the highest and lowest shall be globular in shape and green in color and the middle one diamond in shape and white.

(a) Vessels of the Coast and Geodetic Survey shall carry the above-prescribed marks while actually engaged in hydrographic surveying and under way, including drag work. Launches and other boats shall carry the prescribed marks when necessary.

(b) It must be distinctly understood that these special signals serve only to indicate the nature of the work upon which the vessel is engaged and in no way give the surveying vessel the right-of-way over other vessels or obviate the necessity for a strict observance of the rules for preventing collisions of vessels.

(c) By night a surveying vessel of the Coast and Geodetic Survey, under way and employed in hydrographic surveying, shall carry the regular lights prescribed by the rules of the road.

(d) A vessel of the Coast and Geodetic Survey, when at anchor in a fairway on surveying operations, shall display from the mast during the daytime two black balls in a vertical line and 6 feet apart. At night two red lights shall be displayed in the same manner. In the case of a small vessel the distance between the balls and between the lights may be reduced to 3 feet if necessary.

(e) Such vessels, when at anchor in a fairway on surveying operations, shall have at hand and show, if necessary, in order to attract attention, a flare-up light in addition to the lights which are, by this section, required to be carried.

International Rules, Part B, Rule 4 (c), state that a vessel engaged in laying or in picking up a submarine cable or navigation mark, or a vessel engaged in surveying or underwater operations when from the nature of her work she is unable to get out of the way of approaching vessels, shall carry, in lieu of the lights specified in Rule 2 (a) (i) and (ii), three lights in a vertical line one over the other not less than 6 feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all round the horizon at a distance of at least 2 miles. By day, she shall carry in a vertical line one over the other not less than 6 feet apart, where they can best be seen, three shapes each not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and red in colour, and the middle one diamond in shape and white.

The **wire drags** used by the Coast and Geodetic Survey in sweeping for dangers to navigation may be crossed by vessels without danger of fouling at any point except between the towing launches and the large buoys near them, where the towline approaches the surface of the water. Vessels passing over the drag are requested to change course so as to cross it approximately at right angles, as a diagonal course may cause the propeller to foul the supporting buoys and attached wires. No attempt should be made to pass between the drag launches while the wire is being set out or taken in, unless it would endanger a vessel to do otherwise, because the bottom wire is slack and the floats at each 100-foot section may lift it nearly to the surface; at this time the launches usually are headed directly toward or away from each other and the operation may be clearly seen.

**Nautical charts** are published primarily for the use of the mariner but serve the public interest in many other ways. They are compiled principally from Coast and Geodetic Survey basic field surveys, supplemented by data from other Government organizations.

The **scales of nautical charts** range from 1:2,500 to about 1:5,000,000. Graphic scales are generally shown on charts with scales of 1:80,000 or larger, and numerical scales are given on smaller-scale charts. Coast and Geodetic Survey charts are classified according to scale as follows:

**Sailing charts**, scales 1:600,000 and smaller, are for use in fixing the mariner's position as he approaches the coast from the open ocean, or for sailing between distant coastwise ports. On such charts the shoreline and topography are generalized and only offshore soundings, the principal lights, outer buoys, and landmarks visible at considerable distances are shown.

**General charts**, scales 1:100,000 to 1:600,000, are for coastwise navigation outside of outlying reefs and shoals.

**Coast charts**, scales 1:50,000 to 1:100,000, are for in-

shore navigation leading to bays and harbors of considerable width, and for navigating large inland waterways.

**Harbor charts**, scales larger than 1:50,000, are for harbors, anchorage areas, and the smaller waterways.

**Intracoastal Waterway charts**, scale 1:40,000, are a special series covering the New Jersey inside route, the Atlantic Coast inside route from Norfolk, Virginia, to Key West, Florida, and the Gulf Coast inside route from Carrabelle, Florida, to Port Brownsville, Texas.

Mariners are urged to obtain and use the largest-scale chart available for the area to be navigated.

The **date of a chart** is of vital importance to the navigator. When charted information becomes obsolete, further use of the chart for navigation may be dangerous. Up-to-date charts should be obtained at regular intervals.

A **new edition** of a chart is printed only when corrections are so extensive or of such importance to navigation as to necessitate a replacement of all previous issues; the number and date of the current edition are printed in the lower left corner. When the edition is revised, the date of the latest revision is printed to the right of the edition date. Before a chart is issued by the Coast and Geodetic Survey it is corrected by hand for all important information published in the weekly Notice to Mariners since the date of printing; the number and date of the last Notice to Mariners used are stamped in the lower right corner. Purchasers of charts should consult the Notice to Mariners for corrections subsequent to the stamped date.

The **Mercator projection** used on most nautical charts has straight-line meridians and parallels that intersect at right angles. On any particular chart the distances between meridians are equal throughout, but distances between parallels increase progressively from the equator toward the poles, so that a straight line between any two points is a rhumb line. This unique property of the Mercator projection is one of the main reasons why it is preferred by the mariner.

**Echo soundings.**—Most of the various types of echo sounder are calibrated for a velocity of sound in water of 800 fathoms per second, but the actual velocity may differ from the calibrated value by as much as 5 percent, depending upon the temperature and salinity of the waters in which the vessel is operating; the highest velocities are found in warm, highly saline water, and the lowest in icy, fresh water. Variation in line voltage can also cause errors of 10 percent or more in reading. Echoes can be obtained from schools of fish; in fact, trawlers are using the sounders for that purpose. The most serious error commonly occurs where the depth is greater than the scale range of the instrument; a 400-fathom scale indicates 15 fathoms visually and graphically when the depth is 415 fathoms. Where possible, wide variations from charted depths should be checked by wire soundings.

The **plane of reference** for depths on C&GS charts is the mean of all low waters for the Atlantic coast of the United States, including the West Indies, and the mean of the lower low waters for the Pacific coast, including the Hawaiian Islands and Alaska. The plane most frequently used on foreign charts is mean low water springs. The effect of strong winds, in combination with

the regular tidal action, may at times cause the water level to fall considerably below the reference plane.

**Compass roses on charts.**—The annual change in variation gradually introduces an error in the magnetic compass roses on charts. The compass roses are replotted for every new edition of the chart if the error is appreciable; and the amount and date of the variation and the amount of annual change are stated for each compass rose. On some of the sailing and general charts the magnetic variation is shown by isogonic lines.

**Deviation of the compass.**—The magnetic effect of the ship itself combines with any instrumental error of the compass to cause the deviation, which varies with the heading of the ship and with the magnetic latitude. It is customary to counteract the deviation as far as possible with soft iron and permanent magnets, suitably placed in or on the binnacle.

**Local magnetic disturbance.**—The charts show areas where the compass is disturbed by magnetic masses external to the ship. Such disturbances are fairly common in shallow waters but are never encountered over oceanic depths. Magnetic force diminishes so rapidly with distance that a magnetic center on land would have to be of unprecedented intensity to affect the compass of a vessel 0.5 mile from shore.

**Overhead cables** are shown on the charts and described in the Coast Pilots; the clearances given are for the lowest wires at high water. Vessels with masts, stacks, booms, or aerials should allow for an additional clearance under power cables equal to the distance between adjacent cables.

**Submarine cable areas** are shown on the charts but are not described in the Coast Pilots. Special effort should be made to avoid anchoring or trawling in cable areas. If a vessel does foul a cable, extreme care should be used when attempting to clear. Should normal methods fail, the anchor or other gear should be slipped and abandoned rather than risk breaking or cutting the cable. The high voltages in certain cables could cause severe burns or loss of life.

**Tide Tables** are issued annually by the Coast and Geodetic Survey in advance of the year for which they are prepared. These tables include predicted times and heights of high and low waters for every day in the year for a number of reference stations and differences for obtaining similar predictions for numerous other places. They also include other useful information such as a method for obtaining heights of tide at any time, local civil time of sunrise and sunset for various latitudes, reduction of local civil time to standard time, and time of moonrise and moonset for various ports.

**Caution.**—In using the Tide Tables, slack water should not be confused with high or low water. For ocean stations there is usually little difference between the time of high or low water and the beginning of ebb or flood currents; but for places in narrow channels, landlocked harbors, or on tidal rivers, the time of slack current may differ by several hours from the time of high or low water. The relation of the times of high or low

water to the turning of the current depends upon a number of factors, so that no simple general rule can be given. To obtain the times of slack water, reference should be made to the Tidal Current Tables.

**Tidal Current Tables** for the coasts of the United States are issued annually by the Coast and Geodetic Survey in advance of the year for which they are prepared. These tables include daily predictions of the times of slack water and the times and velocities of strength of flood and ebb currents for a number of waterways, together with differences for obtaining predictions for numerous other places. Also included is other useful information such as a method for obtaining the velocity of current at any time, duration of slack, coastal tidal currents, wind currents, combination of currents, and current diagrams. Some information on the Gulf Stream is included in the tables for the Atlantic coast.

**Tidal Current Charts** are published by the Coast and Geodetic Survey for various localities. These charts depict the direction and velocity of the current for each hour of the tidal cycle. They present a comprehensive view of the tidal current movement in the respective waterways as a whole and when used with the proper current tables or tide tables supply a means for readily determining for any time the direction and velocity of the current at various localities throughout the areas covered.

The **COAST GUARD** has among its duties (1) enforcement of the laws of the United States on the high seas, in harbors, bays, sounds, roadsteads, and other like bodies of water along the coasts of the United States, its territories and possessions; (2) enforcement of navigation laws, of neutrality laws and regulations, of rules and regulations in relation to anchorage grounds, and of the Oil Pollution Act; (3) inspection of all vessels to insure safety to passengers and crews; (4) aid to distressed mariners and saving of life and property from shipwreck; (5) issuance of marine licenses and certificates; (6) investigation of circumstances connected with shipwreck or collision at sea; (7) destruction of derelicts; (8) construction, operation, maintenance, and inspection of aids to navigation; and (9) publication of Light Lists and Local Notices to Mariners.

**Light Lists.**—Aids to navigation, consisting of lights, radiobeacons, fog signals, buoys, and daymarks, are described in the light lists which are for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C., and by the various sales agents in the principal seaports. Mariners should refer to these publications for detailed information regarding the characteristics, candlepower, and visibility of lights, as well as descriptions of light structures and daybeacons, buoys, radiobeacons, and fog signals.

**Local Notice to Mariners.**—Changes and deficiencies in aids to navigation maintained by or under the authority of the Coast Guard are published in Local Notices to Mariners issued by the district commander of the area in which the aids are located. These notices are intended for local navigation interests operating within the limits of a

Coast Guard district. Changes in aids to navigation of the United States are also contained in the Weekly Notice to Mariners, Part I (Western Hemisphere Edition), prepared jointly by the Commandant, United States Coast Guard, and the Hydrographer, United States Navy. These notices are intended for mariners and others who have a definite need for them in connection with extended seagoing activities or those operating in several Coast Guard districts.

**Lights.**—The distances at which lights may be seen in clear weather, given in the Light Lists and on the charts, are the geographic ranges computed in nautical miles for a height of the observer's eye of 15 feet above sea level, unless the lights are not of sufficient candlepower to be seen to the limit of their geographic range, in which case the luminous range is given. These distances may at times be increased by abnormal atmospheric refraction and may be greatly decreased by unfavorable weather conditions, such as fog, rain, haze, or smoke. All except the most powerful lights are easily obscured by such conditions.

**Buoys.**—Buoyage of the United States, with color, shape, numbering, and light characteristics, is described in the introductory pages of the Light Lists. Buoys are liable to be carried away, shifted, or capsized; lighted buoys may be extinguished; or sound buoys may not function because of storm, ice, or collision. The navigator should, therefore, check his position by shore bearings, soundings, or other means.

Vessel operators are required by law to notify the nearest Coast Guard office of collisions with aids to navigation.

**Fog signals.**—Caution should be exercised in the use of sound fog signals for determining position or a safe course to follow. Sound travels through the air in a variable manner with or without the effects of wind and, therefore, the hearing of fog signals cannot be implicitly relied upon. Experience indicates that distances must not be judged only by the intensity of the sound; that occasionally there may be areas close to a fog signal in which it is not heard; and that fog may exist not far from a station, yet not be seen from it, so the signal may not be operating.

**Radiobeacons.**—A list and descriptive details of all marine radiobeacons are given in the Light Lists and H. O. Publication No. 205, Radio Navigational Aids. There is also included in these publications the procedure to follow for the use of radiobeacons for calibration of radio direction-finders as well as a list of special radio direction-finder calibration stations.

A vessel steering a course for a radiobeacon should observe the same precautions as when steering for a light or any other mark. If the radiobeacon is aboard a lightship, particular care should be exercised to avoid the possibility of collision, and sole reliance should never be placed on sighting the lightship or hearing its fog signal. If there are no dependable means by which the vessel's position may be fixed and the course changed well before reaching the lightship, a course should be selected that will insure passing the lightship at a distance, rather

than close aboard, and repeated bearings of the radiobeacon should show an increasing change in the same direction.

**Radio bearings.**—No exact data can be given as to the accuracy to be expected in radio bearings taken by a ship, since the accuracy depends to a large extent upon the skill of the ship's operator, the condition of the ship's equipment, and the accuracy of the ship's calibration curve. Mariners are urged to obtain this information for themselves by taking frequent radio bearings, when their ship's position is accurately known, and recording the results. Bearings of aircraft ranges and standard broadcast stations should be used with particular caution due to coastal refraction and lack of calibration of their frequencies.

**Radio bearings from other vessels.**—Any vessel with a radio direction-finder can give a bearing to a vessel equipped with a radio transmitter. Such service will generally be furnished when requested, particularly by Government vessels. These bearings, however, should be used only as a check, as comparatively large errors may be introduced by local conditions surrounding the radio direction-finder unless known and accounted for. Any radio station, for which the position of the transmitter is definitely known, may serve as a radiobeacon for vessels equipped with a radio direction-finder. However, mariners are cautioned that stations established especially for maritime service are more reliable.

**Conversion of radio bearings to Mercator bearings.**—The increasing use of radio directional bearings for locations of ships' positions at sea, especially during foggy weather, has made it particularly desirable to be able to apply these radio bearings directly to the nautical chart. These radio bearings are the bearings of the great circles passing through the radio stations and the ship, and, unless in the plane of the Equator or of a meridian, would be represented on a Mercator chart as curved lines. Obviously it is impracticable for a navigator to plot such lines on a Mercator chart, so it is necessary to apply a correction to a radio bearing to convert it into a Mercator bearing, that is, the bearing of a straight line on a Mercator chart laid off from the sending station and passing through the receiving station.

A table of corrections is given in the Appendix for the conversion of a radio bearing into a Mercator bearing. It is sufficiently accurate for practical purposes for distances up to 1,000 miles.

The only data required are the latitudes and longitudes of the radiobeacons and of the ship by dead reckoning. The latter is scaled from the chart, and the former is either scaled from the chart or taken from the list of radiobeacons in the Light List or H. O. Publication No. 205, Radio Navigational Aids.

The table is entered with the differences of longitude in degrees between the ship and station (the nearest tabulated value being used), and opposite the middle latitude between the ship and station, the correction to be applied is read.

The sign of the correction (bearings read clockwise from the north) will be as follows: In north latitude,

the minus sign is used when the ship is east of the radiobeacon and the plus sign used when the ship is west of the radiobeacon. In south latitude, the plus sign is used when the ship is east of the radiobeacon, and the minus sign is used when the ship is west of the radiobeacon.

To facilitate plotting, 180 degrees should be added to or subtracted from the corrected bearing, and the result plotted from the radiobeacon.

Should the position by dead reckoning differ greatly from the true position of the ship as determined by plotting the corrected bearings, a retrial should be made, using the new value as the position of the ship.

**Loran.**—Instructions, tables, and charts of the Loran System are published by the Navy Hydrographic Office. Coast charts of the United States with loran lines are published by the Coast and Geodetic Survey.

Caution must be used in matching loran signals to insure that the ground wave signal of one station is not matched with a sky wave signal of the other station or near the base-line extensions are subject to an error exceeding two nautical miles per microsecond and, therefore, should be avoided whenever possible.

**Numbering and recording of undocumented vessels.**—Certain undocumented vessels must conform to requirements of the Numbering Act. Owners may obtain the necessary information from the District Commander, United States Coast Guard, having jurisdiction over the area in which the vessel is owned.

**Licensing of vessels.**—Navigation laws pertaining to registry, enrollment, and licensing of vessels are administered by the United States Bureau of Customs. The bureau's functions also include issuing of commissions to yachts and the assignment of signal letters; the measurement of vessels, administration of tonnage duties, and the collection of tolls; the regulation of vessels in the coasting and fishing trade and limitation of the use of foreign vessels in waters under the jurisdiction of the United States; the recording of sales, conveyances, and mortgages of vessels; the protection of steerage passengers, and the remission of fines, penalties, and forfeitures incurred under the laws governing these matters. Collection districts and ports of entry located within the area covered by this Coast Pilot are tabulated in the Appendix.

**Advance notice of arrival of vessels in ports.**—The master or agents of certain vessels (foreign and domestic) are required to give advance notice to the Captain of the Port, United States Coast Guard, of the time of arrival in port; see § 124.10, Chapter 2.

**Danger signal.**—**Inland Pilot Rules**, Section 80.1, state, "If, when steam vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving several short and rapid blasts, not less than four, of the steam whistle, the danger signal." **International Pilot Rules**, Part D, Rule 28 (b), state, "Whenever a power-driven vessel which, under

these Rules, is to keep her course and speed, is in sight of another vessel and is in doubt whether sufficient action is being taken by the other vessel to avert collision, she may indicate such doubt by giving at least five short and rapid blasts on the whistle."

**Minesweeper signals.**—United States vessels engaged in minesweeping operations have their maneuvering powers considerably hampered. All other vessels, whether steamers or sailing craft, should keep out of the way of the sweepers, remembering especially that it is dangerous to pass between the vessels of a pair or group sweeping together.

All vessels towing sweeps are to show a black ball at the foremasthead and at each yardarm by day and green lights instead of the black balls by night; the lights may only be exhibited when necessary to warn approaching friendly vessels. Other vessels are not to approach the sweepers nearer than 500 yards on either beam or 1,000 yards astern; under no circumstances is a vessel to pass through a formation of mine sweepers. The sweepers should be prepared to warn other vessels who persist in approaching too close by means of any of the appropriate signals from the International Code of Signals.

**Signals to be made by vessels inconvenienced by searchlights.**—When navigation of a vessel is inconvenienced by the glare from searchlights near a port, she should make the International Code Signal ZO by lamp and by whistle, siren, or foghorn. Both the light and sound signals should be employed, whenever possible, and should be repeated until the inconvenience is removed. Only real urgency should dictate the use of this signal, as it is not possible for the searchlight operator to know which projector is affected unless the vessel is actually in the rays. This signal is designed to assist mariners; no liability whatever will be admitted.

**Search and rescue operations** for surface vessels or aircraft in distress or overdue are coordinated by the Coast Guard. Air-Sea Rescue planes have special markings of chrome yellow on the wing tips and wing-tip floats. The cooperation of vessel operators with the Air-Sea Rescue planes may mean the difference between life and death of some seaman or aviator.

Operators of disabled wooden craft that are, or may consider themselves to be, the object of a search should hoist on a halyard or otherwise place aloft any metallic object that would assist their detection by radar. All Coast Guard patrol vessels, planes, and some buoy tenders utilize this equipment and thus can continue searches in darkness and during other periods of low visibility if it can be assumed that the object of the search can be detected through the use of this aid.

Actual observations have shown that wooden hulls or other non-metallic objects are suited as radar targets according to the size, orientation, shape, and other radar-reflecting qualities of the object. Their value as radar targets may be enhanced by the use of special radar-reflecting devices properly oriented and placed as high above the waterline as possible. The largest metallic object available should be used.

**Ships in distress.**—Radio-equipped vessels requiring assistance may obtain the services of the Coast Guard by transmitting a request on the international distress and calling frequency 500 kc. to "Any Coast Guard Unit" (radio call NCU), or to any shore radio station addressed to "COGARD." Shore radio stations will forward to the Coast Guard all information regarding vessels requiring assistance unless such information is contained in a message specifically addressed elsewhere.

If the following information is included in the original request for assistance it will place the responsible Coast Guard officer in a position to determine immediately the types and number of vessels required to render adequate aid, thus greatly facilitating the work of the Coast Guard and avoiding any unnecessary delay in the dispatching of assistance:

1. Name, type, and nationality of vessel; color, size, and shape.
2. Position, course, and speed (including drift).
3. Nature of trouble and condition of vessel, sea, and wind. Action taken, if any.
4. Number of persons on board.
5. State whether or not Coast Guard assistance is required.

**Small craft in distress.**—Under the provision of the international regulations, which permits the use of any means available to a vessel or aircraft in distress to draw attention and obtain help, small commercial and private craft equipped with radiotelegraph or radiotelephone apparatus that cannot be operated on the international distress frequency of 500 kc. (600 m.) may usually obtain United States Coast Guard assistance by transmitting the distress signal or call and the message on the 2182 kc. frequency.

**Submarine emergency identification signals.**—The following smoke-bomb or flare signals are made by submarines of the United States in cases of necessity:

**Green** indicates torpedo has been fired; will be used to simulate torpedo firing on special exercises such as convoy exercises.

**Yellow** indicates that submarine is about to come to periscope depth from below periscope depth. Surface craft terminate antisubmarine counterattacks and clear vicinity of submarine. Do not stop propellers!

**Red** indicates an emergency condition within the submarine and she will surface immediately if possible. Surface vessels clear the area and stand by to give assistance after the submarine has surfaced. In case of repeated red signals, or if the submarine fails to surface within a reasonable time, she may be assumed to be disabled. Buoy the location, look for submarine marker buoy, and attempt to establish sonar communications. Advise naval authorities.

The foregoing, all of which mark the submarine's position, are fired from a submerged signal ejector into the air to a height of about 300 feet, then float downward slowly, suspended from a small parachute, and give colored illumination for about 30 seconds.

Submarines are also equipped with messenger buoys which are about 3 feet in diameter and are painted inter-

national orange. A submarine on the bottom in distress and unable to surface, will, if possible, release this buoy. An object of this description which is sighted on the surface of the water should be investigated and naval authorities advised.

**Signals for aid of aircraft in distress.**—The information below is quoted from Annex 12 to International Civil Aviation Organization (S. A. R.) (Annex), Search and rescue signals.

**6.1—Signals with surface craft.**

**6.1.1**—When it is necessary for an aircraft to direct a surface craft to the place where an aircraft or a surface craft is in distress, the aircraft shall do so by transmitting precise instructions by any means at its disposal. If such precise instructions cannot be transmitted or when necessary for any other reason, the instructions shall be given by using the procedure prescribed in 6.1.2.

**Note.**—Current maritime signalling procedures include:

For acknowledging receipt of signals, (i) the hoisting of the Code pennant (vertical red and white stripes) close up (meaning understood); (ii) the flashing of a succession of T's by signal lamp in the Morse code; (iii) the changing of heading.

For indicating inability to comply, (i) the hoisting of the International flag N (a blue and white checkered square); (ii) the flashing of a succession of N's in the Morse Code.

**6.1.2**—The following procedures performed in sequence by an aircraft shall mean that an aircraft is directing a surface craft toward an aircraft or a surface craft in distress:

(a) Circling the surface craft at least once.

(b) Crossing the projected course of the vessel close ahead at a low altitude, opening and closing the throttle, or changing the propeller pitch.

(c) Heading in the direction in which the surface craft is to be directed. Repetition of such procedures shall have the same meaning.

**6.1.3**—The following procedure performed by an aircraft shall mean that the assistance of the surface craft to which the signal is directed is no longer required: Crossing the wake of the surface craft close astern at a low altitude, opening and closing the throttle, or changing the propeller pitch.

Mariners are advised that United States Government vessels or planes in distress may exhibit, in addition to the distress signals set forth under International Rules of the Road, an orange smoke visible by day.

**The CORPS OF ENGINEERS**, United States Army, has charge of the improvement of the rivers and harbors of the United States and of miscellaneous other civil works which include the administration of the Federal laws enacted for the protection and preservation of navigable waters of the United States, the establishment of regulations for the use, administration, and navigation of navigable waters, the approval of plans of bridges, the alteration of obstructive bridges, the establishment of anchorage grounds and harbor lines, the removal of sunken vessels obstructing or endangering navigation,

and the granting of permits for structures or operations in navigable waters.

Information concerning the various ports, improvements, channel depths, navigable waters, and the condition of the Intracoastal Waterways in the areas under their jurisdiction may be obtained direct from the District Engineer offices; see Appendix.

**Anchorage areas and restricted areas** in most places are defined and regulations governing them are established by the Corps of Engineers. The regulations are enforced by the United States Coast Guard, and the areas are shown on the large-scale charts of the Coast and Geodetic Survey. Copies of the regulations may be obtained at the offices of the Corps of Engineers. The regulations also are copied into the appropriate Coast Pilots.

The **Port Series**, prepared jointly by the Corps of Engineers and the Maritime Administration and sold by the Superintendent of Documents, are complete reports on the principal seaports of the United States and are primarily of interest to commercial and industrial concerns. They cover the subjects of particular interest to the shipping world, such as the physical features of each port, its organization and practices, regulations regarding the movement of ships and goods, port dues and charges, fuel and water, rail connections, and commerce.

**Protection of navigable waters.**—Given below are extracts from the laws of the United States for the protection and preservation of the navigable waters of the United States.

That it shall not be lawful to throw, discharge, or deposit, or cause, suffer, or procure to be thrown, discharged, or deposited either from or out of any ship, barge, or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever, other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of any navigable water from which the same shall float or be washed into such navigable waters; and it shall not be lawful to deposit, or cause, suffer or procure to be deposited material of any kind in any place on the bank of any navigable water, or on the bank of any tributary of any navigable water, where the same shall be liable to be washed into such navigable water, either by ordinary or high tides, or by storms or floods, or otherwise, whereby navigation shall or may be impeded or obstructed.

That it shall not be lawful to tie up or anchor vessels or other craft in navigable channels in such a manner as to prevent or obstruct the passage of other vessels or craft; or to voluntarily or carelessly sink, or permit or cause to be sunk, vessels or other craft in navigable channels; or to float loose timber and logs, or to float what is known as sack rafts of timber and logs in streams or channels actually navigated by steamboats in such a manner as to obstruct, impede, or endanger navigation. And whenever a vessel, raft, or other craft is wrecked and sunk in a navigable channel, accidentally or otherwise, it shall be the duty of the owner of such sunken craft to immediately mark it with a buoy or beacon during the

day and a lighted lantern at night, and to maintain such marks until the sunken craft is removed or abandoned, and the neglect or failure of said owner so to do shall be unlawful; and it shall be the duty of the owner of such sunken craft to commence the immediate removal of the same and prosecute such removal diligently, and failure to do so shall be considered as an abandonment of such craft, and subject the same to removal by the United States as hereinafter provided for.

That, except in case of emergency imperiling life or property, or unavoidable accident, collision, or stranding, and except as otherwise permitted by regulations prescribed by the Secretary as hereinafter authorized, it shall be unlawful for any person to discharge, or suffer, or permit the discharge of oil by any method, means, or manner into or upon the coastal navigable waters of the United States from any vessel using oil as fuel for the generation of propulsion power, or any vessel carrying or having oil thereon in excess of that necessary for its lubricating requirements and such as may be required under the laws of the United States and the rules and regulations prescribed thereunder. The Secretary is authorized and empowered to prescribe regulations permitting the discharge of oil from vessels in such quantities, under such conditions, and at such times and places as in his opinion will not be deleterious to health or sea food, or a menace to navigation, or dangerous to persons or property engaged in commerce on such waters, and for the loading, handling, and unloading of oil.

**WEATHER BUREAU.**—Forecasts and warnings of the approach of storms over land and ocean areas are among the services of the Weather Bureau to navigation, commerce, agriculture, and the general public. Other warnings cover cold waves, frost, forest-fire hazard, and floods.

Meteorological information is collected and transmitted at hourly, 3-hourly, and 6-hourly intervals from land stations, ships at sea, and aircraft. These reports form a basis for the forecasting service, for summarization and publication of climatological data having general value and applicability, and for research basic to improvement of the national weather service.

Weather Bureau offices are located in many ports and other places throughout the continental United States and possessions. Stations in the area of concern to this Coast Pilot, at which the public may compare barometers against Weather Bureau barometers and discuss matters of weather service with Weather Bureau officials, are listed in the Appendix. By international agreement, the Weather Bureau also bears a share in the maintenance and operation of certain weather ships on the free oceans.

**Marine meteorological service.**—The collection of observations from ships at sea is conducted on a purely voluntary and cooperative basis. The Weather Bureau supplies shipmasters with blank forms, printed instructions, and such other material as is essential to the making and recording of observations. In the course of an average peace-time year, more than 100,000 observations are received from vessels representing every maritime nation and reaching every quarter of the globe.

The hurricane and storm warning service was established primarily to aid marine interests. Storm warnings are prepared at regular district forecast centers and at special hurricane forecast centers. The warnings are distributed to the public through all neighboring Weather Bureau offices by radio, the press, and every other available means. During the West Indian hurricane season, June to November, inclusive, teletype circuits expedite the exchange of reports from the Atlantic and Gulf coasts; special reports are obtained from weather reconnaissance planes which fly near the storms and sometimes into the storm centers.

**Coastal Warning Display System.**—The Weather Bureau employs the following system for displaying warning signals at stations along United States coasts, including the Great Lakes, Hawaiian Islands, and Puerto Rico, when winds dangerous to navigation are forecast for any coastal section.

**Small craft warning:** One red pennant displayed by day and a red light above a white light at night to indicate that winds up to 33 knots and/or sea conditions dangerous to small craft operations are forecast for the area.

**Gale warning:** Two red pennants displayed by day and a white light above a red light at night to indicate that winds ranging from 34 to 48 knots are forecast for the area.

**Whole gale warning:** A single square red flag with black center displayed by day and two red lights at night to indicate that winds ranging from 48 to 63 knots are forecast for the area.

**Hurricane warning:** Two square red flags with black centers displayed by day and a white light between two red lights at night to indicate that winds of 64 knots and above are forecast for the area.

The UNITED STATES HYDROGRAPHIC OFFICE exists for the improvement of the means of navigating safely the vessels of the United States Navy and the Merchant Marine by providing accurate nautical charts and related publications for foreign waters. Publications include Sailing Directions (pilots), Light Lists, Table of Distances, Radio Navigational Aids, Radio Weather Aids, International Code of Signals, the American Practical Navigator (Bowditch), and the Notice to Mariners.

The weekly **Notice to Mariners** contains corrections to Charts, Coast Pilots, Sailing Directions, Light Lists, and other publications. Part I, Western Hemisphere, covers North and South America, Greenland, and the Hawaiian Islands and includes general information of world interest. Part II, Eastern Hemisphere, covers notices to mariners and light lists for the rest of the world.

The IMMIGRATION AND NATURALIZATION SERVICE administers the laws relating to admission, exclusion, and deportation of aliens, the registration and fingerprinting of aliens, and the naturalization of aliens lawfully resident in the United States.

The designated ports of entry for aliens are divided into three classes. Class A is for all aliens. Class B is only

for aliens who at the time of applying for admission are lawfully in possession of valid and unexpired resident aliens' border-crossing identification cards or valid non-resident aliens' border-crossing identification cards. Class C is only for aliens who are arriving in the United States as seamen as that term is defined in the last sentence of section 1 of the Immigration Act of 1917 (39 Stat. 874; 8 U. S. C. 173). [That the term seaman as used in this Act shall include every person signed on the ship's articles and employed in any capacity on board any vessel arriving in the United States from any foreign port or place.] No alien may enter the United States until he has been inspected by an immigration officer. A list of the ports of entry for aliens is given in the Appendix.

The PUBLIC HEALTH SERVICE administers hospitalization and outpatient treatment to legal beneficiaries of the Government; it also administers foreign and domestic quarantine laws, supervising the medical examination of immigrants and enforcing interstate laws.

**Quarantine.**—A vessel arriving at a port under the control of the United States shall undergo quarantine inspection prior to entry unless: (1) in the current voyage the vessel has not touched at any port other than those under the control of the United States, or in Canada, the Islands of St. Pierre and Miquelon, Iceland, Greenland, the West Coast of Lower California, Cuba, the Bahama Islands, the Canal Zone, the Bermuda Islands, and the Islands of Aruba and Curacao; or (2) in the current voyage the vessel has received pratique at a port under the control of the United States and since receiving same has not touched at a port other than those listed in (1); or (3) the vessel possesses a duplicate of a pratique issued at a port in Canada or the Canal Zone and since receiving same has not touched at ports other than those listed in (1).

A vessel otherwise exempt from quarantine inspection shall undergo such inspection prior to entering a port under the control of the United States if the vessel has aboard a person infected or suspected of being infected with certain communicable diseases, or if the vessel arrives from a port where at the time of departure there was present or suspected of being present cholera, plague, or yellow fever, or there was a significant increase in the prevalence of smallpox or typhus.

Vessels subject to quarantine inspection shall upon arrival at ports under the control of the United States fly a yellow flag, anchor in the quarantine anchorage, and await inspection. Only the quarantine officer, quarantine employees, or pilots shall be permitted to board any vessel subject to quarantine inspection until after it has been inspected by the quarantine officer and granted pratique, except with the permission of the quarantine officer. A person boarding such vessel shall be subject to the same restrictions as those imposed on the persons on the vessel.

**Sanitary inspection.**—Vessels arriving at a port under the control of the United States from a foreign port shall be subject to sanitary inspection to ascertain whether

there exists rodent, vermin, or insect infestation or other unsanitary condition requiring measures for the prevention of the introduction, transmission, or spread of communicable disease.

In general, where State quarantine is in force, the minimum requirements of quarantine are in accordance with the regulations of the Public Health Service. National quarantine regulations will be found at the stations of the service and at United States consulates, and will be furnished to vessels upon application to officers of the service or to the Bureau in Washington, D.C.

**Medical service.**—United States merchant seamen are entitled to medical relief obtainable through the Public Health Service. A United States seaman is one engaged on board in care, preservation, or navigation of any registered, enrolled, or licensed vessel of the United States, or in the service, on board, of those so engaged. **Hospitals, outpatient clinics, and outpatient offices** of the Public Health Service are located at the addresses given in the Appendix. Free medical advice is furnished to seamen by H. O. Publication 205, Radio Navigational Aids.

**RADIO.**—The Federal Communications Commission controls radio communications in the United States and in all possessions except the Panama Canal Zone. Commission inspectors have authority to board ships to determine whether their radio stations comply with international treaties, Federal laws, and Commission regulations. The Commission has field offices in the principal United States ports. Information concerning ship radio regulations and service documents may be obtained from the Federal Communications Commission, Washington 25, D.C., or from any of the field offices.

**Marine weather broadcasts.**—Information on weather over North Atlantic and North Pacific waters is issued by the Weather Bureau for broadcast by commercial and Government radio stations. Marine bulletins for the western North Atlantic are broadcast by Navy station NSS, Washington, D.C.; those for the eastern North Pacific are transmitted by KPH, Bolinas, Calif., and KTK, San Francisco, Calif. A separate bulletin for Central Pacific waters is broadcast by KHK, Kahuku, Hawaii. The marine bulletins include storm advisories and forecasts. Station frequencies, broadcast times, and areas affected are stated in H. O. Publication 206, Radio Weather Aids.

Advisories and forecasts also are broadcast by Navy stations NBA, Balboa, C.Z.; NPG, San Francisco, Calif.; NHB, Kodiak, Alaska; and NPM, Honolulu, Hawaii. Additional surface and upper-air data for preparation of weather maps at sea is contained in the Synoptic Weather Bulletins broadcast by Civil Aeronautics Administration station WBR, Miami, Fla.

**Local weather bulletins,** containing coastal-area forecasts, storm advisories, and weather summaries for specific areas, are broadcast on regular schedules by many Government and commercial radio stations.

**Emergency broadcasts by Navy radio stations.**—Storm advisories and notices concerning the safety of navigation

at sea are broadcast by Navy radio stations in accordance with the degree of urgency, as follows:

A. Notices of tidal waves, hurricanes, typhoons, and cyclones so imminent as to warrant immediate broadcasting: (1) One transmission immediately on receipt; (2) one transmission at the end of the first ensuing silent period; and (3) one transmission during the first ensuing on-watch period for ships with one operator, in case both previous transmissions were made during the off watch period.

B. Storm warnings and notices of less urgency than those specified in (A) and other than those normally included in scheduled hydrographic broadcasts: (1) One transmission at the end of the first ensuing silent period; and (2) one transmission during the on-watch period for ships with one operator in case the previous transmission was made during an off-watch period.

These broadcasts are preceded by transmission of the Urgent Signal (XXX) or the Safety Signal (TTT) and a preliminary announcement on 500 kc. of the message to follow on the station working frequency.

**Emergency broadcasts by Coast Guard radio stations.**—Storm and hurricane warnings, advisories and other urgent marine information are broadcast by Coast Guard radio stations:

A. By radiotelegraph on the station's medium frequency immediately following the first silent period after receipt of the message at the radio station (HH+18 or HH+48) preceded by an initial call on 500 kc. Whenever this transmission occurs outside the watch hours for single radio operator ships, the message will be repeated at the end of the next silent period falling within the radio watch hours for such vessels. If a station makes daily broadcasts of marine information, the message will also be included in its next scheduled transmission.

B. By radiotelephone on the District Voice Working frequency immediately following receipt of the message at the radio station preceded by an initial call on 2182 kc. and repeated at the station's next scheduled broadcast.

**Radiotelephone broadcasts of weather information (United States).**—Transmission by voice of weather information from the Weather Bureau is made through certain radio stations of the Coast Guard and of the commercial coastal radiotelephone service. These broadcasts are followed immediately by reports of dangerous obstructions and changes in aids to navigation.

This service gives to yachts, fishing craft, tugboats, and other vessels equipped with a radio receiving set having a band covering the frequency range of 2 to 3 megacycles, official weather information from the Weather Bureau in plain language and on regular schedules.

These radiotelephone broadcasts are made twice and, in some cases, four times daily at definite times and include marine forecasts, and storm warnings whenever they are issued, for coastal waters in or adjacent to the areas served by the radio stations.

Certain local radio stations in the standard broadcast band have microphones installed in nearby Weather Bureau offices. From these stations forecasts, weather summaries, and warnings are broadcast on regular schedule.

For stations and schedules in the area covered by this volume, see the Appendix.

**West Indies.**—Coast Guard station NMR, San Juan, P.R., broadcasts twice daily by radiotelephone and radiotelegraph a weather bulletin consisting of marine forecasts and weather summary for the Caribbean Sea area and small-craft, storm, and hurricane warnings when applicable.

**Mexico and Canada.**—Scheduled broadcasts of weather information affecting the coasts of Mexico and Canada are made by designated stations of those countries on marine frequencies by both radiotelegraph and radiotelephone.

**Alaska.**—Weather broadcasts are made by radiotelegraph by Naval station NHB, Kodiak, and Coast Guard station NMJ, Ketchikan. Radiotelephone broadcasts are made by NMJ and by various stations of the Alaska Communication System operating in the 2-megacycle band.

**Reports from ships.**—The master of every ship of the United States equipped with radio transmitting apparatus, on meeting with a tropical storm, dangerous ice, derelict, or any other direct danger to navigation, is required to cause to be transmitted a report of these dangers to ships in the vicinity and to the appropriate Government agencies.

During the West Indies hurricane season, June 1 to November 30, ships in the Gulf of Mexico, Caribbean Sea area, southern North Atlantic Ocean, and the Pacific waters west of Central America and Mexico are urged to cooperate with the Weather Bureau in furnishing these special reports in order that warnings to shipping and coastal areas may be issued.

**TIME SIGNALS.**—The United States system of broadcasting time signals begins at 55 minutes 0 second of some hour and continues for 5 minutes. Signals are transmitted on every second of this period except the 29th of each minute, the 51st of the first minute, the 52d of the second minute, the 53d of the third minute, the 54th of the fourth minute, the last 4 seconds of the first 4 minutes, and the last 9 seconds of the last minute. The hour signal is a 1.3-second dash, which is much longer than the others.

In all cases the beginnings of the dashes indicate the beginnings of the seconds, and the ends of the dashes are without significance. The number of dashes sounded in the group at the end of any minute indicates the number of minutes of the signal yet to be sent. In case of signal failure or error, the signal is repeated 1 hour later.

The National Bureau of Standards broadcasts time signals from its radio station WWV near Washington, D.C., on radio frequencies of 2.5, 5, 10, 15, 20, and 25 megacycles, which are on the air at all times, day and night. This insures reliable coverage of the United States and extensive coverage of other parts of the world. The services include time announcements, standard time intervals, standard audio frequencies, and radio-propagation disturbance-warning notices.

**Time announcements.**—The audio frequencies are interrupted at precisely 1 minute before each hour and each 5 minutes thereafter. They are resumed precisely on the hour and each 5 minutes thereafter. The beginnings of the periods, when the audio frequencies are resumed, are in agreement with the basic service of the United States Naval Observatory, and accordingly they accurately mark the hour and successive 5-minute periods.

Greenwich Mean Time is announced in telegraphic code each 5 minutes. The zero- to 24-hour system is used. This announcement refers to the end of the announcement interval. A voice announcement of eastern standard time is given following each telegraphic code announcement.

**Standard time intervals.**—On each carrier frequency is a pulse which occurs at intervals of precisely 1 second. The pulse is omitted at the beginning of the last second of every minute. The 1-minute, 4-minute, and 5-minute intervals, synchronized with the second pulses, are marked by the beginning or ending of the periods when the audio frequencies are off.

A radio-propagation disturbance warning forecast is transmitted in Morse code twice each hour at 19½ and 49½ minutes past the hour. These warnings tell users of radio transmission paths over the North Atlantic the condition of the ionosphere at the time of the announcement and how good or bad communication conditions are expected to be for the next 12 hours. During a period of radio-propagation disturbance, direction-finder observations may be unreliable: the letters "N", "U", and "W" signify that radio propagation conditions are, respectively, normal, unsettled, or disturbed.

Radio station WWVH, on the island of Maui, Hawaii, broadcasts on 5, 10, and 15 megacycles. The schedule of broadcasts is the same as that of station WWV for standard time intervals, time announcements in code, standard audio frequencies, and accuracy. Simultaneous reception of WWV and WWVH does not interfere with ordinary use of the standard frequency and time signals.

The WWVH broadcast is interrupted for 4 minutes following each hour and half hour and for periods of 34 minutes each day beginning at 1900 GMT.

**DESTRUCTIVE WAVES.**—Unusual sudden changes in water level can be caused by seismic sea waves or violent storms. These two types of destructive waves have become commonly known as tidal waves, a name which is technically incorrect as they are not the result of tide-producing forces.

Seismic sea waves are set up by submarine earthquakes. Many such seismic disturbances do not produce sea waves and often those produced are small, but the occasional large waves can be very damaging to shore installations and dangerous to ships in harbors.

These waves travel great distances and can cause tremendous damage on coasts far from their source. The wave of April 1, 1946, that originated in the Aleutian Trench demolished nearby Scotch Cap Lighthouse and also

caused \$25,000,000 damage in the Hawaiian Islands 2,200 miles away.

The speed of seismic sea waves varies with the depth of the water, reaching 300 to 500 knots in the deep water of the open ocean. In the open sea they cannot be detected from a ship or from the air because their length is so great, sometimes a hundred miles, as compared to their height, which is usually only a few feet. Only on certain types of shelving coasts do they build up into waves of disastrous proportions.

There is usually a series of waves with crests 10 to 40 minutes apart, and the highest may occur several hours after the first wave. Sometimes the first noticeable part of the wave is the trough which causes a recession of the water from shore, and people who have gone out to investigate this unusual exposure of the beach have been engulfed by the oncoming crest. Such an unexplained withdrawal of the sea should be considered as nature's warning of an approaching wave.

Improvements have been and are being made in the quick determination and reporting of earthquake epicenters, but no method has yet been perfected for determining whether a sea wave will result from a given earthquake. The problem of detecting and reporting the existence of seismic sea waves when they do occur is being studied. A reporting system has been organized in the Pacific with its center in the Hawaiian Islands.

When an advance warning is available, water-front areas should be vacated for higher ground and ships in

the vicinity of land should head for the deep water of the open sea.

**Storm waves.**—A considerable rise or fall in the level of the sea along a particular coast may result from strong winds and a sharp change in barometric pressure. In cases where the water level is raised, higher waves can form with greater depth and the combination can be destructive to low regions, particularly at high stages of tide. Extreme low levels can result in depths which are considerably less than those shown on nautical charts. This type of wave occurs especially in coastal regions bordering on shallow waters which are subject to tropical storms.

**Seiche** is a stationary vertical wave oscillation with a period varying from a few minutes to an hour or more, but somewhat less than the tidal periods. It is usually attributed to external forces such as strong winds, changes in barometric pressure, swells, or seismic sea waves disturbing the equilibrium of the water surface. Seiche is found both in enclosed bodies of water and superimposed upon the tides of the open ocean. When the external forces cause a short-period horizontal oscillation of the water, it is called **surge**.

The combined effect of seiche and surge sometimes makes it difficult to maintain a ship in its position alongside a pier even though the water may appear to be completely undisturbed, and heavy mooring lines have been parted repeatedly under such conditions. Pilots advise taut lines to reduce the effect of the surge.

## 2. NAVIGATION REGULATIONS

THIS chapter contains the sections of Code of Federal Regulations, Title 33, Navigation and Navigable Waters, that are of most importance in the areas covered by Coast Pilot 7. The sections are from Part 82, Boundary Lines of Inland Waters; Part 124, Control Over Movement of Vessels; Part 202, Anchorage Regulations; Part 203, Bridge Regulations; Part 204, Danger Zone Regulations; and Part 207, Navigation Regulations.

### PART 82—BOUNDARY LINES OF INLAND WATERS:

**§ 82.1 General basis and purpose of boundary lines.** By virtue of the authority vested in the Commandant of the Coast Guard under section 101 of Reorganization Plan No. 3 of 1946 (3 CFR, 1946 Supp., Ch. IV), and section 2 of the act of February 19, 1895, as amended (28 Stat. 672, 33 U.S.C. 151), the regulations in this part are prescribed to establish the lines dividing the high seas from rivers, harbors, and inland waters in accordance with the intent of the statute and to obtain its correct and uniform administration. The waters inshore of the lines described in this part are "inland waters," and upon them the inland rules and pilot rules made in pursuance thereof apply. The waters outside of the lines described in this part are the high seas and upon them the international rules apply. The regulations in this part do not apply to the Great Lakes or their connecting and tributary waters.

**§ 82.2 General rules for inland waters.** At all buoyed entrances from seaward to bays, sounds, rivers, or other estuaries for which specific lines are not described in this part, the waters inshore of a line approximately parallel with the general trend of the shore, drawn through the outermost buoy or other aid to navigation of any system of aids, are inland waters, and upon them the inland rules and pilot rules made in pursuance thereof apply, except that Pilot Rules for Western Rivers apply to the Red River of the North, the Mississippi River and its tributaries above Huey P. Long Bridge, and that part of the Atchafalaya River above its junction with the Plaquemine-Morgan City alternate waterway.

**§ 82.120 Juan de Fuca Strait, Wash., and Puget Sound.** A line drawn from the northernmost point of Angeles Point to Hein Bank Lighted Bell Buoy; thence to Line Kiln Light; thence to Kellett Bluff Light; thence to Turn Point Light on Stuart Island; thence to westernmost extremity of Skipjack Island; thence to Patos Island Light; thence to Point Roberts Light.

**§ 82.125 Columbia River Entrance.** A line drawn from the west end of the north jetty (above water) to South Jetty Bell Buoy 2SJ.

**§ 82.130 San Francisco Harbor.** A straight line from Point Bonita Lighthouse drawn through Mile Rocks Lighthouse to the shore.

**§ 82.135 San Pedro Bay.** A line drawn from Los Angeles Harbor Lighthouse through the axis of the Middle Breakwater to the eastern-most extremity of the Long Beach Breakwater; thence to Anaheim Bay East Jetty Light 4.

**§ 82.140 San Diego Harbor.** A line drawn from the southerly tower of the Coronado Hotel to San Diego Channel Lighted Bell Buoy 5; thence to Point Loma Lighthouse.

**§ 82.175 Mamala Bay.** A line drawn from Barbers Point Lighthouse to Diamond Head Lighthouse.

### PART 124—CONTROL OVER MOVEMENT OF VESSELS:

**§ 124.10 Advance notice of vessel's time of arrival to Captain of the Port.** (a) The master or agents of every vessel (foreign and domestic) shall give at least 24 hours' advance notice of the time of such vessel's arrival to the Captain of the Port where the vessel is to arrive. The master or agents of every foreign vessel, as well as every documented vessel of the United States, destined from one port or place to another port or place shall give at least 24 hours' advance notice of the time of such vessel's arrival to the Captain of the Port where the vessel is to arrive. For such foreign and domestic vessels, this 24 hours' advance notice of time of arrival is applicable at every port of call. In any case where the port of arrival is not located within the geographical area assigned to a particular Captain of the Port, this advance notice of time of arrival shall be made to the Commander of the Coast Guard District in which such a port or place is located. In a case of force majeure, if it is not possible to give at least a 24 hours' advance notice of time of arrival, then an advance notice as early as practicable shall be furnished.

(b) The master and agents of a vessel entering the Great Lakes shall be exempt from the requirements of paragraph (a) of this section, but the master or agents of such vessel if bound for a United States port shall:

(1) Immediately on the vessel's entry into Lake Ontario inbound, advise the Commander, 9th Coast Guard District, of the vessel's first intended United States port of call and estimated time of arrival in that port.

(2) Upon the vessel's arrival in the first United States port cause to be delivered to the Captain of the Port an itinerary giving the vessel's foreign ports of call during the preceding six months or last visit to a U.S. port which ever is later, the intended ports of call on the Great Lakes, and the estimated dates of arrival.

(3) Thereafter, immediately advise the Commander, 9th Coast Guard District, when the necessity of a deviation from that itinerary becomes known.

(c) The master or agents of a vessel engaged upon a scheduled route need not furnish the advance notice of arrival in individual instances if a copy of the schedule is filed with the Captain of the Port for each port of call named in the schedule and the times of arrival at each such port are adhered to.

(d) The masters of merchant vessels (except on coastwise voyages of 24 hours or less) reporting in accordance with the U.S. Coast Guard's voluntary "Merchant Vessel Reporting Program" shall be considered to be in constructive compliance with the requirements of paragraph (a) of this section, and no additional advance notice of vessel's arrival reports to the Captain of the Port are required. The master or agent of a vessel on coastwise voyages of 24 hours or less shall report the advance notice of vessel's arrival as provided in paragraph (a) of this section.

(e) In the case of a vessel which is engaged in operations in and out of the same port, either on voyages to sea and return without having entered any other port, or on coastwise voyages within the same Coast Guard District, or from ports within the First, Ninth, Thirteenth or Seventeenth Coast Guard Districts to adjacent Canadian ports, and where no reason exists which renders such action prejudicial to the rights and interests of the United States, the Coast Guard District Commander having jurisdiction may prescribe conditions under which Coast Guard Captains of the Ports may consider such a vessel as being in constructive compliance with the requirements of this section without the necessity for reporting each individual arrival.

(f) Failure to give advance notice will subject the master or agents of a vessel to the penalties of fine and imprisonment, as well as subject the vessel to seizure and forfeiture, as provided in section 2, title II of the act of June 15, 1917, as amended, 50 U.S.C. 192. In addition, such failure may result in delay in the movement of the vessel from the harbor entrance to her facility destination within the particular port.

(g) The requirements of this section do not apply to the following:

(1) Vessels which, during the course of their voyages, do not navigate any portion of the high seas; and

(2) Vessels which are numbered by the Coast Guard.

(h) The term "high seas", as used in this section, shall be construed to mean any portion of the open sea below the low water mark along the coasts and projections of the

land across the entrances of bays, sounds and other bodies of water which join the open sea.

## PART 202—ANCHORAGE REGULATIONS:

§ 202.1 General. (a) The areas described in Subpart A of this part are designated as special anchorage areas pursuant to the authority contained in an act amending laws for preventing collisions of vessels approved April 22, 1940 (54 Stat. 150). Section 1 of the act amended Article 11 of the Navigation Rules for Harbors, Rivers, and Inland Waters Generally (33 U.S.C. 180), section 2 amended Rule 9 of the Navigation Rules for Great Lakes and Their Connecting and Tributary Waters (33 U.S.C. 258), and section 3 amended Rule 10 of the Navigation Rules for Red River of the North and Rivers Emptying into Gulf of Mexico and Tributaries (33 U.S.C. 319). Vessels not more than 65 feet in length, when at anchor in any special anchorage area, shall not be required to carry or exhibit the white anchor lights required by the Navigation Rules.

(b) The anchorage grounds for vessels described in Subpart B of this part are established, and the rules and regulations in relation thereto adopted, pursuant to the authority contained in section 7 of the River and Harbor Act approved March 4, 1915 (38 Stat. 1053; 33 U.S.C. 471).

(c) All bearings in this part are referred to true meridian.

### Subpart A—Special Anchorage Areas:

§ 202.90 San Diego Harbor, Calif.—(a) Area A-1. All of the Municipal Yacht Harbor within the following described boundaries: Beginning at station 120 on the United States pierhead line; thence along the pierhead line through stations 250A, 258A, 260, 262, 264, 266, 268, 270, and 272A; thence (from station 272A) 226°57' 2,893.65 feet; thence 191°, 1,118.20 feet; thence 269°28', 26.83 feet to the point of beginning.

NOTE: This area is reserved for yachts and other recreational craft, and for all types of small craft during storm, stress, or other emergency. Single and fore and aft moorings will be allowed in the area as permitted by the Port Director, Port of San Diego.

(b) Area A-2. An area in the Commercial Basin having the southwesterly side parallel to and 325 feet from the pierhead line and all other sides parallel to and 250 feet from the pierhead line.

NOTE: This area is reserved for commercial fishing boats having a length of 65 feet and under. Single and fore and aft moorings will be allowed in the area as permitted by the Port Director, Port of San Diego.

(c) Area A-3. An area between the United States bulkhead and pierhead lines bounded on the north by a portion of the bulkhead line between Stations 218 and 220; on the northeast by a portion of the bulkhead line between Stations 220 and 222; on the southeast by a line perpendicular to that portion of the bulkhead line between Stations 220 and 222, at a point 1,300 feet southeasterly

of Station 220; on the southwest by a portion of the pierhead line between Stations 304 and 306; and on the west by the easterly side of the nonanchorage area.

NOTE: This area is reserved for commercial fishing boats having a length of 65 feet and under. Single and fore and aft moorings will be allowed in the area as permitted by the Port Director, Port of San Diego.

(d) Area A-4. [Revoked]

(e) Area A-5. Shoreward of a line extending from United States Bulkhead Line Station 159 to Station 171.

NOTE: This area is reserved for yachts and other small recreational craft. Fixed moorings will be allowed in the area as permitted by the Port Director, Port of San Diego.

**§ 202.95 Newport Bay Harbor, Calif.—**(a) Area A-1. In Lido Channel, northeast of a line parallel to and 195 feet from the pierhead line along the southwest shore of Lido Isle; north of the south U.S. Bulkhead line off Lido Isle extended; southwest of a line parallel to and 120 feet from the pierhead line along the southwest shore of Lido Isle; and southeast of the north side of Via Barcelona, on Lido Isle, extended.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the city of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(b) Area A-2. East of the east side of 15th Street extended; north of a line parallel to and 250 feet from the pierhead line between 14th and 15th Streets, this line being the north line of Newport Channel, and extending east in a straight line to an intersection with a line bearing 268° from the flashing red beacon on the southeast end of Lido Isle, this line being the northwest line of the main fairway; west of the east side of 13th Street extended; and south of a line parallel to and 220 feet from the pierhead line off the south shore of Lido Isle.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the city of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(c) Area A-3. A rectangular area, 40 feet wide and 885 feet long, on the west side of Upper Bay Channel, 120 feet east of and parallel to the west pierhead line, the south end being 50 feet north from U.S. Bulkhead Station 130.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to Orange County Harbor Ordinance No. 490 for recreational and small craft of such size and alignment as permitted by the harbor master.

(d) Area A-4. South of a line bearing 268° from the flashing green beacon off Bay Island and passing through the beacon off 13th Street, this line being the south line of the main fairway; north of a line parallel to and 200 feet from the pierhead line off 11th to 8th Streets; and west of a line bearing 203° from the flashing red beacon at the south extremity of Bay Shores, passing through the pierhead line at the east end of Lido Isle.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(e) Area A-5 (Newport Harbor Yacht Club). East of a line bearing 23° from the center of the north end of 8th Street, being parallel to and 150 feet distant from the east end of Area A-4; north of a line parallel to and 200 feet from the pierhead line off 7th and 8th Streets; northwest of a line parallel to and 200 feet from the northwest pierhead line off Bay Island; and south of a line bearing 268° from the flashing green beacon off Bay Island and passing through the beacon off 13th Street, this line being the southerly line of the main fairway.

NOTE: This area is reserved for recreational and other small craft. Single moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for pleasure boats and yachts of such sizes and alignments as permitted by the harbor master.

(f) Area A-6. Northwest of Harbor Island, beginning at a point on the Newport City line 107 feet from the angle point northwest of Harbor Island; thence 36°27', 55 feet; thence 303°18', 300 feet; thence 216°27', 72 feet; thence 165°12', 211 feet; thence 75°11'44'', approximately 216 feet, to the point of beginning.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to Orange County Harbor Ordinance No. 490 for recreational and small craft of such size and alignment as permitted by the harbor master.

(g) Area A-7. East of a line parallel to and 150 feet from the east pierhead line off Bay Island; north of a line parallel to and 150 feet from the pierhead line off Fernando Street; northwest of the east side of Adams Street extended; and southwest of a line bearing 131° from the flashing green beacon off Bay Island, being parallel to and 100 feet southwest of the southwest line of the main channel.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(h) Area A-8. Northeast of a line parallel to and 270 feet from the southwest pierhead line from Collins Isle to Balboa Island; north of a line bearing 311° from the flashing red beacon off the southwest point of Balboa Island and passing through the flashing red beacon off the south point of Bay Shore, this line being the northeast line of the main channel; southwest of a line parallel to and 150 feet from the southwest pierhead line from Collins Isle to Balboa Island; and southeast of a line bearing 238° from U.S. Station 160.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(i) Area A-9. In Balboa Island Channel, east of a line

bearing due north from U.S. Station 151, being 25 feet west of the end of Emerald Avenue; north of a line parallel to and 75 feet from the north pierhead line off Balboa Island; west of the east side of Amethyst Avenue extended; and south of a line parallel to and 150 feet from the north pierhead line of Balboa Island.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(j) Area A-10. Southeast of a line bearing 209° from the flashing red beacon on the southwest point of Balboa Island and passing through the east side of the end of "A" Street; north of an irregular line parallel to and 150 feet from the north pierhead line off Balboa Peninsula from "A" to "K" Streets; south of the south line of the main channel; and south and southeast of an irregular line parallel to and 375 feet from the north pierhead line off Balboa Peninsula.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(k) Area A-11. Northeast of a line bearing 108°30' from the flashing red beacon at the southwest point of Balboa Island, passing through the flashing red channel buoy No. 4, this line being the northeast line of the main channel; north of a line parallel to and 350 feet from the south pierhead line off Balboa Island; west of the west bulkhead line of the Grand Canal extended; and south of a line parallel to and 150 feet from the south pierhead line off Balboa Island.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for recreational and small craft of such size and alignment as permitted by the harbor master.

(l) Area A-12 (Balboa Yacht Club). South of a line parallel to and 150 feet from the south pierhead line off Balboa Island; west of the east end pierhead line off Balboa Island extended and bearing 161°; north of a line parallel to and 700 feet from the south pierhead line off Balboa Island; and east of a line parallel to and 1,000 feet from the east boundary, bearing 161° from the point of intersection of the east bulkhead line of Grand Canal and the south bulkhead line off Balboa Island.

NOTE: This area is reserved for recreational and other small craft. Single moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for pleasure boats and yachts of such sizes and alignments as permitted by the harbor master.

(m) Area A-13. In Upper Bay Channel, beginning at a point 60 feet north of the north side of the State Highway bridge and 62 feet west of the adjudicated high-tide line; thence 20°, 165 feet; thence 267°17', 100 feet; thence 200°, 165 feet; thence 87°17', 100 feet, to the point of beginning.

NOTE: This area is reserved for recreational and other small craft. Fore and aft moorings will be allowed in this area conforming to Orange County Harbor Ordinance No. 490 for recreational and small craft of such size and alignment as permitted by the harbor master.

(n) Area B-1. Southeast of a line bearing 227° from the flashing red beacon at the southwest corner of Lido Isle and being parallel to and 200 feet from the pierhead line off the southeast end of Rhine Point; northeast of the southwest bulkhead line off Rhine Point extended; north of a line parallel to and 250 feet from the pierhead line between 15th and 18th Streets, this line being the north line of Newport Channel; west of the west side of 15th Street extended; and south of a line parallel to and 220 feet from the pierhead line off the south shore of Lido Isle.

NOTE: This area is reserved for commercial fishing vessels. Fore and aft moorings will be allowed in this area conforming to the City of Newport Beach Harbor Ordinance No. 543 for boats licensed for commercial fishing of such sizes and alignments as permitted by the harbor master.

(o) Area B-2. In Upper Bay Channel, beginning at the northeast corner of Area A-13; thence 267°17', 100 feet; thence 11°, 195 feet; thence 111°, 122 feet; thence 200°, 153 feet, to the point of beginning.

NOTE: This area is reserved for commercial fishing vessels. Fore and aft moorings will be allowed in this area conforming to Orange County Harbor Ordinance No. 490 for commercial fishing boats of such size and alignments as permitted by the harbor master.

#### § 202.100 Los Angeles and Long Beach Harbors, Calif.—

(a) Area A-1. North of a line 200 feet from and parallel to the axis of the San Pedro breakwater; bayward of the mean high tide line; southwest of a line bearing 125° from the tall concrete stack south of Fort MacArthur lower reservation; west of the bulkhead line from U.S. 104 through U.S. 102, extended, and northwest of a line extending from U.S. 103 to U.S. 101.

(b) Area A-2. Consisting of three parts of the outer basin of Fish Harbor, on the east and west sides of Fish Harbor Entrance Channel, described as follows:

(1) Part 1. Beginning at a point at the intersection of westerly side of Fish Harbor Entrance Channel and the outer jetty; thence southwesterly along the jetty about 900 feet to the shore; thence northerly about 500 feet; thence northeasterly about 650 feet, on a line parallel to jetty; thence southeasterly about 500 feet, along the westerly side of Fish Harbor Entrance Channel to the point of beginning.

(2) Part 2. Beginning at a point at the intersection of the east side of Fish Harbor Entrance Channel and Fish Harbor mole (outer Fish Harbor); thence northwesterly along channel line about 850 feet to the southerly side of the Fairway; thence northeasterly and easterly along the southerly side of the Fairway, about 478 and 565 feet respectively to its intersection with Fish Harbor mole; thence southerly and southwesterly along the mole to the point of beginning.

(3) Part 3. Beginning at a point at the intersection of the east side of Fish Harbor Entrance Channel and the northerly side of the Fairway; thence along the northerly side of the Fairway about 565 feet; thence northerly about 129 feet; thence about 138 feet along a line perpendicular to the inner jetty; thence southwesterly along the inner jetty to the east side of Fish Harbor Entrance Channel; thence southeasterly along the east side of the channel to the point of beginning.

§ 202.105 Avalon Bay, Santa Catalina Island, Calif. Shoreward of a line connecting the promontories known as Casino Point and Bathhouse Point; excluding therefrom the fairways as established by the harbor master, City of Avalon.

NOTE: This area is reserved for yachts and other small craft. Moorings will be allowed in this area conforming to the City of Avalon Ordinance No. 264 of such size and alignment as permitted by the harbor master.

§ 202.110 Santa Monica Harbor, Calif. The waters inclosed by a line 1,000 feet southwest of and parallel to the axis of the Santa Monica breakwater and extending 2,000 feet northwest and 2,000 feet southeast of the ends of the breakwater, lines extending shoreward from and normal to each end of the said line, and the mean high tide line; excluding therefrom the fairways as established by the harbor master, City of Santa Monica.

NOTE: This area is reserved for small craft. Fore and aft moorings will be allowed in this area conforming to the City of Santa Monica Harbor Ordinances Nos. 541, 705, 706, and 1356 for recreational and other small craft of such size and alignment as permitted by the harbor master. Fixed mooring piles or stakes are prohibited.

§ 202.115 Santa Barbara Harbor, Calif. North of the Santa Barbara breakwater; seaward of the line of mean high water; and southwest of a line bearing 46°30' from the north corner of Bath Street and Cabrillo Boulevard to the end of the Santa Barbara breakwater; excluding a fairway 225 feet wide, 100 feet from each side of and parallel to the Navy pier.

NOTE: Fore and aft moorings will be allowed in this area conforming to the City of Santa Barbara Harbor Ordinance No. 2106 for yachts and small craft of such size and alignment as permitted by the harbor master.

§ 202.120 San Luis Obispo Bay, Calif. Eastward of the San Luis Obispo County wharf; northward of a line bearing 116° from the southeast corner of San Luis Obispo County wharf; and westward of a line bearing 210° from the most seaward extremity of Fossil Point.

§ 202.125 Morro Bay Harbor, Calif.—(a) Area A-1. Opposite the town of Morrow, beginning at the intersection of the west channel line and the prolongation of the center line of Seventh Street; thence 270° to the mean high water line on the peninsula; thence generally south along the mean high water line to the prolongation of the axis of the south breakwater; thence northeasterly

to the intersection of a line 200 feet westerly of and parallel to the east channel line and the prolongation of the center line of Third Street; thence northerly along the line 200 feet westerly of and parallel to the east channel line about 350 feet to its intersection with the west channel line; and thence northwesterly along the west channel line to the point of beginning.

NOTE: This area is reserved for small craft. Temporary floats or buoys for marking anchors or moorings in place will be allowed in this area. Fixed mooring piles or stakes are prohibited.

(b) Area A-2. Beginning at a point on the channel line opposite the angle point near the south end of the revetment; thence southeast along the east channel line to the end of the channel; thence 166°30' to White Point; thence along the mean high tide line north to the angle point near the south end of the revetment; thence southwest to the point of beginning.

NOTE: This area is reserved for small craft. Temporary floats or buoys for marking anchors or moorings in place will be allowed in this area. Fixed mooring piles or stakes are prohibited.

§ 202.126 Monterey Harbor, Calif. The waters of Monterey Harbor south of the Monterey Breakwater; and shoreward of a line beginning at Point "A" on the south side of the Monterey Breakwater about 750 feet east of the shore and at the westerly extremity of the U.S. Coast Guard wharf along the southerly side of the breakwater; thence 200°, 175 feet, to Point "B"; thence 110°, 1,300 feet, to Point "C"; thence 120° to Point "D" on the northerly extension of the westerly line of Park Avenue, City of Monterey; and thence 168°30' along the westerly line of Park Avenue extended to the shore; excluding from this area a fairway 125 feet wide whose centerline begins at Point "C" and extends thence 205°, 610 feet, and thence 246°, 720 feet, and the waters between this fairway and the northerly end of Municipal Wharf No. 2 and between the southwesterly end of the fairway and Municipal Wharf No. 1.

§ 202.128 Columbia River at Portland, Oreg. The waters of the Columbia River between Sand Island and Government Island, bounded on the west by pile dike U.S. 5.75 and a line extending true north from the northerly end of the dike to the south shore of Sand Island and bounded on the east by a line bearing 339°15' true, from a point on Government Island at latitude 45°35'101'', longitude 122°32'41'', to the southerly shore of Sand Island.

#### Subpart B—Anchorage Grounds:

§ 202.210 San Diego Harbor, Calif.—(a) The anchorage grounds. The anchorage grounds for general use shall include all of the navigable waters of the harbor except cable and pipe-line areas, the special anchorage areas described in § 202.90, the seaplane restricted area described in § 207.612 of this chapter, and the following:

(1) Special anchorage for U.S. Government vessels. Shoreward of a line extending from Ballast Point Light

approximately 351°30' to the shore end of the Quarantine Dock.

(2) Seaplane area, U.S. Coast Guard Air Station. An area extending easterly from the Coast Guard Air Station, bounded on the north by a line parallel to and 100 feet bayward of the high-water line, on the east by a line from United States Pierhead Line Station 300 to Bulkhead Station 210 and extended northward, and on the south by that portion of the pierhead line between Stations 206 and 300.

(3) Nonanchorage area. A lane between San Diego and Coronado bounded on the east by a line extending southerly from a point 410 feet west of United States bulkhead line Station 220 on the San Diego side of the bay to a point 350 feet west of United States bulkhead line Station 149 on the Coronado side of the bay, and on the west by a line extending due north from the intersections of the west side of "E" Avenue with the south side of First Street, Coronado, and a line extending 225° from the intersection of the west side of Pacific Highway with the north side of Harbor Drive, San Diego.

(4) Temporary naval anchorage. Beginning at a point on the high-tide line bearing 25°30', approximately 1,200 feet, from North Tower, Coronado Heights; thence 25°30', 7,343 feet; thence approximately 351°57'41'', 11,930 feet, to United States Pierhead Line Station 318; thence 261°57'41'', approximately 902 feet, to a point on the east boundary line of the seaplane restricted area approximately 168 feet southerly of a point "e" as described in § 207.612 of this chapter; thence southerly and southwesterly along the boundary line of the seaplane restricted area through point "f" to point "g"; and thence southerly along the high-tide line to the point of beginning.

(b) The regulations. (1) Vessels anchoring in portions of the harbor other than the areas excepted in paragraph (a) of this section shall leave a free passage for other craft and shall not unreasonably obstruct the approaches to the wharves in the harbor.

(2) The special anchorage described in paragraph (a)(1) of this section is reserved exclusively for the anchorage of vessels of the United States Government and of authorized harbor pilot boats. No other vessels shall anchor in this area except by special permission obtained in advance from the Commandant, Eleventh Naval District, San Diego, California.

(3) The seaplane area described in paragraph (a)(2) of this section is reserved exclusively for the use of seaplanes and their attendant plant. Vessels may pass through the area but are not permitted to anchor in the area at any time.

(4) The area described in paragraph (a)(3) of this section is occupied by submerged pipe lines, power cables, and communication cables and is extensively used as a ferry lane by the San Diego-Coronado ferries. No vessels shall anchor in this area at any time.

(5) The temporary naval anchorage described in paragraph (a)(4) of this section is reserved as a special anchorage for naval vessels of the United States and

authorized harbor pilot boats. When the area or a part thereof is not required for the use of naval craft, navigation by other craft may be permitted provided permission is obtained in advance from the Commandant, Eleventh Naval District, San Diego, California.

§ 202.212 Newport Bay Harbor, Calif.—(a) The anchorage grounds—(1) Temporary Anchorage C-1. Southeast of a line parallel to and 170 feet from the pierhead line at the east end of Lido Isle; north of a line parallel to and 250 feet north of a line bearing 268° from the flashing green beacon off Bay Island and passing through the beacon off 13th Street, this line being the north line of the main fairway; northwest of a line 120 feet in length bearing 203° from the point of the pierhead line off the west end of Harbor Island; and southwest of the pierhead line off the northeast shore of Lido Isle extended.

(2) Temporary Anchorage C-2. A parallelogram-shaped area, 100 feet wide and 400 feet long, lying 100 feet bayward from and parallel to the existing pierhead line, and adjoining and on the north side of Anchorage C-3 described in subparagraph (3) of this paragraph.

(i) Vessels may anchor temporarily in Temporary Anchorages C-1 and C-2 when necessary and space permits, but shall move promptly when the necessity passes or upon order of the harbor master.

(ii) Vessels anchoring in Temporary Anchorages C-1 and C-2 shall comply with all applicable Pilot Rules, including that requiring anchor lights at night.

(iii) Floats or buoys for marking anchors or mooring in place and fixed mooring piles or stakes are prohibited.

(3) Anchorage C-3. A parallelogram-shaped area, 100 feet wide and 500 feet long, lying 100 feet bayward from and parallel to the existing pierhead line, and adjoining and on the south side of Temporary Anchorage C-2 described in subparagraph (2) of this paragraph.

(i) This area is reserved for recreational and other small craft.

(ii) Fore and aft moorings will be allowed in this area conforming to Orange County Harbor Ordinance No. 490 and other local harbor regulations for recreational and small craft of such size and alinement as permitted by the harbor master.

(iii) All vessels using this area are required to maintain anchor lights from sunset to sunrise.

§ 202.214 Los Angeles and Long Beach Harbors, Calif.—(a) The Anchorage grounds—(1) Commercial and Naval Anchorage B (Los Angeles Harbor). North of a line 200 feet from and parallel to the axis of the San Pedro Breakwater; southeast of a line ranging from U.S. 101 towards U.S. 115; southwest of a line bearing 125° from the tall concrete stack south of Fort MacArthur lower reservation; south of a line bearing 75° from U.S. 100 (white cross near the west end of the San Pedro Breakwater); and west of a line bearing 172° from Fish Harbor 2 Light and passing through the east white cross on the San Pedro Breakwater.

(i) In this area the requirements of commercial ships will predominate. In case of Navy requirements, see subparagraph (2) (iii) of this paragraph.

(ii) Vessels requiring examination by quarantine, customs, or immigration authorities may anchor in this area when quarantine anchorage F is not available for this purpose.

(iii) Fixed mooring piles or stakes and floats or buoys for marking anchors or moorings in place are prohibited.

(2) Commercial Anchorage C (Los Angeles Harbor). North of a line 200 feet from and parallel to the axis of the Middle Breakwater; north of a line about 3,000 feet long, bearing 293° from Los Angeles entrance East Light; east of a line bearing 152° from Fish Harbor 2 Light; west of a line bearing 338° from the white cross near the west end of the Middle Breakwater; and bayward of the line of mean high water; excepting therefrom non-anchorage Area I and the Navy restricted area for degaussing ranges.

(i) In this area the requirements of commercial ships will predominate. Vessels requiring examination by quarantine, customs, or immigration authorities may anchor in this area when quarantine anchorage F is not available for this purpose.

(ii) Fixed mooring piles or stakes and floats or buoys for marking anchors or moorings in place are prohibited.

(iii) The established anchorages for naval vessels having been found inadequate at times, when an especially large number of naval vessels are gathered in the harbor, a special anchorage chart overlay for naval anchorages superimposed on U.S. Coast and Geodetic Survey Chart No. 5148 (not published in this section) will be prepared showing a numbered series of anchorages in order that a naval vessel may be ordered to proceed to a designated numbered anchorage in the harbor. Those designated anchorages, with the exception of those in naval anchorages D and E, which are primarily for naval vessels, are not set aside for the exclusive use of naval vessels, but permission will be given for naval vessels to use them when available. When the Captain of the Port receives notification from the proper naval authorities that it is desired to utilize the specially numbered naval anchorages in anchorages B, C, F, or G, he will authorize the use by naval vessels of the required numbers if they can be made available, the commercial conditions at the time being given proper consideration. If, in the opinion of the Captain of the Port, there are sufficient reasons why the numbers first asked for should not be used, he will confer with the naval officer making the request and if other numbers can be agreed upon he will authorize their use.

(3) Naval Anchorage D. East of a line bearing 338° from a white cross near the west end of the Middle Breakwater, said line being the easterly boundary line of Commercial Anchorage C; north of a line parallel to and 200 feet from the axis of the Middle Breakwater; southwest of a line bearing 310° from Long Beach entrance West Light and passing through the east end of the Navy Mole; south of the bayward side of the Navy Mole; and south of the south line of the navy restricted area for degaussing ranges.

(i) In this area the requirements of the naval service will predominate. Vessels other than those of the Navy may anchor temporarily in this area when necessary and space permits. Whenever this area is required for the anchoring of naval vessels, it shall be immediately cleared of commercial vessels by the Captain of the Port upon request of the appropriate naval authority.

(ii) The southeast and southwest portions of this anchorage are reserved for use as Explosives Anchorages Nos. 1 and 2 whenever a necessity arises therefor. See subparagraph (8) (i) and (ii) of this paragraph.

(iii) Floats or buoys for marking anchors or moorings in place and fixed mooring piles or stakes are prohibited, except those which may be required by the Navy and approved by the Captain of the Port.

(4) Naval Anchorage E (Long Beach Harbor). North of a line 200 feet from and parallel to the axis of the Long Beach Breakwater; northeast of a line bearing 309° from the west end of the Long Beach Breakwater and passing through the south end of the Long Beach Mole; south of a line 5,500 feet from and parallel to the axis of the Long Beach Breakwater; east of a line bearing due north from the center of the opening between the Middle and Long Beach Breakwaters; south of a line bearing 101° from the south end of pier D; and west of a line bearing due north from the east end of the Long Beach Breakwater.

(i) In this area the requirements of the naval service will predominate. Vessels other than those of the Navy may anchor temporarily in this area when necessary and space permits. Whenever this area is required for the anchoring of naval vessels, it shall be immediately cleared of commercial vessels by the Captain of the Port upon request of the appropriate naval authority.

(ii) Floats or buoys for marking anchors or moorings in place and fixed mooring piles or stakes are prohibited, except those which may be required by the Navy and approved by the Captain of the Port.

(iii) The southwest portion of this anchorage is reserved for use as an explosives anchorage whenever a necessity arises therefor. See subparagraph (8) (iii) of this paragraph.

(5) Quarantine Anchorage F. East of a line bearing 172° from Fish Harbor 2 Light and passing through the east white cross on the San Pedro Breakwater; southwest of a line bearing 302° from the Los Angeles Harbor Light Station; and northerly of a line parallel to and 200 feet from the axis of the San Pedro Breakwater.

(i) Vessels arriving at quarantine and awaiting inspection will anchor in this anchorage, except that if space in this anchorage is not available then any available anchorages in Anchorages B and C may be temporarily occupied for examination. In case of Navy requirements, see subparagraph (2) (iii) of this paragraph.

(ii) No vessels, except those awaiting quarantine inspection or clearance, will anchor in the quarantine anchorage except in cases of emergency. All vessels so anchored will vacate this area as soon as the emergency ceases.

(iii) U.S. Public Health Service Quarantine Laws and

Regulations of the United States are quoted in part as follows: "Paragraph 34—Every vessel subject to quarantine inspection, entering a port of the United States, its possessions or dependencies, shall be considered in quarantine until given free pratique. Such vessel shall fly a yellow flag at the foremast head and shall observe all the other requirements of vessels actually quarantined."

(6) Commercial Anchorage G (Long Beach Harbor). North of a line 5,500 feet from and parallel to the axis of the Long Beach Breakwater; southeast of a line 1,000 feet from and parallel to the outer arm of pier A; southwest of a line bearing 116° from the end of the pier A enrockment; and west of a line bearing due north from the center of the opening between the Middle and Long Beach Breakwaters.

(i) In this area the requirements of commercial ships will predominate. In case of Navy requirements, see subparagraph (2) (iii) of this paragraph.

(ii) Fixed mooring piles or stakes and floats or buoys for marking anchors or moorings in place are prohibited.

(7) Non-Anchorage Area I. An area extending 1,300 feet south from the north boundary line of Anchorage C, 300 feet wide on each side of the prolongation of the centerline of Ferry Street. This non-anchorage area is established for the protection of a submerged outfall sewer pipeline. The City of Los Angeles Board of Harbor Commissioners will mark this area with signs reading "Do not anchor in this area."

(8) Explosives anchorages—(i) No. 1. A circular area within Anchorage D of 900-foot radius whose center bears 266°, 4,650 yards, from Long Beach Harbor Light.

(ii) No. 2. A circular area within Anchorage D of 900-foot radius whose center bears 276°, 2,975 yards, from Long Beach Harbor Light.

(iii) No. 3. A circular area within Anchorage E of 900-foot radius whose center bears 69°, 2,260 yards, from Long Beach Harbor Light.

(iv) Safety zones. When an explosives anchorage is occupied by a vessel carrying, loading, or unloading explosives, a circular zone surrounding the explosives anchorage of 600 yards or of 1,000 yards, as the Captain of the Port may determine, may be declared by the Captain of the Port to be a forbidden anchorage in the interests of port security and commerce. Vessels within such circular zone, upon being notified by the Captain of the Port to move or shift position, shall get under way at once or signal for a tug and change position as directed with reasonable promptness.

(b) The regulations. (1) Except in cases of great emergency, no vessel shall be anchored in the navigable waters of Los Angeles and Long Beach Harbors outside of the anchorages established in this section.

(2) Anchors must not be placed outside the anchorages, nor shall any portion of the hull or rigging at any time extend outside the boundaries of the anchorages.

(3) Any vessel anchoring under circumstances of great emergency outside of the anchorages must be placed near the edge of the channel and in such position as not to interfere with free navigation of the channel nor obstruct

the approach to any pier nor impede the movement of any vessel, and shall move away immediately after the emergency ceases, or upon notification by the Captain of the Port.

(4) No vessel, while carrying, loading, or unloading explosives as commercial cargo, shall anchor in any of the established anchorages, including the explosives anchorages, or in any other areas within Los Angeles and Long Beach Harbors as defined by the San Pedro, Middle, and Long Beach breakwaters, or closer than one nautical mile to any part of said breakwaters in the waters seaward thereof, without permission of the Captain of the Port. In granting permission for the anchorage of vessels carrying, loading, or unloading explosives in quantities in excess of 500 tons, the Captain of the Port will be guided by other activities in the harbor and the requirements of the American Table of Distances for remoteness and isolation. Any such vessel shall constantly be kept in readiness to get under way with towboats standing by if the vessel is inoperative.

(5) The instructions of the Captain of the Port assigning vessels to parts of anchorage grounds suitable to their draft, requiring vessels to anchor bow and stern, or with two bow anchors, requiring shifting the anchorage of any vessel within any anchorage ground for the common safety or convenience, or for otherwise enforcing the regulations in this section, shall be promptly followed by owners, masters, and persons in charge of vessels.

(6) Permission to anchor in the channels within the limits of Los Angeles and Long Beach Harbors may be granted by the Captain of the Port to plant or vessels engaged in recovering sunken property or in laying or repairing pipe or cable lines legally established, when approved by the District Engineer, Corps of Engineers, and to plant or vessels engaged in dredging operations when authorized by the District Engineer. The provisions of this subparagraph shall not apply to plant or vessels engaged under the supervision of the District Engineer upon works for the improvement of the harbor, but the District Engineer will advise the Captain of the Port in all cases where plant is to be employed under his supervision.

(7) Nothing in this section shall be construed as relieving the owner or person in charge of any vessel or plant from the penalties of law for obstructing navigation or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, fog signals, or for otherwise violating law.

§ 202.216 Pacific Ocean at Santa Catalina Island, Calif.—(a) The anchorage grounds—(1) Descanso Bay. Shoreward of a line connecting the promontories known as White Rock and Casino Point.

(2) Isthmus Cove. All waters shoreward of a line connecting the promontories known as Lion Head and Blue Cavern Point, excluding the following-described non-anchorage area: An area 300 feet wide (170 feet west and 130 feet east of the centerline of the Catalina Island Steamship Line pier), extending 1,600 feet from the root

of the pier, and an area 150 feet seaward of the shore line extending approximately 1,500 feet east and 1,500 feet northwest of the centerline of said pier.

(b) The regulations. (1) The Descanso Bay anchorage is reserved for yachts and other small craft. Floats or buoys for marking anchors or moorings in place will be allowed in this area. Fixed mooring piles or stakes are prohibited.

(2) The Isthmus Cove anchorage shall be available for anchorage of all types of craft. Temporary floats or buoys for marking anchors or moorings in place will be allowed in this area. Fixed mooring piles or stakes are prohibited.

(3) The non-anchorage area described in paragraph (a) (2) of this section shall be used only by commercial vessels. Commercial vessels of 15 feet draft or over may anchor in this area seaward of the Catalina Island Steamship Line pier during hours between sunrise and sunset. The use of this area for anchorage is forbidden to all other craft at all times. Fixed mooring piles or stakes and floats or buoys for marking anchors or moorings in place are prohibited.

(4) The instructions of the Captain of the Port requiring vessels to anchor bow and stern, or with two bow anchors, or requiring shifting the anchorage of any vessel within the anchorage grounds for the common safety or convenience, or for otherwise enforcing the regulations in this section, shall be promptly complied with by owners, masters, and persons in charge of vessels.

(5) Nothing in this section shall be construed as relieving the owner or person in charge of any vessels or plant from the penalties of law for obstructing navigation or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, fog signals, or for otherwise violating law.

**§ 202.218 Pacific Ocean at San Clemente Island, Calif.; in vicinity of Wilson Cove.**—(a) The anchorage grounds. Shoreward of a line beginning at a point on the beach bearing 153° true, 1,400 yards, from the flashing green light on the southeast headland at Wilson Cove; thence 62° true, 0.67 nautical mile; thence 332° true, 1.63 nautical miles; thence 241°31' true to the shore line.

(b) The regulations. (1) This area is reserved exclusively for anchorage of United States Government vessels or vessels temporarily operating under Government direction, and no vessel, except in an emergency, shall anchor in the area without first obtaining permission from the Commandant, Eleventh Naval District, or the Senior Naval Officer present who shall in turn notify the Commandant promptly.

(2) No vessel shall anchor in such a manner as to unreasonably obstruct the approach to the wharf.

**§ 202.220 Pacific Ocean at San Nicolas Island, Calif.; restricted anchorage areas.**—(a) The restricted areas—(1) East area. All waters within a circle having a radius of one nautical mile centered at latitude 33°13'45'', longitude 119°25'50'' (the former position of San Nicolas Is-

land East End Light), which point bears approximately 101°, 420 yards, from San Nicolas Island East End Light.

(2) West area. Shoreward of a line bearing 276° true from San Nicolas Island south side light a distance of six nautical miles; thence to a point bearing 270° true, two nautical miles, from the westernmost point of the island; thence 60° to a point due north of the northernmost point of the island; thence 180° true to the shore.

(b) The regulations. Except in an emergency, no vessel shall anchor in these restricted areas without authority of the Commandant, Eleventh Naval District. Cargo vessels destined for San Nicolas Island may anchor in the east area for unloading or loading.

**§ 202.222 Pacific Ocean at Santa Barbara Island, Calif.**—(a) The anchorage grounds. Shoreward of a line beginning at the Santa Barbara Island Light on the northeast end of the island and bearing 23° true a distance of 1.515 nautical miles seaward from the beach; thence 140°30' true, 2.54 nautical miles; thence 212°30' true, 2.30 nautical miles; thence 296°30' true, 0.96 nautical mile; and thence 325° true to the beach.

(b) The regulations. The anchorage shall be available for anchorage of all types of craft. Temporary floats or buoys for marking anchors in place will be permitted in this area.

**§ 202.224 San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay, San Joaquin River, and connecting waters, Calif.**—(a) San Francisco Bay—(1) Anchorage 1 (general). (i) That portion of San Francisco Bay bounded by the north shore of the City of San Francisco and lines joining points which are the following bearings and distances from Alcatraz Light: 201°40', 2,670 yards; 220°20', 1,800 yards; 251°, 4,210 yards; 234°30', 4,410 yards.

(ii) All of this area is a general anchorage with the exception of a 333-yard wide cable area therein.

(2) Anchorage 2 (general). That portion of Richardson Bay north of a line bearing 257° from Peninsula Point to the shore at Sausalito, except so much of this area as is included in Naval Anchorage 11 and the improved channel to, and the turning basin at, Sausalito.

(3) Anchorage 3 (general). That portion of Belvedere Cove west of a line bearing 25°30' from Peninsula Point to the shore at Tiburon.

(4) Anchorage 4 (general). Bounded by the westerly shore of San Francisco Bay and the following lines: Beginning on shore at Bluff Point; thence to a point bearing 286°, 3,630 yards, from Southampton Shoal Light; thence to a point bearing 228°, 4,450 yards from East Brother Island Light; thence along a line bearing 266° to the shore south of Point San Quentin. Excluded from this anchorage are the portions of the following areas included therein: The restricted area at the Naval Net Depot, Tiburon (see § 207.640 (h) of this chapter); Quarantine Anchorage 17 when being used for quarantine purposes; and Explosives Anchorage 13 and the forbidden anchorage zone surrounding it.

(5) Anchorage 5 (general). (i) Bounded by the easterly shore of San Francisco Bay and the following lines: Beginning at the shoreward end of the Standard Oil Wharf at Point Orient; thence along the wharf to the southwest corner thereof; thence to a point bearing 334° 30', 4,050 yards, from Southampton Shoal Light; thence along a line bearing 93° to the shore; except so much of this area as is included in the restricted area. Naval Fuel Annex, Molate Point (see § 207.640 (i) of this chapter), and the improved channel to Richmond Inner Harbor.

(ii) Vessels may anchor in this anchorage immediately adjacent to the improved channel to Richmond Inner Harbor: *Provided*, That any ship obstructing the channel must move from its position immediately if and when the fairway is required by a vessel navigating the channel.

(6) Anchorage 6 (general). Bounded by the easterly shore of San Francisco Bay and the following lines: Beginning at the shore at the southernmost extremity of Point Isabel; thence along the northerly shore of Brooks Island to the training wall extending westerly therefrom; thence westerly along the training wall to its bayward end; thence to a point bearing 104°, 1,035 yards, from Treasure Island North End Light; thence along a line bearing 144°30' to a point 290 yards northerly of the center of Pier K of the San Francisco-Oakland Bay Bridge; thence along a line bearing 71° to the shore; excluding from this area, however, the cable areas therein.

(7) Anchorage 7 (Temporary). (i) That portion of San Francisco Bay bounded by the westerly shore of Treasure Island and the following lines: Beginning at the most westerly shore of Treasure Island at a point bearing 89°, 4,135 yards, from Alcatraz Light; thence to points which are the following bearings and distances from Alcatraz Light: 73°30', 3,100 yards; 117°40', 2,087 yards; 122°30', 3,730 yards; 111°00', 4,167 yards; 109°30', 3,833 yards; 98°30', 4,583 yards.

(ii) That portion of this anchorage lying westerly of a line having a bearing of 311°30' from Pier E of the San Francisco-Oakland Bay Bridge and passing through Point Knox Light on Angel Island, is reserved for the use of vessels while undergoing examination by quarantine, customs, immigration, Coast Guard, and other governmental authorities. Upon completion of these examinations, vessels shall promptly move out of this portion of the anchorage.

(iii) That portion of this anchorage lying easterly of the said line, having a bearing of 311°30' from Pier E of the San Francisco-Oakland Bay Bridge, is for use of vessels undergoing examination, as in subdivision (ii) of this subparagraph, and also for use of vessels requiring a temporary anchorage. Vessels shall not remain in this portion of the anchorage for longer than 36 hours.

(8) Anchorage 8 (general). That portion of San Francisco Bay east of the City of San Francisco, the corners of which are the following bearings and distances from the center of the anchor pier (Pier C) of the San Francisco-Oakland Bay Bridge: 118°, 2,635 yards; 175°30', 2,420 yards; 172°, 3,470 yards; and 168°, 3,520 yards.

(9) Anchorage 9 (general). Bounded on the north by the shore, the breakwater and turning basin at the

Naval Air Station, Alameda, and a line from Air Station Channel Lighted Buoy 6 to Air Station Channel Entrance Lighted Buoy 2; bounded on the west by a line beginning at Air Station Channel Entrance Lighted Buoy 2, thence to a point bearing 17°, 4,050 yards, from Hunters Point Light, thence to a point bearing 343°30', 4,000 yards, from Hunters Point Light, and thence to a point bearing 343°30', 3,330 yards, from Hunters Point Light, and thence 146°; bounded on the south by a line 1,000 yards northerly from and parallel to the Hayward-San Mateo Bridge; and bounded on the east by the shore, including all of San Leandro Bay. The following areas are excluded from this anchorage: The seaplane restricted area, Naval Air Station, Alameda (described in § 207.640(e) of this chapter); Explosives Anchorage 14, Explosives Storage Anchorage 15, and the forbidden anchorage zone surrounding each of these two anchorages.

(10) Anchorage 9-A (general). Shoreward of the following lines: Beginning at the outer end of the south fender of the former automobile ferry slip at the end of the Alameda Mole; thence 270°, 400 yards; thence 216°, approximately 2,000 yards; thence along a line bearing 127° from Alcatraz Light, 1,200 yards; thence 36° to the shore.

(11) Anchorage 10 (naval). (i) The triangular-shaped area immediately east of Sausalito northwest of a line bearing 234° from Point Stuart Light, and southwest of a line bearing 303° from Alcatraz light.

(ii) This anchorage is for the use of public vessels of the United States, but may be used by yachts when not required for use by public vessels. All yachts making use of this anchorage shall be prepared to move immediately upon notice should the anchorage be required for public vessels. With the permission of the District Commander or Captain of the Port, permanent yacht moorings may be placed within this anchorage, not more than 300 yards from the shore.

NOTE: As used in this section, the term "District Commander" means the Commander, Twelfth Coast Guard District, and the term "Captain of the Port" means the officer who has been designated by the Commandant, U.S. Coast Guard, as Captain of the Port, San Francisco.

(12) Anchorage 11 (naval). (i) That portion of Richardson Bay the corners of which are the following bearings and distances from Point Stuart Light: 273°, 1,150 yards; 271°, 2,520 yards; 257°30', 2,580 yards; and 248°30', 1,530 yards; except so much of this area as is included in the improved channel to Sausalito.

(ii) This anchorage is reserved for the exclusive use of vessels and seaplanes of the United States Navy.

(13) Anchorage 12 (naval). (i) That portion of San Francisco Bay east of the City of San Francisco the corners of which are the following bearings and distances from the center of the anchor pier (Pier C) of the San Francisco-Oakland Bay Bridge: 95°, 3,035 yards; 110°, 980 yards; 188°, 1,170 yards; 175°30', 2,420 yards; and 118°, 2,635 yards.

(ii) This anchorage is reserved for the use of vessels of the United States or foreign navies and for other public vessels of the United States. With the permission of the District Commander or Captain of the Port, this anchor-

age may be used temporarily by vessels other than public vessels, but vessels availing themselves of this privilege must hold themselves in readiness to shift berth immediately upon receiving notice to do so.

(14) Anchorage 13 (explosives). (i) A circular area having a radius of 333 yards around a white buoy used to mark its location bearing  $51^{\circ}30'$ , 1,900 yards, from the northerly extremity of California Point.

(ii) This anchorage is for the use of vessels loaded with, loading, or unloading explosives. This provision is not intended to prohibit lighters and barges from lying alongside ships for transfer of cargo.

(iii) The maximum total quantity of explosives that may be on board vessels in this anchorage shall be limited to 50 tons; except that, at the discretion of the District Commander or Captain of the Port, vessels in transit, loaded with explosives in excess of this limitation, may be permitted to anchor temporarily in this area provided the hatches to the holds containing explosives are not opened.

(iv) A circular zone 667 yards wide partially surrounding the anchorage is a forbidden anchorage zone and shall not be used for anchorage purposes by any vessels.

(15) Anchorage 14 (explosives). (i) The area 1,000 yards wide and 2,760 yards long, the end boundaries of which are semicircles with radii of 500 yards and centers, respectively,  $100^{\circ}00'$ , 3,270 yards, and  $112^{\circ}30'$ , 4,800 yards from Hunters Point South End Light, and the side boundaries of which are parallel tangents joining said semicircles. The anchorage is marked at each extremity by a white buoy.

(ii) The anchorage is for the use of vessels loaded with, loading, or unloading explosives. This provision is not intended to prohibit lighters and barges from lying alongside ships for transfer of cargo.

(iii) The maximum total quantity of explosives that may be on board any one vessel moored in this anchorage shall be limited to 3,000 tons. Vessels will be assigned berths in this anchorage by the District Commander or Captain of the Port on the basis of the maximum quantity of explosives that will be on board the vessel.

(iv) Vessels in this anchorage shall not anchor closer than 400 yards to one another but the number of vessels which may anchor in this area at any one time shall be at the discretion of the District Commander or Captain of the Port. This provision is not intended to prohibit barges or lighters from lying alongside vessels for transfer of cargo.

(v) The 667-yard wide area partially surrounding this anchorage is a forbidden anchorage zone and shall not be used for anchorage purposes by any vessels.

(vi) This anchorage and the surrounding forbidden anchorage zone may be temporarily discontinued by the District Engineer, Corps of Engineers, San Francisco, California, when the area is required for general anchorage purposes.

(16) Anchorage 15 (explosives storage). (i) An area 1,000 yards square whose center is marked by a white

buoy bearing  $124^{\circ}30'$ , 9,835 yards, from Hunters Point Light, and whose sides are due north-south and east-west.

(ii) This anchorage is for the purpose of storage of explosives. Barges and vessels shall be anchored so as not to approach within 167 yards of one another. All barges using this anchorage for storage purposes shall anchor with two or more anchors. The District Commander or Captain of the Port may authorize the placing of moorings within this anchorage, provided these moorings are so placed that barges at one mooring shall at all times be not less than 167 yards from barges at an adjacent mooring.

(iii) A square zone 500 yards wide surrounding this anchorage is a forbidden anchorage zone and shall not be used for anchorage purposes by any vessels.

(17) Anchorage 17 (quarantine). An area 1,000 yards square, the easterly side of which is coincident with the easterly boundary of General Anchorage 4 and the north-easterly corner of which is on the said easterly boundary  $97^{\circ}30'$ , 2,250 yards, from the northerly extremity of California Point.

NOTE: This anchorage is under the jurisdiction of the Medical Officer in charge of the Port of San Francisco and is included in this section for information only.

(b) San Pablo Bay—(1) Anchorage 18 (general). Bounded by the westerly shore of San Pablo Bay and the following lines: Beginning at the shore at Point San Pedro; thence  $90^{\circ}$  to the easterly of the Sisters Islands; thence to points which are the following bearings and distances from Petaluma Creek Entrance Channel Light and Echo Board 2:  $202^{\circ}30'$ , 1,200 yards; and  $288^{\circ}30'$ , 5,870 yards; excluding from this area, however, the channel to Hamilton Field and the extension of this channel easterly to the boundary of the anchorage, and the pipeline area therein.

(2) Anchorage 19 (general). Bounded by the north-easterly shore of San Pablo Bay and the following lines: Beginning at the shore at a point bearing  $03^{\circ}15'$ , 6,830 yards, from Petaluma Creek Entrance Channel Light and Echo Board 2; thence to points which are the following bearings and distances from Petaluma Creek Entrance Channel Light and Echo Board 2:  $177^{\circ}30'$ , 8,600 yards;  $131^{\circ}$ , 7,000 yards;  $103^{\circ}00'$ , 9,500 yards;  $95^{\circ}30'$ , 13,370 yards;  $93^{\circ}30'$ , 13,330 yards; and thence along the long dike extending southwestwardly from Mare Island to the shore at Mare Island.

NOTE: See § 204.215 of this chapter establishing a target area in San Pablo Bay adjacent to the westerly shore of Mare Island for use of the Mare Island Navy Yard.

(3) Anchorage 20 (general). Bounded by the south-easterly shore of San Pablo Bay and the following lines: Beginning at the northeast corner of Parr Terminal No. 4 at Point San Pablo; thence to a point bearing  $14^{\circ}$ , 1,135 yards from the northeast corner of the wharf at Pinole Point; thence to a point on the Union Oil Company Pier at Oleum,  $206^{\circ}00'$ , 1,870 yards from Mare Island Pier 35 Light; and thence along this pier to the shore; excluding from this area Explosive Anchorages 22 and 23.

(4) Anchorage 21 (naval). A rectangular area south of Mare Island the corners of which are the following bearings and distances from the tall stack at the Selby Smelting Works: 331°30', 1,285 yards; 300°30', 1,830 yards; 286°30', 1,530 yards; and 321°, 800 yards.

(5) Anchorage 22 (explosives). (i) A circular area having a radius of 500 yards whose center is at the northwest corner of the wharf of the Atlas Powder Company at Pinole Point.

(ii) This anchorage is for the use of vessels loaded with, loading, or unloading explosives, and this anchorage shall not be used by any other vessel.

(iii) The maximum quantity of explosives that may be in this anchorage at one time shall be limited to 500 tons.

(6) Anchorage 23 (explosives). (i) A circular area having a radius of 500 yards whose center is at the northwest corner of the wharf of the Hercules Powder Company which is located approximately 2,330 yards southwesterly of Lone Tree Point at Rodeo, California.

(ii) This anchorage is for the use of vessels loaded with, loading, or unloading explosives, and this anchorage shall not be used by any other vessels.

(iii) The maximum quantity of explosives that may be in this anchorage at any one time shall be limited to 100 tons.

(c) Carquinez Strait—(1) Anchorage 24 (general). Bounded by the northerly shore of Carquinez Strait and lines joining points which are the following bearings and distances from Port Costa Light: 332°30', 1,820 yards; 347°, 1,330 yards; 347°, 710 yards; and 109°30', 1,800 yards.

(2) Anchorage 25 (general). Bounded by the south shore of Carquinez Strait and lines joining points which are the following bearings and distances from Benicia City Wharf Light; 145°30', 2,970 yards; 141°, 1,970 yards; and 234°, 1,300 yards.

(d) Suisun Bay—(1) Anchorage No. 26 (general). On the west side of Suisun Bay, adjacent to and northeast of the City of Benicia within the following boundaries: The northeast edge of the Southern Pacific Bridge from the north shore to the first siren; thence 77°30', 430 yards; thence 38°47', 7,800 yards; thence 312° to shore; thence along the shore to the point of beginning.

NOTE: A portion of Anchorage 26 is occupied by the Suisun Bay Reserve Fleet of the Maritime Administration, and § 207.900 of this chapter establishes a restricted area in the vicinity of this Reserve Fleet.

(2) Anchorage 27 (general). An area in the northeast portion of Suisun Bay lying east of a line due north through tripod on Roe Island at Preston Point; north of a line bearing 84° from fixed range light located 1,187 yards to the southwest of said tripod on Roe Island, to the old lighthouse at the most southerly point of Roe Island; thence bearing 101° to Middle Ground Light, thence bearing 88° to Chippis Island.

(e) San Joaquin River—(1) Anchorage 28 (general). The waters adjacent to Lower Sherman Island south-easterly of a line 450 yards long bearing 238° from Sher-

man Island North End Light; easterly of a line bearing 163°30' from the west end of said 450-yard line; and northerly of a line bearing 27° from New York Slough East End Light and Echo Board.

(2) Anchorage 29 (General). [Revoked]

(3) Anchorage 30 (explosives). (i) That portion of the Old San Joaquin River channel bounded on the west by Mandeville Point and on the north, east, and south by lines joining points which are the following bearings and distances from Stockton Channel 3 Light: 341°, 1,400 yards; 348°30', 1,520 yards; 355°20', 1,340 yards; 08°30', 835 yards; and 341°, 870 yards.

(ii) This anchorage is for the use of vessels, lighters, and barges loaded with, loading, or unloading explosives or explosive materials, and shall not be used by any other vessel or craft while such operations are in progress. At all other times the area will be open to fishing and navigation without restriction.

(iii) Notice of loading and unloading operations will be given by notice published by the United States Coast Guard in "Notice to Mariners", and by notice given by the Port of Stockton to local radio stations and newspapers, and by telephonic means to any organization that may request that such advice be given. In all cases the notice will state how long the operations will be in progress and on what days.

(f) Sacramento River, Decker Island; restricted anchorage for vessels of the United States Government—(1) The anchorage ground. An elongated area in the waters of the Sacramento River adjacent to the northeast shore of Decker Island within the following boundaries: Beginning at Sacramento River Light 4, FL. R., at the northerly tip of Decker Island, thence 90°, 117 yards; thence 180°, 633 yards; thence 184°, 817 yards; thence 186°30', 450 yards; thence 209°, 467 yards; thence 231°, 383 yards; thence 330° to shore; thence with the shore to the point of beginning.

(2) The regulations. No vessel or other craft except those owned by or operating under contract with the United States shall navigate or anchor within fifty feet of any moored Government vessel in the area. Commercial and pleasure craft shall not moor to buoys or chains of Government vessels, nor shall they, while moored or underway, unreasonably obstruct the passage of Government or other vessels through the area.

(3) Enforcement. The regulations in this paragraph shall be enforced by the Commanding General, San Francisco Port of Embarkation, Fort Mason, California, or his authorized representative.

(g) General regulations. (1) Except in cases of distress, great emergency, or heavy fog, no vessel shall be anchored in the navigable waters of San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay, New York Slough, San Joaquin River Deep Water Channel, and the Stockton Turning Basin, California, outside of the anchorages defined and established in this section, nor anchor within an improved channel or a cable or pipe line area shown on Government charts, nor be moored, anchored,

or made fast to any pier, wharf, bulkhead, or vessel in such manner as to impede or endanger the passage of any vessel in transit by, or to or from, adjacent wharves, piers, slips, or navigation channels.

(2) Whenever in the opinion of the District Commander or Captain of the Port such action may be necessary, that officer may require any or all vessels in any designated anchorage area to moor with two or more anchors. (Vessels using Anchorage 15 for the purpose of storage of explosives will be required to anchor with two or more anchors at all times.)

(3) Every vessel whose crew may be reduced to such number that it will not have sufficient men on board to weigh anchor at any time shall be anchored with two anchors, with mooring swivel put on before the crew is reduced or released.

(4) Anchors shall not be placed outside the anchorage areas, nor shall any vessel be so anchored that any portion of the hull or rigging extends outside the boundaries of the anchorage area.

(5) Vessels anchoring outside of the designated anchorage areas because of distress or heavy fog, shall be placed in such position as not to interfere with navigation or obstruct the approach to any pier, wharf, slip, or boat harbor. They shall move from such position as soon as the emergency ceases or when ordered by the District Commander or Captain of the Port or by his duly authorized representative.

(6) The anchorages will be used only for the purposes stated for each and under the special limitations applicable thereto.

(7) The District Commander or Captain of the Port shall assign berths in the anchorages to all vessels applying for such permission. He may grant permits to those vessels habitually maintaining and using the same mooring place in an anchorage area, and no vessel shall occupy a permanent berth in an anchorage area except under authority of such permit which may be revoked at any time.

(8) A vessel, upon being notified to move into the anchorage limits or to shift its position in the anchorage grounds shall get under way at once or obtain a tug and change its position with reasonable promptness, as directed.

(9) Whenever required by maritime or commercial interests of the United States, the District Commander or Captain of the Port is empowered to shift the position of any vessel anchored within or outside of an anchorage area, of any vessel which is so moored or anchored that its position impedes or obstructs vessel movements in any channel or obstructs or interferes with range lights, and of any vessel which, lying at the exterior end of a pier or alongside of a wharf or bulkhead, obstructs or endangers the passage of vessels to or from adjacent wharf property or impedes the movement of vessels entering or leaving slips and boat harbors.

(10) Permits to anchor in channels within the limits of the waterways covered by the regulations in this section may be granted by the District Commander or Captain of the Port to wrecking plants or other vessels legally

engaged in recovering sunken property or in laying pipe or cable lines legally established or in repairing same when the application for such anchorage is approved by the District Engineer, Corps of Engineers, and to plant engaged in dredging operations when authorized by the District Engineer. The provisions of this subparagraph will not apply to plant engaged under the supervision of the District Engineer upon works for the improvement of rivers and harbors, but the District Engineer will advise the District Commander or Captain of the Port in advance of the proposed work for such improvement in all cases where the plant is to be employed under his supervision.

(11) Nothing in this section shall be construed as relieving the owner or person in charge of any vessel from the penalties of law for obstructing navigation or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights, fog signals, or for otherwise violating the law.

(12) (i) Anchorages 13, 14, 15, 22, 23 and 30 are reserved for vessels carrying explosives. All vessels carrying explosives shall be within these areas when anchored, except as provided in subparagraph (15) of this paragraph.

(ii) A written permit shall be obtained from the District Commander or Captain of the Port before vessels carrying explosives, or on which explosives are to be loaded, may proceed to the anchorages provided for them, and no vessel shall occupy a berth in such anchorage except by authority of such permit, which may be revoked at any time.

(iii) At the discretion of the District Commander or Captain of the Port, written permits to occupy a berth in explosive anchorages may be issued to vessels carrying flammable liquids, flammable solids, oxidizing materials, corrosive liquids, compressed gases and poisonous substances. Such permits must be obtained prior to entering the anchorage and are revokable at any time.

(iv) Vessels used in connection with transporting explosives to be loaded on or unloaded from other vessels in explosive anchorage areas, shall obtain and carry a written permit from the District Commander or Captain of the Port. The District Commander or Captain of the Port may, at his discretion, require every person having business on board vessels which are either laden or being loaded with explosives, to have a document which is acceptable to the Coast Guard for identification purposes. Such identification shall be shown whenever required by the District Commander or Captain of the Port.

(13) (i) Whenever any non-self-propelled vessel, or any self-propelled vessel that is unable to maneuver under its own power due to mechanical difficulties, lack of personnel, or for any other reason, occupies explosives anchorages 13, 14, 15, 22, 23 and 30, the District Commander or Captain of the Port may require the attendance of a tug upon such vessels when, in his judgment, such action is deemed necessary.

(ii) Every vessel loading, unloading, or laden with explosives shall, while within an explosive anchorage, display by day at its masthead, or at least 10 feet above the

upper deck if the vessel has no masthead, a red flag 16 square feet or more in area, and shall display by night, in the same position specified for the flag, an electric red light visible through 360° for a distance of at least one mile.

(14) When vessels are conducting loading operations from barges at any of the established anchorages, as indicated by the display at its masthead of a red flag by day or a red light by night, passing vessels shall reduce speed to six knots.

(15) The District Engineer, Corps of Engineers, is empowered to authorize in writing, the anchoring of a single barge carrying explosives in or near the vicinity of work being done directly under his supervision, or under a Department of the Army permit, but only in quantities considered by him as safe and necessary. The District Engineer shall prescribe the conditions under which this explosive shall be stored and handled and in each case shall furnish the District Commander or Captain of the Port with a copy of the written permit to anchor explosives on the wharf and a copy of the rules and regulations for storing and handling.

(16) Vessels other than those under Federal supervision shall not go alongside or in any manner moor to any Government-owned vessel, mooring buoy, or pontoon boom, their anchor cables, or any of their appendages. Vessels other than those under Federal supervision shall not obstruct or interfere in any manner with the mooring, unmooring or servicing of vessels owned by the United States.

(17) Vessels anchoring in the San Joaquin River Deep Water Channel or the Stockton Turning Basin because of distress or heavy fog, shall be placed as near the edge of the channels or turning basin as possible, and in such position as not to interfere with the free navigation thereof, nor obstruct the approach to any pier, wharf, slip, or boat harbor. They shall move from such position as soon as the emergency ceases or when ordered by the District Commander or Captain of the Port, San Francisco. No vessel shall be permanently moored in areas adjacent to the San Joaquin River Deep Water Channel except on permission in writing from the District Commander or Captain of the Port.

**§ 202.223 Columbia River, Oreg. and Wash.—**(a) The anchorage grounds—(1) Lower Tongue Point Anchorage. A rectangular area bounded as follows: Beginning at a point bearing 253°30', 675 yards, from Tongue Point Light; thence to a point bearing 247°30', 2,015 yards, from Tongue Point Light; thence to a point bearing 261°, 2,125 yards, from Tongue Point Light; thence to a point bearing 284°, 950 yards from Tongue Point Light; and thence to the point of beginning.

(2) Upper Tongue Point Anchorage. Northwesternly of a line running from a point bearing 42°, 1,200 yards, from Tongue Point Light, to a point bearing 253°30', 675 yards, from Tongue Point Light; northeasterly of the northeast boundary of Lower Tongue Point Anchorage; southeasterly of a line ranging from a point bearing 284°, 950

yards, from Tongue Point Light, toward a point bearing 24°, 1,425 yards, from Tongue Point Light; southerly of a line 50 yards south of and parallel to the south side of the main ship channel; and southwesterly of a line ranging from a point bearing 42°, 1,200 yards, from Tongue Point Light, toward a point bearing 24°, 1,425 yards, from Tongue Point Light.

(b) The regulations. (1) No vessel shall anchor in anchorages described in paragraph (a) (1) and (2) of this section without prior permission from the Captain of the Port, or his authorized representative. No vessel shall occupy either anchorage for a period longer than 30 days unless a permit is obtained from the Captain of the Port for that purpose. No vessel in a condition such that it is likely to sink or otherwise become a menace or obstruction to the navigation or anchorage of other vessels shall occupy an anchorage except in an emergency and then only for such period as may be permitted by the Captain of the Port. A berth in an anchorage, if available, shall be assigned to any vessel by the Captain of the Port upon application and he may grant revocable permits for the continuous use of the same berth.

**§ 202.230 Puget Sound area, Wash.—**(a) The anchorage grounds—(1) Freshwater Bay emergency explosives anchorage, Strait of Juan de Fuca. All of Freshwater Bay and adjacent waters shoreward of a line beginning at Observatory Point, latitude 48°09'03'', longitude 123°38'12'', thence due north approximately 1,150 yards to latitude 48°09'36'', longitude 123°38'12''; thence 90°, approximately 6,450 yards, to latitude 48°09'36'', longitude 123°33'27''; thence 180° to the shoreline.

(i) This area does not constitute an explosives anchorage for loading or discharging explosives, but is established exclusively for use by explosives laden vessels enroute to the ammunition dumping area which encounter adverse weather and sea conditions and are forced to await more favorable conditions before proceeding to sea.

(1a) Bellingham Bay general anchorage. The waters of Bellingham Bay within a circular area with a radius of 2,000 yards, having its center at latitude 48°44'15'', longitude 122°32'25''.

(1b) Bellingham Bay explosives anchorage. The waters of Bellingham Bay within a circular area with a radius of 1,000 yards, having its center at latitude 48°42'48'', longitude 122°33'37''.

(2) Port Townsend explosives anchorages—(i) Fair weather anchorage area. A circular area having a radius of 300 yards, whose center is at latitude 48°06'26'', longitude 122°43'46''.

(ii) Foul weather anchorage area. A circular area having a radius of 300 yards, whose center is at latitude 48°04'05'', longitude 122°44'52''.

(3) Holmes Harbor general anchorage. All of Holmes Harbor lying southerly of a line ranging 310° through Hackney Island, between the shores of Whidbey Island.

(4) Port Gardner general anchorage, Possession Sound. Beginning at a point bearing 211°, 560 yards, from Everett Jetty Light; thence 180°, 675 yards; thence

216°, 250 yards; thence 254°, 800 yards; thence 302°, 1,700 yards; thence 49°, 1,280 yards; thence approximately 115°, 1,525 yards, to the point of beginning.

(5) Port Madison explosive anchorage, Puget Sound. The waters of Port Madison south of the 3-fathom line between longitude 122°28'54" and 122°30'00", and north of latitude 47°44'00".

(6) Thorndike Bay emergency explosives anchorage, Hood Canal. Beginning at a point bearing 267°, 3,500 yards, from Hood Canal 5 Light; thence 180°, 1,000 yards, to a point approximately 251°, 3,725 yards, from Hood Canal 5 Light; thence 270°, 1,350 yards, to a point approximately 256°, 5,000 yards, from Hood Canal 5 Light; thence due north 1,000 yards, to a point approximately 268°, 4,900 yards, from Hood Canal 5 Light; thence approximately 90°, 1,350 yards, to the point of beginning.

(7) Smith Cove general anchorage (west), Elliott Bay. Shoreward of a line beginning at Fourmile Rock Light; thence to a point bearing 207°, 1,100 yards, from Fourmile Rock Light; thence southeasterly to point bearing 6°30', 2,075 yards, from Duwamish Head Light; thence due north to the shore of Smith Cove.

(8) Smith Cove general anchorage (east), Elliott Bay. Beginning at the intersection of the Federal pierhead line and a line drawn along the north side of Denny Way; thence westerly on said line 2,000 feet; thence northwesterly along a line paralleling the Federal pierhead line to its intersection with a straight line drawn along the east side of Pier 88; thence due north to the intersection with the Federal pierhead line; thence along said pierhead line to the point of beginning.

(9) Elliott Bay general anchorage (east). Shoreward of a line beginning at the northeast corner of Harbor Island; thence northerly and in a straight line to its intersection with a line drawn along the south side of King Street; thence west on said line to its intersection with the east line of West Waterway; thence along said line to the northwest corner of Harbor Island.

(10) Elliott Bay general anchorage (west). Shoreward of a line beginning at a point of intersection of the Federal pierhead line with a straight line drawn along the west line of West Waterway; thence north to a point intersecting a straight line drawn along the south side of Dearborn Street; thence in a westerly direction to the foot of West Fairmount Avenue.

(11) Orchard Point general anchorage, Puget Sound. Beginning at Orchard Point Light; thence 106°, two miles; thence 180° to the northern shore of Blake Island; thence west and south along the shoreline to the southern end of Blake Island at approximate longitude 122°29'16"; thence 250° to the dock at Harper; thence westerly and northerly along the shoreline to the point of beginning.

(12) Blake Island explosives anchorage, Puget Sound. Shoreward of a line bearing 90° from the south tangent of Blake Island, 2,000 yards; thence due north, 1,400 yards; thence 270°, 1,300 yards, to the east point of Blake Island.

(b) The regulations. (1) No vessel shall anchor in any general anchorage described in paragraph (a) of this section without prior permission from the Captain

of the Port, or his authorized representative. No vessel shall occupy any general anchorage for a period longer than 30 days unless a permit is obtained from the Captain of the Port for that purpose. No vessel in a condition such that it is likely to sink or otherwise become a menace or obstruction to the navigation or anchorage of other vessels shall occupy a general anchorage except in an emergency and then only for such period as may be permitted by the Captain of the Port. A berth in a general anchorage, if available, may be assigned to any vessel by the Captain of the Port upon application and he may grant revocable permits for the continuous use of the same berth.

(2) Explosive anchorages are reserved for vessels carrying explosives. All vessels carrying explosives shall be within these areas when anchored.

(3) Whenever any vessel not fitted with mechanical power, anchors in an explosives anchorage, the Captain of the Port may require the attendance of a tug upon such vessel, when, in his judgment, such action is necessary.

(4) Vessels carrying explosives shall comply with the general regulations in subparagraph (1) of this paragraph, when applicable.

(5) Every vessel at anchor in an explosives anchorage shall display by day a red flag at least 16 square feet in area at its mast head or at least 10 feet above the upper deck if the vessel has no mast, and by night a red light in the same position specified for the flag. These signals shall be in addition to day signals and lights required to be shown by all vessels when at anchor.

(6) Every vessel constructed of wood shall, unless there are steel bulwarks or metallic cases or cargo on board, be fitted with radar reflector screens of metal of sufficient size to permit target indication on the radar screen of commercial type radars.

(7) Fishing and navigation by pleasure and commercial craft are prohibited within the area at all times when vessels which are anchored in the area for the purpose of loading or unloading explosives display a red flag by day and a red light by night, unless special permission is granted by the Captain of the Port.

(8) No explosives handling in any explosive anchorage will be undertaken by any vessel unless personnel from the Captain of the Port are on board to supervise the handling of explosives.

(9) No vessel shall remain at anchor in any explosive anchorage unless there is on board such vessel a competent watchman or a tug in attendance.

**§ 202.235 Pacific Ocean (Mamala Bay), Honolulu Harbor, T.H.; anchorage for nitrate laden vessels—**(a) The anchorage ground. The waters of the Pacific Ocean (Mamala Bay) within an area directly offshore of Keehi Lagoon at Honolulu, T.H., described as follows: Beginning at a point bearing 240°, 4,900 yards, from Honolulu Harbor Light (Aloha Tower); thence 202°, 1,000 yards; thence 290°30', 2,230 yards; thence 22°, 1,000 yards; and thence 110°30', 2,230 yards, to the point of beginning. This area provides anchorage space for two vessels 1,230 yards apart.

(b) The regulations. (1) Anchorage within this area shall be restricted to not more than two nitrate laden vessels at any one time. Other vessels are cautioned against frequenting the area at any time, and they shall not, without specific authority from the District Commander, enter or remain in the area when a nitrate laden vessel is anchored within or is approaching the area, or anchor outside the area within 1,000 yards of a nitrate laden vessel anchored within the area.

NOTE: The term "District Commander," as used in this section, means the Commander, 14th Coast Guard District, Federal Building, Honolulu, T.H., or his duly authorized representative.

(2) Except in an emergency involving danger to life or property, no nitrate laden vessel shall anchor within the area without first obtaining permission from the District Commander. The master of a nitrate laden vessel shall notify the District Commander in advance of his intention to anchor within the area, giving the name of the vessel and the time he expects to anchor and any additional information requested such as the reason for the stopover, anticipated period of the stopover, kind and amount of cargo carried, destination, and proposed location of any necessary torches or welding anticipated, etc. The vessel shall not enter the area until permission to anchor has been received from the District Commander, and it shall then anchor along the longitudinal center line of the area 500 yards from either the southeast or the northwest end as designated by the District Commander.

(3) The master of the vessel shall request permission from the District Commander for any necessary additional stopover privilege longer than the period originally anticipated. He shall also notify the District Commander when his vessel is ready to leave the area.

(4) In addition to the appropriate day and night signals, the anchored vessel shall display by day a red flag of at least 16 square feet, and by night a red light, at the mast head or at least 10 feet above the upper deck if the vessel has no mast.

(5) The master of the vessel shall have the vessel properly patrolled at all times, and anchor bearings carefully checked at frequent intervals. During rough seas, if he is in any doubt as to being securely anchored and is without ship power he shall call for tug service from any of the commercial tug-service firms available in Honolulu Harbor. All charges incurred thereby shall be charged to the vessel owner or agent.

(6) Upon being notified to shift its position a vessel shall get under way at once or signal for a tug and change position as directed with reasonable promptness.

(7) In the event of fire on board any anchored vessel, the master or other officer in charge shall immediately sound five blasts of five seconds each of a whistle or siren, which signal may be repeated at intervals to attract attention. This signal shall be used in addition to any other means available for reporting a fire. If for any reason the whistle signal is inoperative the master shall make arrangements whereby the radio transmitter and operator will be available.

(8) Nothing in this section shall be construed as relieving the owner or person in charge of any vessel from strict compliance with all applicable navigation laws and regulations and regulations established by the Commandant of the Coast Guard with respect to explosives and other dangerous articles and substances on board vessels.

## PART 203—BRIDGE REGULATIONS:

**§ 203.1 General.** Drawbridges across navigable waters of the United States will not be opened to navigation for certain periods determined to be in the interests of public safety by the proper civil defense authorities during a major disaster or civil defense emergency indicated by the military condition of warning: Yellow (i.e., attack by enemy aircraft, probable) or Red (i.e., attack by enemy aircraft, imminent) notwithstanding any general or special regulations heretofore or hereafter prescribed for the operation of any such drawbridge or drawbridges.

**§ 203.710 Navigable waters of the United States within the State of California; bridges generally—(a)** Operation requirements. The owners of or agencies controlling drawbridges shall provide the necessary tenders and the proper mechanical appliances for the safe, prompt, and efficient opening of the draws for the passage of vessels.

(b) Signals—(1) Sound signals. To be used if weather conditions are such that sound signals can be heard:

(i) Call signal for opening of draw. Three long blasts, sounded within reasonable hearing distance of the bridge, repeated if necessary, and in time to give due notice to the draw tender.

NOTE: As used in this section, the term "long blasts" means distinct blasts of a whistle or horn or calls through a megaphone of four seconds' duration, or loud and distinct strokes of a bell.

(ii) Acknowledging signals—(a) When draw can be opened immediately. Same as call signal.

(b) When draw cannot be opened immediately, or when it is open and must be closed immediately. Two long blasts, repeated at regular intervals until acknowledged by the vessel. The vessel shall acknowledge by the same signal. Thereafter, as soon as the draw can be opened, the draw tender shall repeat the call signal.

(2) Visual signals. To be used if weather conditions are such that sound signals may not be heard:

(i) Call signal for opening of draw. A white flag by day or a white lighted lantern by night, swung in vertical circles at arm's length in full sight of the bridge and facing the draw.

(ii) Acknowledging signals—(a) When draw can be opened immediately. Same as call signal, to be given in full sight of the vessel.

(b) When draw cannot be opened immediately, or when it is open and must be closed immediately. A red flag by day or red lighted lantern by night, swung in vertical

circles at arm's length in full sight of the vessel, repeated until acknowledged by the vessel. The vessel shall acknowledge by the same signal, given in full sight of the bridge and facing the draw. Thereafter, as soon as the draw can be opened, the draw tender shall repeat the call signal, given in full sight of the vessel.

(3) Fog signal. When fog prevails by day or by night the draw tender, after repeating the call signal, shall toll a bell continuously during the approach and passage of the vessel.

(c) Prompt opening required except when delayed by train. The draw shall be opened with the least possible delay on receiving the prescribed signal: *Provided*, That the draw shall not be opened when a train is approaching so closely that it cannot be stopped safely before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the draw tender.

(d) Interference with operation of bridge prohibited. Trains and vehicles shall not be stopped on a drawbridge for the purpose of delaying its opening, nor shall watercraft be navigated so as to hinder or delay the operation of the draw, but all passage over or through a drawbridge shall be prompt to prevent delay to either land or water traffic.

(e) Vessels for which openings not required. A drawbridge shall not be required to open for any vessel carrying appurtenances unessential for navigation which extend above the normal superstructure, if the height of the normal superstructure would permit the vessel to pass under the closed bridge. Military masts shall be considered as part of the normal superstructure.

NOTE: On request, the District Engineer, Corps of Engineers, in charge of a waterway will cause an inspection to be made of the superstructure and appurtenances of a vessel habitually frequenting that waterway with a view to adjusting any differences of opinion in this matter between the vessel owner and a bridge owner.

(f) Bridges requiring advance notice for prompt opening. (1) The owners of or agencies controlling bridges for the prompt opening of which advance notice is required by special regulations (§§ 203.712 to 203.718, inclusive) need not keep draw tenders in constant attendance at such bridges.

(2) Whenever a vessel, unable to pass under a closed bridge, desires to pass through the draw, advance notice, as specified in the special regulations, of the time the opening is required must be given to the authorized representative of the owner of or agency controlling the bridge to insure prompt opening thereof at the time required. Unless otherwise provided in the special regulations, such advance notice may be given at any regular office of the owner of or agency controlling the bridge. Such notice may also be given to the draw tender or to the person named in the notice posted on the bridge in accordance with subparagraph (4) of this paragraph.

(3) On receipt of such advance notice, the authorized representative, in compliance therewith, shall arrange for the prompt opening of the draw on proper signal at approximately the time specified in the notice.

(4) The owners of or agencies controlling the bridges

shall keep conspicuously posted on both the upstream and downstream sides thereof, in such manner that it can be read easily at any time, a copy of the special regulations pertaining to the respective bridges together with information as to whom notice should be given when it is desired that a bridge be opened and directions for communicating with such person by telephone or otherwise.

(5) Vessels desiring to pass through these bridges without having given advance notice as specified in the special regulations may be delayed, but the owners of or agencies controlling the bridges shall, under such circumstances, use every reasonable means to expedite openings.

(6) The operating machinery of the draws shall be maintained in a serviceable condition, and the draws shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

NOTE: The following special regulations (§§ 203.711 to 203.718, inclusive), modifying and supplementing the foregoing general regulations (§ 203.710), are prescribed for certain bridges where local conditions warrant.

**§ 203.711 Los Angeles and Long Beach Harbors, Calif.** (a) Long Beach Entrance Channel; temporary retractable pontoon bridge—(1) Closed periods. From 7:00 to 8:00 a.m. and from 4:00 to 5:15 p.m., daily, except Sundays and holidays for Federal employees, this bridge will not be required to open for the passage of vessels, except in case of extreme emergency.

(2) Signals. The call signal for opening the bridge shall be one long blast followed by two short blasts. This signal shall be acknowledged by two long blasts followed by one short blast when the bridge can be opened immediately, and by two long blasts when the bridge cannot be opened immediately.

NOTE: As used in this section, the term "long blasts" means distinct blasts of a whistle or horn or calls through a megaphone of four seconds' duration, and the term "short blasts" means distinct blasts of a whistle or horn or calls through a megaphone of one second's duration.

(3) Signs. The owner of or agency controlling the bridge shall keep conspicuously posted on the south and north sides thereof, in such manner that they can be easily read from approaching vessels, signs showing the call and acknowledging signals prescribed in subparagraph (1) of this paragraph.

(b) Cerritos Channel; Commodore Schuyler F. Heim highway bridge, and Henry Ford (formerly Badger) Avenue railroad and highway bridge approximately 130 feet westerly thereof—(1) Closed periods. From 6:45 to 8:00 a.m. and from 4:00 to 5:15 p.m. daily, except Sundays and holidays for Federal employees, the draw of the Commodore Schuyler F. Heim bridge will not be required to open for the passage of vessels, except in case of extreme emergency. The draw of the Henry Ford Avenue bridge shall be opened with the least possible delay at any time on receiving the prescribed signal.

(2) Signals for opening both bridges. The call sig-

nal for opening the draws of both bridges at once shall be three long blasts. This signal shall be acknowledged by two long blasts followed by one short blast when the draws of both bridges can be opened immediately, and by two long blasts when the draw of either bridge cannot be opened immediately.

NOTE: The bridges are connected electrically to insure that the call signal of three long blasts will not be acknowledged by the opening signal unless both bridges can be opened.

(3) Signals for opening of Henry Ford Avenue bridge only. The call signal for opening the draw of the Henry Ford Avenue bridge only shall be two short blasts followed by one long blast. This signal shall be acknowledged by two long blasts followed by one short blast when the draw can be opened immediately, and by two long blasts when the draw cannot be opened immediately.

(4) Signs. The owners of or agencies controlling these bridges shall keep conspicuously posted on the east side of the Commodore Schuyler F. Heim bridge and the west side of the Henry Ford Avenue bridge, in such manner that they can be easily read from approaching vessels, signs showing the call and acknowledging signals prescribed in subparagraphs (2) and (3) of this paragraph.

**§ 203.712 Tributaries of San Francisco Bay and San Pablo Bay, Calif.**—(a) Mud Slough; Southern Pacific Company railroad bridge near Alviso. At least 24 hours' advance notice required.

(b) Newark Slough; Southern Pacific Company railroad bridge near Newark. At least 24 hours' advance notice required. To be given to the Superintendent Southern Pacific Company, Oakland Pier, Oakland, California.

(c) San Leandro Bay; State of California highway bridge between Alameda and Bay Farm Island. From 9:00 p.m. to 5:00 a.m., the draw need not be opened for the passage of vessels. From 5:00 a.m. to 8:00 a.m. and from 5:00 p.m. to 9:00 p.m., at least 12 hours advance notice required. To be given to the operator of the Bay Farm Island Bridge (telephone LAkehurst 2-2969) between 8:00 a.m. and 5:00 p.m., and to the operator of the Park Street Bridge, Alameda (telephone LAkehurst 2-7272), at all other times.

(d) Oakland Tidal Canal; Department of the Army highway and railroad bridge at Fruitvale Avenue. All vessels, except motorboats without tow, are forbidden to approach within 300 feet of this bridge for the purpose of eventual passage through the draw except during slack water or when opposing the tidal flow. Vessels and barges shall not attempt passage through the draw while running with the tide, and the bridge will not be opened for vessels under such conditions.

(e) Corte Madera Creek; Northwestern Pacific Railroad Company bridge and State of California highway bridge near Corte Madera. From 7:30 a.m. to 9:00 a.m., and from 4:30 p.m. to 6:00 p.m., on all days the draws need not be opened for the passage of vessels. On Saturdays, Sundays, and holidays at least 72 hours' advance notice required; on all other days at least 24 hours' advance notice required.

(f) Novato Creek; State of California highway bridge near Ignacio. At least 24 hours' advance notice required.

(g) Petaluma Creek—(1) Northwestern Pacific Railroad Company bridge at Black Point. The owner of or agency controlling this bridge need not keep a draw tender in constant attendance except when the draw is closed for the passage of railroad traffic. At all other times the draw may remain in full open position and unattended. During foggy weather a bell shall be tolled continuously when the draw is in open position.

(2) City of Petaluma highway bridges at "D" and Washington Streets, Petaluma. At least 6 hours' advance notice required, to be given to the Petaluma Police Department, telephone Petaluma 2-2727.

(h) Sonoma Creek—(1) State of California highway bridge (Sears Point Cutoff Bridge). At least four hours' advance notice required. To be given to the operator of the State of California highway bridge (Sears Point Cutoff Bridge) across Napa River at Vallejo.

(2) Northwestern Pacific Railroad Company bridge at Wingo. At least 24 hours' advance notice required.

(i) Mare Island Strait, Napa River, and their tributaries. (1) Department of the Navy bridge (Mare Island Causeway) and State of California highway bridge (Sears Point Cutoff Bridge) at Vallejo. From 7:00 a.m. to 8:00 a.m. and from 4:15 p.m. to 5:15 p.m. daily, except Saturdays, Sundays, and holidays, the draws need not be opened for the passage of vessels other than vessels owned, operated, or controlled by the United States.

(2) Southern Pacific Company railroad bridge at Brazos. The owner of or agency controlling this bridge need not keep a draw tender in constant attendance except when the draw is closed for the passage of railroad traffic. At all other times the draw may remain in full open position and unattended. During foggy weather a bell shall be tolled continuously when the draw is in open position.

(3) Napa County highway bridge near Imola. At least one, and not more than 24, hours' advance notice required. To be given to the operator of the Napa Sewage Disposal Plant, telephone Napa 4-0593.

(4) Dutchman Slough; James Irvine Bridge. At least 24 hours' advance notice required.

(5) Devil Slough; Russ Investment Company highway bridge. At least 24 hours' advance notice required.

**§ 203.713 Minor tributaries of Suisun Bay, Calif.**—

(a) Pacheco Creek; Contra Costa County highway bridge and Southern Pacific Company railroad bridge near Martinez. At least 24 hours' advance notice required.

(b) Cordelia Slough; a tributary of Suisun Slough; Southern Pacific Company railroad bridge. At least 24 hours' advance notice required.

**§ 203.714 San Joaquin River and its tributaries,**

Calif.—(a) San Joaquin River—(1) Stockton Port District railroad bridge between Rough and Ready Island and Stockton. At least 12 hours' advance notice required. To be given to the Director of the Port, Stockton Port District, Stockton, California.

(2) San Joaquin County highway bridge between Rough

and Ready Island and Stockton. At least 12 hours' advance notice required. To be given to the San Joaquin County Highway Department or to the County Surveyor at Stockton, California.

(3) Atchison, Topeka and Santa Fe Railway Company bridge near Stockton. At least 12 hours' advance notice required. To be given to the bridge owner's agent at Stockton, California.

(4) State of California highway bridge (Garwood Bridge). At least 12 hours' advance notice required. To be given to the Division of Highways Maintenance Superintendent, 1200 Wilson Way, Stockton, California.

(5) San Joaquin County highway bridge (Brandt Bridge). At least 12 hours' advance notice required. To be given to the County Surveyor of San Joaquin County, Stockton, California.

(6) Southern Pacific Company railroad bridge, State of California highway bridges (Mossdale Bridges), and Western Pacific Railroad Company bridge, near Lathrop. (i) The signal for opening at once all four of these bridges shall be the call signal described in § 203.710(b) (1). The signal for opening certain of these bridges, and those bridges only, shall be as follows: For the Southern Pacific Company railroad bridge, two long blasts followed by one short blast; for the highway bridges, two short blasts followed by one long blast; and for the Western Pacific Railroad Company bridge, one long blast followed by one short blast and one long blast.

NOTE: As used in this section, the term "long blasts" means distinct blasts of a whistle or horn or calls through a megaphone of four seconds' duration, and the term "short blasts" means distinct blasts of a whistle or horn or calls through a megaphone of one second's duration.

(ii) For upstream passages through these bridges, except as provided in subparagraph (iii), at least 24 hours' advance notice required. To be given to the Chief Dispatcher of the Southern Pacific Company at Stockton, California, to the Highway Maintenance Superintendent of the Division of Highways, State of California, at Stockton, California, and to the Chief Dispatcher of the Western Pacific Railroad Company at Sacramento, California. For downstream passages through these bridges, the vessel operators shall notify the individual draw tenders at the time the upstream passages are being made.

(iii) During sand dredging seasons, when, in the opinion of the District Engineer, Corps of Engineers, the attendance of draw tenders is required between 8:30 a.m. and 4:30 p.m. from Monday to Saturday, inclusive, these bridges shall, on proper signal, be opened promptly for the passage of all vessels unable to pass under the closed bridges. Prompt opening between 8:30 a.m. and 4:30 p.m. without advance notice from Monday to Saturday, inclusive, will be directed by the District Engineer provided the operators of sand dredging barges give 15 days' written notice to him and at the same time furnish sufficient evidence that such openings without advance notice are necessary to take care of contemplated traffic.

(7) Drawbridges above Paradise Dam. At least seven days' advance notice required.

(b) Burns Cutoff; San Joaquin County highway bridges (Jacobs Road and Upper Highway Bridges) between Roberts Island and Rough and Ready Island. At least two days' advance notice required. To be given to the County Surveyor of San Joaquin County, Stockton, California.

(c) Middle River—(1) San Joaquin County highway bridge between Bacon Island and Lower Jones Tract. On Sundays and national holidays, and between 5:00 p.m. and 8:00 a.m. on all other days, at least 12 hours' advance notice required, to be given to the County Surveyor of San Joaquin County, Stockton, California, except that if, during crop moving seasons, 20 or more passages through the bridge in any 30-day period are contemplated and 15 days' notice is given of the proposed traffic, the owner will be required to keep a draw tender in constant attendance for the duration of such period.

(1-a) The Atchison, Topeka and Santa Fe Railway Company bridge near Middle River Station. At least 12 hours' advance notice required, to be given the railway company's agent at Stockton, California, except that if, during crop moving seasons, 20 or more passages through the bridge in any 30-day period are contemplated and 15 days' notice is given of the proposed traffic the owner will be required to keep the draw tender in constant attendance for the duration of such period.

(2) State of California highway bridge between Victoria Island and Drexler Tract. At least 12 hours' advance notice required. To be given to the Division of Highways Maintenance Superintendent, 1200 Wilson Way, Stockton, California.

(3) San Joaquin County highway bridge between Union Island and Drexler Tract, at Fish Camp Landing. At least 24 hours' advance notice required. To be given to the County Surveyor of San Joaquin County, Stockton, California.

(4) San Joaquin County highway bridge (Williams Bridge) between Union Island and Roberts Island. At least two days' advance notice required. To be given to the County Surveyor of San Joaquin County, Stockton, California.

(d) Mormon Channel; City of Stockton highway bridge (Washington Street Bridge), Atchison, Topeka and Santa Fe Railway Company bridge (Edison Street Bridge), and City of Stockton (Lincoln Street Bridge).

(1) The signal for opening at once all three of these bridges shall be the call signal described in § 203.710(b) (1). The signal for opening any one of these bridges, and that bridge only, shall be as follows: For the Washington Street Bridge, two long blasts followed by one short blast; for the Edison Street Bridge, two short blasts followed by one long blast; and for the Lincoln Street Bridge, one long blast followed by one short blast and one long blast.

(2) At least 12 hours' advance notice required. To be given to the representative of the City of Stockton and to the railway company's agent at Stockton, California.

(e) King Island Cut; San Joaquin County highway bridge between King Island and Bishop Tract. At least

12 hours' advance notice required. To be given to the San Joaquin County Highway Department or to the County Surveyor at Stockton, California.

(f) Honker Cut; San Joaquin County highway bridge between Empire Tract and King Island. At least 12 hours' advance notice required, to be given to the County Surveyor of San Joaquin County, Stockton, California, except during crop moving seasons when, in the opinion of District Engineer the constant attendance of a draw tender is warranted, and the operators of vessels engaged in the crop moving operations give 15 days' written notice to the District Engineer of the contemplated traffic.

(g) Little Potato Slough; State of California highway bridge at Terminous. (1) The owner of or agency controlling this bridge shall keep a draw tender in constant attendance: (i) From 8:00 a.m. to 5:00 p.m. during the months of July to September, inclusive.

(ii) During periods when, in the opinion of the District Engineer, Corps of Engineers, an emergency exists; or during crop moving seasons when, in the opinion of the District Engineer, the attendance of a draw tender is required, provided the operators of vessels engaged in the crop moving operations give 15 days' written notice to the District Engineer and at the same time furnish sufficient evidence that such service is necessary to take care of the contemplated traffic. In the event that special periods are established by the District Engineer for the constant attendance of a draw tender during an emergency or a crop moving season, information concerning the hours and lengths of such periods will be published in local newspapers and in the "Notice to Mariners" issued by the United States Coast Guard.

(2) From 5:00 p.m. to 8:00 a.m. during the months of July to September, inclusive, when a draw tender is not in attendance, advance notice required; to be given to the draw tender verbally, or by telephone through the Lodi Exchange, before 4:00 p.m. At all other times, at least 12 hours' advance notice required; to be given to the Division of Highways Maintenance Superintendent, 1200 South Wilson Way, Stockton, California.

(h) Mokelumne River, including North and South Forks—(1) Mokelumne River—(i) State of California highway bridge near East Isleton. The owner of or agency controlling this bridge shall keep a draw tender in constant attendance from 9:00 a.m. to 5:00 p.m. throughout the year; and during periods when, in the opinion of the District Engineer, Corps of Engineers, an emergency exists, or during crop moving seasons when, in the opinion of the District Engineer, the attendance of a draw tender is required provided the operators of vessels engaged in the crop moving operations give 15 days' written notice to the District Engineer and at the same time furnish sufficient evidence that such service is necessary to take care of the contemplated traffic. In the event that special periods are established by the District Engineer for the constant attendance of a draw tender during an emergency or a crop moving season, information concerning the hours and lengths of such periods will be published in local newspapers and in the

"Notice to Mariners" issued by the United States Coast Guard. When a draw tender is not in attendance, advance notice required; to be given to the draw tender verbally, or by telephone through the Isleton Exchange, before 4:00 p.m.

(ii) Drawbridges above New Hope Landing. At least two days' advance notice required.

(2) North Fork; Sacramento and San Joaquin Counties Highway bridge (Millers Ferry Bridge). At least 12 hours' advance notice required. To be given to the San Joaquin County Highway Superintendent or to the County Surveyor at Stockton, California.

(3) South Fork; San Joaquin County highway bridge (New Hope Landing Bridge). (1) The signal for opening this bridge shall be two long blasts followed by one short blast.

(ii) At least 12 hours' advance notice required. To be given to the San Joaquin County Highway Superintendent or to the County Surveyor at Stockton, California.

(i) Snodgrass Slough; Southern Pacific Company railroad bridge and Sacramento County highway bridge. From 8:00 a.m. to 5:00 p.m., daily, at least 24 hours' advance notice required. From 5:00 p.m. to 8:00 a.m., the draws need not be opened for the passage of vessels except in cases of extreme emergency.

**§203.715 Georgiana Slough, Calif.**—(a) Sacramento County highway bridge near Isleton. (1) The signal for opening this bridge shall be four long blasts.

NOTE: As used in this section, the term "long blasts" means distinct blasts of a whistle or horn or calls through a megaphone of four seconds' duration.

(2) The owner of or agency controlling this bridge shall keep a draw tender in constant attendance from 8:00 a.m. to 5:00 p.m. throughout the year, and from 5:00 p.m. to 8:00 a.m. from June to September, inclusive, during such other periods as regular crop movements may justify, and during periods when, in the opinion of the District Engineer, Corps of Engineers, an emergency exists. In the event that the crop moving season is started earlier than June 1 or is extended later than September 30, the period for prompt opening of the bridge on proper signal from 5:00 p.m. to 8:00 a.m. shall be adjusted accordingly, provided the operators of vessels navigating this waterway give 15 days' written notice to the County Engineer of Sacramento County that such an adjustment is necessary to take care of contemplated traffic. At all other times, at least 12 hours' advance notice required. To be given to the operator of the Sacramento County highway bridge across Sacramento River at Walnut Grove.

(b) Southern Pacific Company railroad bridge near Isleton. The signal for opening this bridge shall be four long blasts.

(c) Sacramento County highway bridge near Walnut Grove. (1) The signal for opening this bridge shall be four long blasts.

(2) The owner of or agency controlling this bridge shall keep a draw tender in constant attendance from 8:00 a.m. to 5:00 p.m. throughout the year, and from

5:00 p.m. to 8:00 a.m. from June to September, inclusive, during such other periods as regular crop movements may justify, and during periods when, in the opinion of the District Engineer, an emergency exists. In the event that the crop moving season is started earlier than June 1 or is extended later than September 30, the period for prompt opening of the bridge on proper signal from 5:00 to 8:00 a.m. shall be adjusted accordingly: Provided, The operators of vessels navigating this waterway give 15 days' written notice to the County Engineer of Sacramento County that such an adjustment is necessary to take care of contemplated traffic. At all other times, at least 12 hours' advance notice required. To be given to the operator of the Sacramento County highway bridge across Sacramento River at Walnut Grove.

**§ 203.716 Sacramento River and its tributaries, California—**(a) Sacramento River—(1) Sacramento County highway bridge at Walnut Grove and State of California highway bridge at Paintersville. (i) For signaling vessels proceeding downstream and upstream the owner of or agency controlling the Sacramento County highway bridge shall provide lights which shall be operated in conjunction with sound and visual signals from the bridge. The lights shall be visible to approaching vessels and shall be located on the east side of the river. The lights for directing downbound traffic shall be located approximately 3,500 feet upstream from the bridge. The lights for directing upbound traffic shall be located approximately 750 feet downstream from the bridge. When the draw of the bridge can be opened a flashing green light shall be operated. When the draw of the bridge cannot be opened immediately, a flashing red light shall be operated.

(ii) When weather conditions prevent hearing sound signals and obstructions prevent seeing lantern signals, a vessel proceeding downstream may signal for opening of the draw of each of these bridges by swinging the beam of its searchlight from side to side in a vertical arc of about 60 degrees. If the draw can be opened immediately the draw tender shall so signal by projecting a steady beam of his searchlight vertically into the air and holding it steadily in that position until the vessel passes through the draw. If the draw tender finds, after giving the opening signal, that the bridge cannot be opened, he shall extinguish his searchlight immediately, but shall relight it when he is able to open the bridge.

(2) Southern Pacific Company railroad bridge at Sacramento. The signal for opening this bridge shall be four long blasts.

NOTE: As used in this section, the term "long blasts" means distinct blasts of a whistle or horn or calls through a megaphone of four seconds' duration, and the term "short blasts" means distinct blasts of a whistle or horn or calls through a megaphone of one second's duration.

(3) Southern Pacific Company railroad bridge and State of California highway bridge at Knights Landing.

(i) The signal for opening at once both of these bridges shall be the call signal described in § 203.710(b)(1). The signal for opening either of these bridges, and that bridge

only, shall be as follows: For the railroad bridge, two long blasts followed by one short blast; and for the highway bridge, two short blasts followed by one long blast.

(ii) When weather conditions prevent hearing sound signals and obstructions prevent seeing lantern signals, a vessel proceeding downstream may signal for opening of the draw of each of these bridges by swinging the beam of its searchlight from side to side in a vertical arc of about 60 degrees. If the draw can be opened immediately the draw tender shall so signal by projecting a steady beam of his searchlight vertically into the air and holding it steadily in that position until the vessel passes through the draw. If the draw tender finds, after giving the opening signal, that the bridge cannot be opened, he shall extinguish his searchlight immediately, but shall relight it when he is able to open the bridge.

(iii) The owner of or agency controlling each bridge shall keep a draw tender in constant attendance from 8:00 a.m. to 5:00 p.m., and at all times during periods when, in the opinion of the District Engineer, an emergency exists, or during a hauling season which requires 20 or more passages through the bridge in any 30-day period provided 15 days' written notice of the contemplated traffic is given by the operators of the hauling vessels to the Southern Pacific Company's Division Engineer at Sacramento and to the Division of Highways Maintenance Superintendent at Woodland, respectively. At all other times, advance notice required. To be given to the Southern Pacific Company's Chief Dispatcher at Sacramento and to the Division of Highways Maintenance Superintendent, respectively, before 4:00 p.m.

(4) Sacramento Northern Railway Bridge at Meridian. [Revoked]

(4-a) Colusa County highway bridge at Colusa. At least 12 hours' advance notice required. To be given to the Colusa County Sheriff's office at Colusa, California.

(5) State of California highway bridge at Butte City. At least 24 hours' advance notice required. To be given to the California State Highway Commission or to its representative in the vicinity.

(6) Drawbridges above Chico Landing. At least seven days' advance notice required.

(b) Steamboat Slough, State of California highway bridge at the head of Grand Island. (1) From 9:00 a.m. to 5:00 p.m., the bridge shall be opened promptly on receipt of the prescribed signal from a vessel desiring to pass through the bridge. Between 5:00 p.m. and 9:00 a.m. advance notice required before 4:00 p.m., to be given to the draw tender verbally or by telephone through the Courtland Exchange, or to be given to the State Highway Maintenance Superintendent at Fairfield.

(2) The signal for opening this bridge shall be two long blasts followed by one short blast.

(c) Miner Slough—(1) Prospect Farms pontoon bridge between Ryer Island and Prospect Island. At least 12 hours' advance notice required. To be given to the Superintendent of Prospect Farms through the Courtland Exchange, or to the main office of Prospect Farms in San Francisco, Calif.

(2) State of California highway bridge between north-

erly end of Ryer Island and Holland Tract. At least 12 hours' advance notice required. To be given to the Division of Highways Maintenance Superintendent, Rio Vista, Calif.

(3) Continuous attendance of the draws when Prospect Slough is impassable. In the event that Prospect Slough is impassable for any reason, the owners of or agencies controlling these bridges shall, on notification of that fact, provide continuous attendance of the draws during the period of such blocking and consequent hauling season on Miner Slough. Vessel owners shall notify the owners of or agencies controlling these bridges promptly, under such conditions, of the removal of obstruction from Prospect Slough or the termination of their shipping movements through Miner Slough.

(d) Sutter Slough; Sacramento County highway bridge near Courtland. (1) The signal for opening this bridge shall be four long blasts.

(2) At least eight hours' advance notice required. To be given to the Sacramento County Engineer or to the operator of the Sacramento County highway bridge across Sacramento River at Walnut Grove.

(e) American River; Sacramento County highway bridge at Sacramento. At least 4 days' advance notice required. To be given to the Sacramento County Engineer at Sacramento, California.

§ 203.718 Eureka Slough near Eureka, Calif. At least 24 hours' advance notice required.

§ 203.720 Coos Bay, Oreg.—(a) Bridge (highway) across South Inlet. (1) The county highway drawbridge across South Inlet shall open for the passage of vessels or other watercraft of any description upon verbal request, to the person in charge of said drawbridge. The bridge tender is J. J. Burns, who lives at the west end of the bridge. In his absence R. G. De Merritt, who resides at the west end of the bridge, is in charge.

(2) Notice shall be placed on said bridge stating where said tenders may be found in case it is necessary for the draw to be opened.

(b) Bridge of the Willamette-Pacific Railroad Co. (1) The drawspan of the railroad bridge below North Bend shall be kept open at all times except while actually required for the necessary passage of trains over the drawspan.

(2) During foggy weather a fog bell installed in the center of the drawspan shall be rung continuously, striking every 10 seconds.

(3) At any time during foggy weather, when the draw is closed and the passage is not clear for boats, there shall be sounded continuously a siren which may be heard at a distance of 1 mile from the drawspan. When the bridge is again opened the siren shall be stopped, indicating that the way is clear for the passage of boats.

(c) Highway and railroad bridges across Coal Bank Inlet. (1) The railroad drawbridge and the county highway drawbridge across Coal Bank Inlet shall open for the passage of vessels or other watercraft of any description upon verbal request to the persons in charge of said

drawbridges. The bridge tender for the railroad drawbridge is located in the Marshfield depot of the Southern Pacific Co. The bridge tender for the county drawbridge is the county road supervisor, F. P. Morton, of Marshfield, Oreg.

(2) Notice shall be posted on each of the bridges described in subparagraph (1) of this paragraph stating where said tenders may be found in case it is necessary for draws to be opened.

§ 203.725 Umpqua River, Oreg.—(a) Bridge of Willamette-Pacific Railroad Co. at Reedsport, Oreg. (1) The drawspan of the bridge across the Umpqua River at the mouth of Smith River shall be promptly opened for the passage of steamboats or other watercraft upon the following signals: One long blast of the whistle followed quickly by one short blast and one long blast.

(2) Vessels or other watercraft without power shall hail the bridge by horn or megaphone, or the bridge tender shall be notified by verbal communication of the desire to pass through the drawspan.

(3) During foggy weather an answering signal of one long blast from the whistle on the bridge will indicate that everything is clear and the draw open for the passage of boats. An answering signal from the whistle on the bridge of a succession of short blasts will indicate that there is some difficulty in immediately opening the draw, due to a passing train or some other cause.

(b) Bridge (highway) at Reedsport, Oreg. (1) The owner of, or agency controlling, the bridge shall provide the appliances and the personnel necessary for the safe, prompt, and efficient opening of the draw at any time during the day or night for the passage of any vessel or other watercraft, which cannot pass under the closed draw, when the following signal is received:

(i) One long blast followed immediately by one short blast of a whistle, siren, trumpet, horn or megaphone, or one loud and distinct stroke of a bell.

(ii) When the draw of the bridge can be opened immediately the draw tender shall reply by one long blast of a whistle, horn, siren, trumpet or megaphone, or one loud and distinct stroke of a bell.

(iii) If the draw of the bridge cannot be opened immediately, the draw tender shall reply by a succession of short blasts of a whistle, horn, siren, trumpet, or megaphone or loud and distinct ringing of a bell.

(2) A copy of the regulations in this section shall be conspicuously posted on both the upstream and downstream sides of the bridge in such manner that it can be easily read at any time.

(3) The operating machinery of the draw shall be maintained in a serviceable condition, and the draw opened and closed at least once every 4 months to make certain that the machinery is in proper order for satisfactory operation.

(4) This section shall take effect and be in force on and after September 28, 1937.

§ 203.730 Siuslaw River, Oreg.—(a) Oregon State Highway Commission bridge at Florence. (1) The owner

of or agency controlling this bridge shall provide the appliances and personnel necessary for the safe, prompt, and efficient opening of the draw at any time during the day or night for the passage of any vessel or other watercraft which cannot pass under the closed draw, when the call signal is received.

(2) The call signal for opening the draw shall be one long blast of a whistle, siren, trumpet, horn, or megaphone, followed immediately by one short blast, or one loud and distinct stroke of a bell. When the draw of the bridge can be opened immediately the draw tender shall reply by one long blast of a whistle, horn, siren, trumpet, or megaphone, or one loud and distinct stroke of a bell. If the draw of the bridge cannot be opened immediately, the draw tender shall reply by a succession of short blasts of a whistle, horn, siren, trumpet, or megaphone, or loud and distinct strokes of a bell.

(3) The operating machinery of the draw shall be maintained in a serviceable condition, and the draw shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

(4) A copy of the regulations in this paragraph shall be conspicuously posted on both the upstream and downstream sides of the bridge in such manner that it can be easily read at any time.

(b) Southern Pacific Company railroad bridge at Cushman. (1) Whenever a vessel unable to pass under the closed bridge desires to pass through the draw, at least 24 hours' advance notice of the time the opening is required shall be given to the authorized representative of the owner of or agency controlling the bridge.

(2) Upon receipt of such advance notice, the authorized representative shall, in compliance therewith, arrange for the prompt opening of the draw at the time specified in the notice for the passage of the vessel.

(3) The operating machinery of the draw shall be maintained in a serviceable condition, and the draw shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

(4) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides thereof, in such manner that it can be read easily at any time, a copy of the regulations in this paragraph together with a notice stating exactly how the authorized representative may be reached.

**§ 203.735 Tillamook River, Oreg.; bridge (highway).** The county highway drawbridge across the Tillamook River shall open for the passage of vessels or other watercraft of any description upon verbal request to the person in charge of said drawbridge. E. W. Stanley has been appointed by the county court of Tillamook County as bridge tender for the drawbridge across Tillamook River, and has caused notice to be posted on said bridge

stating where said tender may be found in case it is necessary for draw to be opened.

**§ 203.740 Youngs Bay, Walluski River, Lewis and Clark River, Skipanon River, John Day River, Blind Slough, and Clatskanie River, Oreg.; bridges.** (a) The drawbridges across Youngs Bay, Walluski River, Lewis and Clark River, Skipanon River, John Day River, and Blind Slough, all in Clatsop County, Oreg., and the bridge across Clatskanie River, in Columbia County, Oreg., shall be promptly opened for the passage of vessels or other watercraft upon the following signals:

(1) Spokane, Portland & Seattle Ry. bridge across Youngs Bay at Smith Point, one long blast followed quickly by one short blast.

(2) Youngs Bay highway bridge at foot of Fifth Street, Astoria, Oreg., two long blasts followed quickly by one short blast.

(3) Walluski River highway bridge, one long blast followed quickly by three short blasts.

(4) Lewis and Clark River highway bridge, near the mouth, one long blast followed quickly by four short blasts.

(5) Skipanon River railroad and highway bridges at Warrenton, Oreg. (both to be opened on one signal), one long blast followed quickly by one short blast.

(6) John Day River, Spokane, Portland & Seattle Ry. bridge, one long blast followed quickly by one short blast.

(7) John Day River highway bridge. (See special regulations in § 203.745.)

(8) Blind Slough, Spokane, Portland & Seattle Ry. bridge, one long blast followed quickly by one short blast.

(9) Clatskanie River, Spokane, Portland & Seattle Ry. bridge, one long blast followed quickly by one short blast.

(b) The bridges listed in paragraph (a) of this section shall be opened for the passage of vessels or watercraft of any kind upon prescribed signals being given on any form of whistle, horn, siren or trumpet, or upon verbal request of the person in charge of such vessel or watercraft except that the draw of the highway bridge across Youngs Bay at the foot of Fifth Street, Astoria, Oregon, shall not be required to open for vessels habitually using the waterway carrying appurtenances unessential for navigation which extend above the normal superstructure, unless such vessel has in tow a vessel which is unable to pass under the closed draw. Military masts shall be considered as a part of the superstructure.

NOTE: On request, the District Engineer, Corps of Engineers in charge of the waterway, will cause an inspection to be made of the superstructure and appurtenances of a vessel habitually frequenting the waterway with a view to adjusting any differences of opinion in this matter between the vessel and the bridge owner.

(c) This section shall take effect and be in force on and after December 15, 1929, and shall supersede the regulations approved November 7, 1899, governing the operation of the above-mentioned bridges.

**§ 203.745 John Day River, Oreg.; bridge (highway).**

(a) The owner of or agency controlling the bridge will not be required to keep a draw tender in constant attendance at this bridge.

(b) Whenever a vessel unable to pass under the closed bridge desires to pass through the draw, at least 12 hours' advance notice of the time the opening is required shall be given to the authorized representative of the owner of or agency controlling the bridge.

(c) Upon the receipt of such notice, the authorized representative of the owner of or agency controlling the bridge, in compliance therewith, shall arrange for the prompt opening of the draw at the time specified in the notice for the passage of the vessel.

(d) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides of the bridge in such manner that it can easily be read at any time a copy of the regulations in this section, together with a notice stating exactly how the representative specified in paragraph (b) of this section may be reached.

(e) The operating machinery of the draw shall be maintained in a serviceable condition, and the draw opened and closed at least once each quarter to make certain that the machinery is in proper order for satisfactory operation.

(f) This section shall take effect and be in force on and after April 12, 1933, and all regulations or parts of regulations applying to the bridge in conflict therewith are hereby revoked, to take effect on that date.

**§ 203.750 Willamette River at Portland, Oreg., Columbia River at Vancouver, Wash., and North Portland Harbor (Oregon Slough), Oreg.; bridges (highway and railroad): Signals—**

(a) Call signals for opening of draw. These signals shall be as prescribed for each bridge in paragraph (b) of this section. It is given by vessels as notice to bridge operators to open the draw, or in case the draw is already open, that they intend to pass through. A call signal given twice in rapid succession indicates that vessel has authority to pass bridges during closed periods (see paragraph (f) (1) of this section).

(b) Answering signals—(1) Acknowledging signal. Shall be the same as the call signal for each bridge. Its purpose is to acknowledge the call signal of a vessel and to indicate that the operator intends to open the draw as soon as practicable, or that he will hold it open.

(2) Danger signal. Shall consist of a series of short blasts, at least four, given in rapid succession, and repeated if necessary. Its purpose is to answer the call signal of a vessel, but to indicate that the draw cannot or will not be opened at once, or, when vessels are waiting in the vicinity, that the draw, if open, is about to be closed. It is also to be used in emergency to revoke an acknowledging signal.

(3) Rescinding signal. Shall be the reverse of the call signal for each bridge. It is given by a vessel to cancel a previous call signal, to indicate that the vessel does not

intend to pass through and that the draw need not be opened, or may be closed.

(4) Answer to rescinding signal. (i) Answer by the bridge operator to a rescinding signal shall be the danger signal (see subparagraph (2) of this paragraph).

(5) Call signals. The following call signals are prescribed for vessels wishing to have the drawspans opened or held open.

(i) Spokane, Portland & Seattle Ry. bridge, at Vancouver, Wash., one long followed by one short blast.

(ii) Interstate Highway Bridge, at Vancouver, Wash., two long followed by one short blast.

(iii) Spokane, Portland & Seattle Ry. bridge, at North Portland Harbor (Oregon Slough), one long followed by three short blasts.

(iv) Spokane, Portland & Seattle Ry. bridge, at St. Johns, Oreg., one long followed by one short blast.

(v) Broadway Bridge, two long followed by one short blast.

(vi) Oregon-Washington Railroad & Navigation Co. bridge, one long followed by one short blast.

(vii) Burnside Bridge, one long followed by two short blasts.

(viii) Morrison Bridge, one long followed by three short blasts.

(ix) Hawthorne Bridge, one long followed by four short blasts.

Call signals may be given on any form of whistle, horn, siren, or trumpet with sufficient range or volume to be heard by bridge operators.

(c) To bridge owners. All bridges to which this section applies shall be equipped with suitable air whistles of sufficient size and range that signals sounded on same shall be distinctly audible up and down stream under adverse wind and weather conditions for a distance of 2,500 feet, except for the Spokane, Portland & Seattle Ry. Co. bridges over Columbia and Willamette Rivers, which shall have a range of at least 5,000 feet under the same conditions.

(d) To navigators. (1) A vessel, desiring at any time (except during closed periods, see paragraph (f) (1) of this section) to pass through any of the above-mentioned bridges, under which it cannot pass with the draw closed, shall sound the call signal for such bridge as prescribed in paragraph (b) of this section, and shall repeat such signal at intervals until it is answered by the operator of the bridge (see paragraphs (a) and (e) of this section). In case two vessels approaching from opposite directions would meet at or near the bridge, the vessel bound downstream shall be considered as having the right of way. When either vessel waits for passage of the other, it shall again give the call signal for the bridge and receive acknowledgement before proceeding. It is incumbent upon navigators to make sure that their signals are understood before proceeding through a drawspan, and when approaching bridges, vessels should be kept under control, with a view to stopping, if necessary, before reaching the bridge.

(2) Vessels authorized to pass through bridges during closed periods, as provided in paragraph (f) (1) of this section, shall sound the call signal twice in rapid succession. Signals to open shall be given by vessels at a distance of at least 1,000 feet from the bridge, except in case of a vessel leaving a wharf or anchorage or when waiting less than 1,000 feet from the bridge. In such cases the signal shall be given early enough to allow the operator of the bridge sufficient time in which to clear and open the draw before arrival of the vessel.

(3) All vessels when passing any bridge shall be moved as expeditiously as is consistent with established rules governing speed in the harbor of Portland, and all towboats engaged in handling other craft or in towing logs through any of the bridges shall be of sufficient power to handle the tow without unduly delaying the closing of the drawspan.

(4) Vessels with hinged or adjustable masts or booms projecting above their fixed structures shall lower same and pass under the bridge, if practicable, without signaling for the draw to open.

(e) To bridge operators. (1) If the bridge can be opened, or is already open, when a call signal is given, the operator shall promptly answer the vessel calling by giving the acknowledging signal and promptly open the draw (except during closed periods, see paragraph (f) (1) of this section) or hold it open, as the case may be.

(2) In case the draw cannot be opened at once when the call signal is given, the operator shall promptly answer the vessel calling by giving the danger signal and shall repeat same, if necessary. As soon as the exigency which prevented opening has been removed the bridge operator shall promptly sound the regular acknowledging signal for that bridge to advise vessels that the draw can be opened at once, and he shall thereupon proceed to open same if there is a vessel waiting to pass through.

(3) When two vessels arrive at a bridge at or near the same time and blow the call signal, lift spans, when opened, shall be raised high enough to clear the taller vessel. If either vessel at any drawbridge waits for passage of the other and again gives the call signal, the bridge operator shall promptly answer with the acknowledging signal and shall hold the span open. In case the intentions of a waiting vessel are not understood by a bridge operator, when the draw is open he shall sound the danger signal as a warning to vessels that he is about to close the draw.

(4) If a rescinding signal is giving by a vessel to cancel a previously given call signal, and it is evident the vessel does not intend to pass through, the bridge operator shall answer with the danger signal (four or more short blasts) and may then close the draw, or need not open it.

(f) Closed periods. (1) The periods from 7:30 a.m. to 9 a.m. and 4:45 p.m. to 6:15 p.m. are hereby designated closed periods during which the drawspans of bridges carrying street traffic over Willamette River at Portland shall not be opened to navigation except as below provided, or when necessary to prevent accident.

(2) Closed periods above defined shall not be effective

on Sundays, New Year's Day, Washington's Birthday, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, and Christmas Day, or days observed in lieu of these under State law: Provided, That closed periods shall not apply against harbor patrol or fireboats answering calls, nor ocean-going vessels of 750 gross tons or over which are entering the harbor from points outside Willamette River: And provided further, That upon securing the approval and permission of the harbor master, but not otherwise, other ocean-going vessels of 750 gross tons or over may signal for and pass through these bridges at any hour. Vessels desiring and authorized to pass through bridges during closed periods as provided in subparagraph (1) of this paragraph, or in case of emergency when opening of the draw is necessary to prevent accident, shall sound the call signal twice in rapid succession, i.e., with an interval of not over 5 seconds between signals. Drawspans shall be opened, however, for ocean-going vessels of 750 gross tons or over under the rule in paragraph (e) of this section whether the vessel gives a single or double call signal.

(g) This section shall be in force on and after March 1, 1930, and shall supersede all previous Federal regulations for the bridges to which they are applicable.

**§ 203.755 Willamette River, Oreg.; bridges above Oregon City, Oreg.—**

(a) Southern Pacific Company's bridge at Salem. (1) Except as provided in subparagraph (2) of this paragraph, the drawspan shall be opened promptly for the passage of river craft unable to pass under the closed bridge upon the following signal: One long blast, followed quickly by one short blast; or upon verbal request of the operator of any watercraft of his desire to have the drawspan opened.

(2) When river stages are below 20 feet, Corps of Engineers gauge, and a vessel unable to pass under the bridge desires to pass through the draw, at least 24 hours' advance notice of the time the opening is required shall be given to the authorized representative of the owner or agency controlling the bridge. Such advance notice may be given to the dispatchers of the Southern Pacific Company at Portland or to the Southern Pacific Company Agent at Salem.

(3) Upon receipt of such advance notice, arrangements shall be made for the prompt opening of the drawspan at the time given in the notice for passage of the vessel, and the draw shall be so opened.

(4) The owner or agency controlling the bridge shall keep a copy of the regulations in this paragraph conspicuously posted on both the upstream and downstream sides of the bridge, in such place and manner that it can be easily read from the river at any time.

(b) Southern Pacific Company's bridge at Albany, Oreg., and Benton County highway bridge at Corvallis, Oreg.

(1) Whenever a vessel unable to pass under the Southern Pacific Company's railroad bridge at Albany, or the Benton County highway bridge at Corvallis, desires to pass through the draw of either bridge, at least 6 hours' advance notice of the time the opening is required shall be

given to the authorized representative of the owner or agency controlling the bridge through which passage is desired.

(2) Upon receipt of such advance notice, arrangements shall be made for the prompt opening of the draw at the time given in the notice for passage of the vessel, and the draw shall be so opened.

(3) The owner or agency controlling the bridge shall keep a copy of the regulations in this paragraph conspicuously posted on both the upstream and downstream sides of the bridge, in such place and manner that it can be easily read from the river at any time, together with a notice stating exactly how the representative specified in paragraph (b)(1) of this section may be reached.

(4) The operating machinery of the draws of these bridges shall be maintained in a serviceable condition, and the draw opened and closed at least once each three months, to insure that the machinery is in proper order for satisfactory operation.

**§ 203.758 Skamokawa Creek, Wash.; Washington State Highway bridge at Skamokawa.** (a) The owner of or agency controlling the drawbridge will not be required to keep a draw tender in constant attendance.

(b) Whenever a vessel unable to pass under the closed bridge desires to pass through the draw, at least 24 hours' advance notice of the time the opening is required shall be given to the authorized representative of the owner of or agency controlling the bridge.

NOTE: The authorized representative in charge of the operation of the bridge is Mr. A. E. Oakes, Cathlamet, Washington, Telephone, Cathlamet 105-J-2.

(c) Upon receipt of such notice the authorized representative of the owner of or agency controlling the bridge, in compliance therewith, shall arrange for the prompt opening of the draw at the time specified in the notice for the passage of the vessel.

(d) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides of the bridge in a manner that it can be easily read at any time, a copy of the regulations in this section, together with a notice stating exactly how the representative stated in paragraph (b) of this section may be reached.

(e) The operating machinery of the draw shall be maintained in a serviceable condition, and the draw shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

**§ 203.759 Columbia River; Oregon-Washington Bridge Company highway bridge between Hood River, Oreg., and White Salmon, Wash.** (a) The owner of or agency controlling the bridge will not be required to keep a draw tender in constant attendance.

(b) Whenever a vessel unable to pass under the closed

bridge desires to pass through the draw, at least 12 hours' advance notice of the time the opening is required, and the vertical clearance required for the vessel, shall be given to the authorized representative of the owner of or agency controlling the bridge.

(c) Upon receipt of such notice, the authorized representative, in compliance therewith, shall arrange for the prompt opening of the draw upon signal at the time specified in the notice for the passage of the vessel.

(d) The call signal for opening of the draw shall be one long blast followed by two short blasts and one long blast. When the draw has been opened sufficiently to pass the vessel, the draw tender shall reply by waving conspicuously a green flag by day or a green light by night. When the draw cannot be opened immediately, or when it is open and due to an emergency must be closed immediately, the draw tender shall reply by waving conspicuously a red flag by day or a red light by night.

(e) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides of the bridge, in such manner that it can be easily read at any time, a copy of the regulations in this section, together with a notice stating exactly how the authorized representative may be reached.

(f) The operating machinery of the draw shall be maintained in a serviceable condition, and the draw shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

**§ 203.759a Columbia River; Spokane, Portland and Seattle Railway Company bridge between Wishram, Washington, and Celilo, Oregon.** (a) The owner of, or agency controlling the bridge, shall provide the necessary equipment, controls and personnel necessary for the safe, prompt and efficient opening of the draw upon signal at any time of the day or night for the passage of any vessel or other watercraft which cannot pass under the closed draw.

(b) The call signal for opening the draw shall be one long blast of a whistle, siren, trumpet, horn or megaphone, followed immediately by one short blast. When the draw of the bridge can be opened immediately or if the draw is open and will be held open, for the passage of the vessel, the draw tender shall reply by one long blast of a whistle, siren, trumpet, horn or megaphone, followed by one short blast. If the draw cannot be opened immediately the draw tender shall reply by a succession of short blasts on a whistle, siren, trumpet, horn or megaphone.

(c) The operating machinery of the draw shall be maintained in a serviceable condition and the draw shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper condition for prompt operation.

(d) The owner of, or agency controlling the bridge, shall keep conspicuously posted on both the upstream and

downstream sides of the bridge, in such a manner that it can be easily read at any time, a copy of the regulations of this section.

**§ 203.760 Columbia and Snake Rivers in vicinity of Pasco, Wash.; bridges—**(a) Bridges covered by the regulations of this section. (1) The Union Pacific Railroad Company bridge across the Columbia River about 5 miles downstream from Pasco, Washington.

(2) The Northern Pacific Railway Company bridge across the Columbia River between Pasco and Kennewick, Washington.

(3) The Northern Pacific Railway Company bridge across the Snake River at Burbank, Washington.

(b) Posting of regulations. The owner of or agency controlling each bridge shall keep conspicuously posted on the bridge a copy of the regulations of this section together with a notice stating exactly how the representative stated below may be reached. The regulations of this section and notice shall be posted on both the upstream and downstream sides of the bridge and in such a manner that they can be easily read at all times. The names, addresses, and telephone numbers of the bridge representatives are as follows:

(1) For the Union Pacific Railroad Company bridge—The Chief Dispatcher, Spokane, Washington, telephone Main 4121.

(2) For the Northern Pacific Railway Company bridges—The General Yardmaster, Clark and Tacoma Streets, Pasco, Washington, telephone 6242 or 4401.

(c) Advance notification. The owners or operators of vessels requiring that the drawspan of either of the bridges owned by the Northern Pacific Railway Company referred to above, be opened between the hours of 4:00 p.m. and 8:00 a.m., will notify the representative of the bridge owner at least 2 hours in advance of the estimated time of arrival of the vessel at the bridge.

(d) Signals. (1) Call signals for opening of draw. The following signals shall be given by vessels as notice to bridge tender to open the draw, or in case the draw is already open, that they intend to pass through.

(1) Sound signals. (a) For the Union Pacific Railroad Company bridge, 2 long blasts and 1 short blast, sounded at least 10 minutes and not more than 30 minutes before passage is desired.

(b) For the Northern Pacific Railway Company bridges, 1 long blast and 2 short blasts, sounded at least 10 minutes and not more than 30 minutes before passage is desired.

(ii) Visual signals. A white flag by day or a white light at night, swung in full circles at arm's length in full sight of the bridge and facing the draw.

(2) Answering signals—(i) Acknowledging signals. Shall be the same as the call signal for each bridge. The purpose of the signal is to acknowledge the call signal of a vessel and to indicate that the bridge tender intends to open the draw as soon as practicable, or that he will hold the draw open.

(ii) Danger signals. Shall consist of a series of short blasts, at least four, given in rapid succession, and repeated if necessary, or a red flag during the day or a red

light at night swung in full circles in full sight of the vessel. The signals will be used in answering the call signal of a vessel to indicate that the draw cannot or will not be opened at once, or, when vessels are waiting in the vicinity, that the draw, if open is about to be closed. It is also to be used in emergency to revoke an acknowledging signal.

(iii) Rescinding signals. Shall be the reverse of the call signal for each bridge. The signal will be used by a vessel to cancel a previous call signal, and to indicate that the vessel does not intend to pass through and that the draw need not be opened, or may be closed.

(iv) Answer by the bridge tender to a rescinding signal shall be the danger signal.

NOTE: The term "long blast" means a distinct blast of approximately five seconds' duration and the term "short blast" means a distinct blast of approximately two seconds' duration. Visual signals are to be used in conjunction with sound signals when conditions are such that sound signals may not be heard.

(e) All bridges to which the regulations of this section apply shall be equipped with a whistle or horn of sufficient size and range that signals sounded on same shall be distinctly audible up and down stream on a still day for a distance of approximately 2.5 miles.

(f) A vessel, desiring to pass through any of the above bridges, under which it cannot pass with the draw closed, except when advance notice is required by paragraph (c) of this section, shall sound the call signal for such bridge as prescribed and shall repeat such signal at intervals until it is answered by the draw tender. In case two vessels approaching from opposite directions would meet at or near the bridge, the vessel bound downstream shall be considered as having the right of way. When either vessel waits for the passage of the other, the vessel shall again give the call signal for the bridge and receive an acknowledging signal from the draw tender before proceeding. It is incumbent upon navigators to make sure that their signals are understood before proceeding through a drawspan, and when approaching bridges, vessels should be kept under control, with a view to stopping, if necessary, before reaching the bridge.

(g) All vessels when passing any bridge shall be moved as expeditiously as is consistent with safe navigation, and all towboats engaged in towing barges or other craft through any of the bridges shall be of sufficient power to handle the tow without unduly delaying the closing of the drawspan.

(h) Vessels with hinged or adjustable masts or booms projecting above their fixed structure shall lower the same and pass under the bridges, if practicable, without signaling for the draw to open.

(i) If the bridge can be opened, or is already open, when a call signal is given, the draw tender shall promptly answer the vessel calling by giving the acknowledging signal and promptly open the draw or hold it open, as the case may be, except that the opening of the draw may be delayed until immediately after the passage of any train which will cross the bridge before stopping and which has passed any bridge signal block located not

more than two miles from the bridge. Trains shall in no event stand in such location as to prevent operation of the draw when a vessel desiring passage through the bridge has signaled for the draw to be opened.

(j) In case the draw cannot be opened at once when the call signal is given, the draw tender shall promptly answer the vessel calling by giving the danger signal and shall repeat the same, if necessary. As soon as the exigency which prevented opening has been removed the bridge tender shall promptly sound the regular acknowledging signal for the bridge to advise vessels that the draw can be opened at once, and he shall thereupon proceed to open same if there is a vessel waiting to pass through.

(k) When two vessels arrive at a bridge at or near the same time and blow the call signal, the lift span, when opened, shall be raised high enough to clear the taller vessel. If either vessel at any drawbridge waits for passage of the other and again gives the call signal, the bridge tender shall promptly answer with the acknowledging signal and shall hold the span open. In case the intentions of a waiting vessel are not fully understood by a draw tender, when the draw is open he shall sound the danger signal as a warning to vessels that he is about to close the draw.

(l) If a rescinding signal is given by a vessel to cancel a previously given call signal, and it is evident the vessel does not intend to pass through, the draw tender shall answer with the danger signal and may close the draw, or need not open the draw.

**§ 203.765 Cowlitz and Lewis Rivers, Wash.; bridges—**

(a) General regulations. (1) The corporations or persons owning or controlling a drawbridge shall provide the same with the necessary tenders and the proper mechanical devices for the safe, prompt, and efficient opening of the draw for the passage of vessels.

(2) If the weather conditions are good and sound signals can be heard, when a vessel approaches a drawbridge and desires to pass through the draw:

(i) The person in charge of such vessel desiring to pass shall cause to be sounded, within reasonable hearing distance of the bridge, repeating if necessary, and in time to give due notice to its operator, three long distinct blasts of a whistle, horn, or megaphone, or three loud and distinct strokes of a bell.

NOTE: As used in this section, the term long blast of a whistle or horn shall mean a blast of 4 seconds' duration and a short blast shall mean one of 1 second duration.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by two long blasts followed by one short distinct blast of a whistle, horn, or megaphone, or by three loud and distinct strokes of a bell.

(iii) When the draw of the bridge cannot be opened immediately the draw tender shall reply by two long distinct blasts of a whistle, horn, or megaphone, or two distinct strokes of a bell. (This signal may also be used by a vessel to countermand its signal to open draw.)

(iv) When, after a delay, as in subparagraph (2) (iii)

of this paragraph, the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall give the signal described in subparagraph (2) (iii) of this paragraph, viz, two long blasts followed by one short distinct blast of a whistle, horn, or megaphone, or three loud and distinct strokes of a bell.

(3) When weather conditions prevent hearing sound signals:

(i) The person in charge of a vessel desiring to pass shall swing a white lighted lantern or white flag, the former by night, the latter by day; the person signaling to face the drawbridge and swing the lantern or flag in front of him at arm's length, in vertical circles.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by raising and lowering a white lighted lantern or a white flag, the former by night, the latter by day, the movement to be vertical.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by swinging a red lighted lantern or red flag, the former by night, the latter by day; the person signaling to face the vessel and swing the lantern or flag in front of him at arm's length in vertical circles. (This signal may also be used by a vessel to countermand its signal to open draw.)

(iv) When, after a delay, as in subparagraph (3) (iii) of this paragraph the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall give the signal described in subparagraph (3) (ii) of this paragraph, viz, raising and lowering a lighted lantern or a flag.

(4) When fog prevails by day or by night the draw tender on giving signal (subparagraphs (2) (ii), (2) (iv), (3) (ii), and (3) (iv) of this paragraph) that draw will be opened, shall toll a bell continuously during the approach and passage of the vessel.

(5) The draw shall be opened with the least possible delay upon receiving the prescribed signal: Provided, That the drawspan shall not be opened when a train is approaching so closely that it cannot safely be stopped before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the operator of the drawspan.

(6) Trains, wagons, and other vehicles shall not be stopped on a drawbridge for the purpose of delaying its opening, nor shall water craft or vessels be so manipulated as to hinder or delay the operation of a drawspan, but all passage, over, through, or under a drawbridge shall be prompt, to prevent delay to either land or water traffic.

(7) This paragraph shall apply in the cases of all bridges, but to provide for intermittent attendance of bridge tenders on bridges across streams where water traffic is minor, or at times nonexistent, the special regulations and exceptions in paragraph (b) of this section are prescribed.

(b) Special regulations—(1) Northern Pacific Railway Company bridge across Lewis River. (i) The owner of or agency controlling the bridge will not be

required to open the draw of the bridge for the passage of vessels from January 1 to May 24, inclusive, and from July 21 to December 31, inclusive, of any year.

(ii) Whenever a vessel unable to pass under the closed bridge desires to pass through the draw from May 25 to July 20, both dates inclusive, at least 6 hours' advance notice of the time the opening is required shall be given to the authorized representative of the owner of or agency controlling the bridge.

(iii) Upon receipt of such notice, the authorized representative of the owner of or agency controlling the bridge, in compliance therewith, shall arrange for the prompt opening of the draw at the time specified in the notice of the passage of the vessel.

(iv) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides of the bridge, in a manner that it can be easily read at any time, a copy of the regulations of this section, together with a notice stating exactly how the authorized representative may be reached by telephone or otherwise.

(2) Cowlitz River; highway bridge at Allen Street, Kelso, Wash.

(i) The owner of or agency controlling the drawbridge will not be required to keep a draw tender in constant attendance.

(ii) Whenever a vessel unable to pass under the closed bridge desires to pass through the draw, at least 2 hours' advance notice of the time the opening is required shall be given to the authorized representative of the owner of or agency controlling the bridge. In the event a vessel is delayed by weather conditions or otherwise, the operator will remain a reasonable time, not to exceed two hours, and open the bridge on signal for the passage of the vessel. If a vessel is expected to be delayed more than two hours the operator will be so advised, and notified of the later time the opening will be required.

(iii) Upon receipt of advance notice the authorized representative of the owner of our agency controlling the bridge, in compliance therewith, shall arrange for the prompt opening of the draw at the time specified in the notice for the passage of the vessel. If a vessel passing through the bridge intends to return through within two hours the bridge tender will be advised of the fact and he will remain at and open the bridge upon signal for the vessel's return passage.

(iv) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides of the bridge, in a manner that it can be easily read at any time, a copy of these regulations, together with a notice stating exactly how the authorized representative may be reached by telephone or otherwise.

(v) The operating machinery of the draw shall be maintained in a serviceable condition and the draw opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

(c) Effective date. This section shall take effect on

and after April 15, 1927, and shall supersede all regulations heretofore prescribed for the opening of bridges over the waterways to which this section applies.

**§ 203.770 Willapa River and navigable tributaries, Wash.; bridges.** (a) When at any time during the day or night a vessel unable to pass under the closed drawspan of any of these bridges approaches it from a distance of over 1,000 feet, the person in command of such vessel shall cause to be sounded, when the vessel is at a distance of not less than 1,000 feet, the prescribed signal and shall repeat this signal until it is understood at the bridge.

(b) When such vessel is about to leave a landing 1,000 feet or less from the drawbridge, with the intention of passing through the draw, the person in command shall cause the prescribed signal to be sounded at such interval before leaving the landing that the draw may be opened in time for the vessel to pass.

(c) Wagons, vehicles, and trains shall not be stopped on said drawbridges or on a drawspan for the purpose of delaying the operations of drawbridge, nor shall water craft or vessels be so manipulated as to hinder or delay the operations of a drawspan, but all passage upon, through, or under said drawbridge shall be prompt, to prevent delay to either land or water communication.

(d) Whenever possible, vessels with tows shall not so approach a bridge as to attempt to pass the draw in succession without interval. They must endeavor to so arrange their approach as to cause no delay in closing the draw promptly for the relief of land traffic.

(e) The following signals are prescribed for vessels wishing to have the draws opened: For the State highway bridge over Willapa River (North Fork) at Raymond, one long blast of a whistle followed quickly by one short blast and one long blast; for the Northern Pacific Railway Company bridge over Willapa River (South Fork) at Raymond, two long blasts of a whistle followed quickly by one short blast; for the State highway bridge over Willapa River (South Fork) at Raymond, two long blasts of a whistle followed quickly by two short blasts. These bridges shall also be opened for the passage of vessels or watercraft of any description propelled by other than steam power upon like signals given by whistle or trumpet or upon verbal request of the person or persons in charge of the vessels.

(f) In case the drawspan cannot be immediately operated when the prescribed signal is given, a red flag or ball by day and a red light by night shall be displayed, or on bridges where a suitable whistle has been installed five short blasts shall be immediately given, and repeated until the approaching vessel answers.

**§ 203.775 Grays Harbor and tributaries, Wash.; bridges—**(a) General regulations. (1) The corporations or persons owning or controlling a drawbridge shall provide the same with the necessary tenders and the proper mechanical devices for the safe, prompt, and efficient opening of the draw for the passage of vessels.

(2) If the weather conditions are good and sound signals can be heard when a vessel approaches a drawbridge and desires to pass through the draw :

(i) The person in charge of such vessel desiring to pass shall cause to be sounded, within reasonable hearing distance of the bridge, repeating if necessary, and in time to give due notice to its operator, three long distinct blasts of a whistle, horn, or megaphone, or three loud and distinct strokes of a bell.

NOTE: As used in this section, the term long blast of a whistle or horn shall mean a blast of 4 seconds' duration, and a short blast shall mean one of 1 second duration.

(ii) When the draw of the bridge can be opened immediately the draw tender shall reply by two long blasts followed by one short distinct blast of a whistle, horn, or megaphone, or by three loud and distinct strokes of a bell.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by two long distinct blasts of a whistle, horn, or megaphone, or two distinct strokes of a bell. (This signal may also be used by a vessel to countermand its signal to open draw.)

(iv) When, after a delay as in subparagraph (2) (iii) of this paragraph, the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall give the signal described in subparagraph (2) (ii) of this paragraph, viz, two long blasts followed by one short distinct blast of a whistle, horn, or megaphone, or three loud and distinct strokes of a bell.

(3) When weather conditions prevent hearing sound signals:

(i) The person in charge of a vessel desiring to pass shall swing a white lighted lantern or white flag, the former by night, the latter by day; the person signaling to face the drawbridge and swing the lantern or flag in front of him at arm's length, in vertical circles.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by raising and lowering a white lighted lantern or a white flag, the former by night, the latter by day; the movement to be vertical.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by swinging a red lighted lantern or red flag, the former by night, the latter by day; the person signaling to face the vessel and swing the lantern or flag in front of him at arm's length, in vertical circles. (This signal may also be used by a vessel to countermand its signal to open draw.)

(iv) When, after a delay, as in subparagraph (3) (iii) of this paragraph, the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall give the signal described in subparagraph (3) (ii) of this paragraph, viz, raising or lowering a lighted lantern or a flag.

(4) When fog prevails by day or by night the draw tender on giving signal (subparagraphs (2) (ii), (2) (iv), (3) (ii), or (3) (iv) of this paragraph) that draw will be opened, shall toll a bell continuously during the approach and passage of the vessel.

(5) The draw shall be opened with the least possible delay upon receiving the prescribed signal: Provided, That the drawspan shall not be opened when a train is approaching so closely that it cannot safely be stopped before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the operator of the drawspan.

(6) Trains, wagons, and other vehicles shall not be stopped on a drawbridge for the purpose of delaying its opening, nor shall water craft or vessels be so manipulated as to hinder or delay the operation of a drawspan, but all passage over, through, or under a drawbridge shall be prompt to prevent delay to either land or water traffic.

(7) This paragraph shall apply in the cases of all bridges, but to provide for distinctive signals given by vessels to particular bridges, as where two or more are within sight or hearing and but one bridge is desired to be opened, the special regulations and exceptions in paragraph (b) are prescribed.

(b) Special regulations.

(1) State bridge over Hoquiam River at Simpson Avenue: two long blasts of whistle followed quickly by one short blast of whistle.

(2) City bridge over Hoquiam River, Eighth Street, Hoquiam: two long blasts of whistle followed quickly by two short blasts.

(3) Northern Pacific Railway bridge over Hoquiam River near forks of river: one long blast of whistle followed quickly by one short and one long blast.

(4) Northern Pacific Railway bridge over Wishkah River at Aberdeen: one long blast of whistle followed quickly by one short blast.

(5) City bridge over Wishkah River at Heron Street, Aberdeen: one long blast of whistle followed quickly by two short blasts.

(6) City bridge over Wishkah River at Wishkah Street: one long blast of whistle followed quickly by three short blasts.

(7) City bridge over Wishkah River at Second Street, Aberdeen: one long blast of whistle followed quickly by four short blasts.

NOTE: For other special regulations governing operation of this bridge, see § 203.810.

(8) State Highway bridge over Chehalis River at Aberdeen: Two short blasts of whistle followed quickly by one long blast.

(9) Northern Pacific Railway bridge over Chehalis River at Junction City. [Revoked]

(10) This section shall take effect on and after March 10, 1928, and will supersede the regulations approved September 28, 1926, for drawbridges over these waterways.

§ 203.785 City Waterway, Tacoma Harbor, Wash.; bridges—(a) Draw tenders and operating machinery. The owners of or agencies controlling drawbridges shall provide the necessary tenders and the proper mechanical appliances for the safe, prompt, and efficient opening of the draws for the passage of vessels in accordance with the

regulations in this section. The operating machinery of the draws shall be maintained in a serviceable condition, and the draws shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

(b) Signals—(1) Sound signals. To be used if weather conditions are such that sound signals can be heard.

(i) Call signal for opening of draw. For the City of Tacoma bridge at South Eleventh Street, three long blasts followed by one short blast, for the Northern Pacific Rail- 10 way Company bridge at South Fourteenth Street, two long blasts followed by one short blast, and for the Union Pacific Railroad Company bridge near South Fifteenth Street, one long blast followed by one short blast and one long blast, of a whistle, horn, or megaphone, sounded 15 within reasonable hearing distance of the bridge in each case, repeated if necessary, and in time to give due notice to the draw tender.

NOTE: As used in this section, the term "long blast" means a distinct blast of four seconds' duration, and the 20 term "short blast" means a distinct blast of one second's duration.

(ii) Acknowledging signal when draw can be opened immediately (opening signal). Two long blasts followed by one short blast of a whistle, horn or megaphone, or 25 three loud and distinct strokes of a bell.

(iii) Acknowledging signal when draw cannot be opened immediately, or when it is open and must be closed immediately. Two long blasts of a whistle, horn, or mega- 30 phone, or two loud and distinct strokes of a bell. (This signal may also be used by a vessel to countermand its call signal.) Thereafter, as soon as the draw can be opened, the draw tender shall sound the opening signal.

(2) Visual signals. To be used if weather conditions are such that sound signals may not be heard.

(i) Call signal for opening of draw. A white flag by day or a white lighted lantern by night, swung in vertical circles at arm's length in full sight of the bridge and facing the draw.

(ii) Acknowledging signal when draw can be opened immediately (opening signal). Same as call signal, to 40 be given in full sight of the vessel.

(iii) Acknowledging signal when draw cannot be opened immediately, or when it is open and must be closed immediately. A red flag by day or a red lighted lantern 45 by night, swung in vertical circles at arm's length in full sight of the vessel. (This signal may also be used by a vessel to countermand its call signal.) Thereafter, as soon as the draw can be opened, the draw tender shall give the opening signal.

(3) Fog signal. When fog prevails by day or by night the draw tender, after giving the opening signal, shall toll a bell continuously during the approach and passage 50 of the vessel.

(c) Prompt opening required except when delayed by 55 train. Except as otherwise provided in paragraph (e) of this section, the draw shall be opened with the least possible delay on receiving the prescribed signal: Provided, That the draw shall not be opened when a train is ap-

proaching so closely that it cannot safely be stopped before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the draw tender.

(d) Interference with operation of bridge prohibited. 5 Trains and vehicles shall not be stopped on a drawbridge for the purpose of delaying its opening, nor shall watercraft be navigated so as to hinder or delay the operation of the draw, but all passage over or through a drawbridge shall be prompt to prevent delay to either land or water 10 traffic.

(e) Special regulations—(1) City of Tacoma bridge at South Eleventh Street. (i) The owner of or agency controlling this bridge need not keep a draw tender in constant attendance.

(ii) Whenever a vessel, unable to pass under the closed bridge, desires to pass through the draw, at least two hours' advance notice of the time the opening is required must be given to the authorized representative of the 15 owner of or agency controlling the bridge to insure prompt opening thereof at the time required.

(iii) On receipt of such advance notice, the authorized representative, in compliance therewith, shall arrange for the prompt opening of the draw on proper signal at ap- 20 proximately the time specified in the notice: Provided, That the draw need not be opened between 6:45 a.m. and 7:45 a.m. and between 3:30 p.m. and 5:30 p.m. except when necessary to prevent disaster to shipping.

(iv) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and 30 downstream sides thereof, in such manner that it can easily be read at any time, a copy of the regulations in this section pertaining to the bridge together with information as to whom notice should be given when it is desired that the bridge be opened and directions for communicating with such person by telephone or otherwise.

(2) Union Pacific Railroad Company bridge near South Fifteenth Street. The draw of this bridge need not be 35 opened between 7:15 a.m. and 8:00 a.m. and between 4:15 and 5:00 p.m. except when necessary to prevent disaster to shipping.

§ 203.790 Duwamish Waterway at Seattle, Wash.; bridges. (a)—General regulations. (1) The corpora- 40 tion or persons owning or controlling a drawbridge shall provide the same with necessary tenders and the proper mechanical devices for the safe, prompt, and efficient opening of the draw for the passage of vessels.

(2) If the weather conditions are good and signals can be heard when a vessel approaches a drawbridge and de- 50 sires to pass through the draw:

(i) The person in charge of such vessel desiring to pass shall cause to be sounded, within reasonable hearing distance of the bridge, repeating if necessary, and in time to give due notice to its operator, the opening signal pre- 55 scribed in paragraph (b) of this section for the particular bridge.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by the signal pre- scribed under special regulations in paragraph (b) of

this section. As used in this section, the term long blast of a whistle or horn shall mean a blast of 4 seconds' duration, and a short blast shall mean one of 1 second duration.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by the signal 5 prescribed under special regulations in paragraph (b) of this section.

(iv) When, after a delay, as in subparagraph (2) (iii) of this paragraph, the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall 10 give the signal prescribed under special regulations in paragraph (b) of this section.

(3) When weather conditions prevent hearing sound signals:

(i) The person in charge of a vessel desiring to pass 15 shall swing a white lighted lantern or white flag, the former by night, the latter by day; the person signaling to face the drawbridge and swing the lantern or flag in front of him at arm's length in vertical circles.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by raising and 20 lowering a white lighted lantern or a white flag, the former by night, the latter by day, the movement to be vertical.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by swinging a 25 red lighted lantern or red flag, the former by night, the latter by day; the person signaling to face the vessel and swing the lantern or flag in front of him at arm's length in vertical circles. (This signal may also be used by a vessel to countermand its signal to open draw.) 30

(iv) When, after a delay, as in subparagraph (3) (iii) of this paragraph the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall 35 give the signal prescribed in subparagraph (3) (ii) of this paragraph, viz. raising and lowering a lighted lantern or a flag.

(4) When fog prevails by day or by night the draw tender, on giving signal (subparagraphs (2) (ii), (2) (iv), 40 (3) (ii) or (3) (iv) of this paragraph) that draw will be opened, shall toll a bell continuously during the approach and the passage of the vessel.

(5) The draw shall be opened with the least possible delay, upon receiving the prescribed signal: *Provided*, 45 That the drawspan shall not be opened when a train is approaching so closely that it cannot safely be stopped before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the operator of the drawspan.

(6) Trains, wagons, and other vehicles shall not be 50 stopped on a drawbridge for the purpose of delaying its opening, nor shall water craft or vessels be so manipulated as to hinder or delay the operation of a drawspan, but all passage over, through, or under a drawbridge shall be prompt, to prevent delay to either land or water 55 traffic.

(b) Special regulations. (1) the general regulations in paragraph (a) of this section shall apply in the cases of all bridges, but to provide for distinctive signals given 60 by vessels to particular bridges, as where two or more

are within sight or hearing and but one bridge is desired to be opened, and to provide for closed or open periods when land or water traffic predominates, the special regulations and exceptions in this paragraph are prescribed.

(2) The following signals are prescribed for vessels wishing to have the draws opened:

(i) Northern Pacific Ry. and West Spokane Street Bridges.—(a) Opening signal. For the Northern Pacific Ry. bridge only: One long blast of whistle, followed quickly by one short blast. For both the Northern Pacific Ry. and West Spokane Street bridges: One long blast of whistle, followed quickly by three short blasts.

NOTE: Northern Pacific Ry. bridge, clearance 18 feet at mean low water; West Spokane Street bridge, clearance 53 feet at mean lower low water.

(b) Closed periods. Between the hours of 7:00 a.m. and 9:00 a.m. and 4:00 p.m. and 6:00 p.m., the draw of the West Spokane Street bridge need not be opened on any day of the week except Saturdays, Sundays and National Holidays for the passage of any vessel of less than 1,000 gross tons unless such vessel has in tow a vessel of 1,000 gross tons or over, or is required to open the bridge to pick up for towing a vessel of 1,000 gross tons or over, except that openings will be made under emergency conditions upon certification to the Seattle City Engineer by responsible representatives of affected navigation interests.

(ii) City bridge at First Avenue South. Clearance 52 feet at mean lower low water.

(a) Opening signal. The signal for opening this bridge shall be three long blasts of the whistle.

(b) Closed periods. Between the hours of 7:00 a.m. and 9:00 a.m., and 4:00 p.m. and 6:00 p.m., the draw of the First Avenue South bridge need not be opened on any day of the week except Saturdays, Sundays and National Holidays for the passage of any vessel of less than 1,000 gross tons unless such vessel has in tow a vessel of 1,000 gross tons or over, or is required to open the bridge to pick up for towing a vessel of 1,000 gross tons or over, except that openings will be made under emergency conditions upon certification to the Seattle City Engineer by responsible representatives of affected navigation interests.

(iii) City Bridge at Eighth Avenue South. [Revoked]

(iv) County bridge at Fourteenth Avenue South. Clearance 45 feet at mean lower low water.

(a) Opening signal. The signal for opening this bridge shall be one long blast followed quickly by one short blast and one long blast of the whistle.

(b) Closed periods. Between the hours of 7:00 a.m. and 8:00 a.m., and 3:30 p.m. and 5:00 p.m., Monday through Friday of each week, the draw need not be opened for the passage of vessels.

(v) Additional instructions. The bridges described in this subparagraph shall also be opened for the passage of vessels or watercraft of any description propelled by other than steam power, upon like signals given by whistle or trumpet, or upon verbal request of the person or persons in charge of same. If the draw of any of the bridges is ready to be opened immediately when the pre-

scribed signal is given from the vessel, the signal shall be answered immediately by the same prescribed signal from a whistle or horn on the bridge; but if the draw is not ready to be opened immediately upon the prescribed signal being given on the vessel, the signal shall be answered immediately from the bridge by four or more short blasts of a whistle, horn, or megaphone, or four or more distinct strokes of a bell.

(3) All vessels when passing any bridge shall be moved as expeditiously as is consistent with established rules governing speed in the Duwamish Waterway.

(4) All vessels, crafts, or rafts, not self-propelled, navigating the Duwamish Waterway, for which the opening of any bridge may be necessary, shall while passing such bridge, be towed by a suitable self-propelled boat.

(5) When the draw of any of the bridges listed in this subparagraph shall have been opened for 10 minutes, or for such shorter period as may have been necessary for the passage of vessels or other watercraft desiring to pass, it shall be closed for the crossing of trains, cars, vehicles, or individuals, if any be waiting to cross, and after being so closed for 10 minutes, or for such shorter time as may be necessary for the said trains, cars, vehicles, or individuals to cross, it shall again be opened promptly for the passage of vessels or other watercraft, if there be any such desiring, and authorized hereinabove, to pass at such time.

**§ 203.795 Lake Washington Ship Canal, Wash.; bridge.** (a) General regulations. (1) The corporations or persons owning or controlling a drawbridge shall provide same with the necessary tenders and the proper mechanical devices for the safe, prompt, and efficient opening of the draw for the passage of vessels.

(2) If the weather conditions are good and sound signals can be heard when a vessel approaches a drawbridge and desires to pass through the draw:

(i) The person in charge of such vessel desiring to pass shall cause to be sounded, within reasonable hearing distance of the bridge, repeating if necessary, and in time to give due notice to its operator, the opening signal prescribed under paragraph (b) (1) of this section for the particular bridge.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by the signal prescribed under paragraph (b) (1) of this section.

As used in this section, the term long blast of a whistle or horn shall mean a blast of 4 seconds duration, and a short blast shall mean one of 1 second duration.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by the signal prescribed under paragraph (b) (1) of this section.

(iv) When, after a delay, as in subdivision (iii) of this subparagraph, the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall give the signal prescribed under paragraph (b) (1) of this section.

(3) When weather conditions prevent hearing sound signals:

(i) The person in charge of a vessel desiring to pass shall swing a white lighted lantern or white flag, the former by night, the latter by day, the person signaling to face the drawbridge and swing the lantern or flag in front of him at arm's length, in vertical circles.

(ii) When the draw of the bridge can be opened immediately, the draw tender shall reply by raising and lowering a white lighted lantern or a white flag, the former by night, the latter by day, the movement to be vertical.

(iii) When the draw of the bridge cannot be opened immediately, the draw tender shall reply by swinging a red lighted lantern or red flag, the former by night, the latter by day, the person signaling to face the vessel and swing the lantern or flag in front of him at arm's length, in vertical circles. (This signal may also be used by a vessel to countermand its signal to open draw.)

(iv) When, after a delay, as in subparagraph (3) (iii) of this paragraph, the draw of the bridge can be opened and the vessel still desires to pass, the draw tender shall give the signal prescribed in subparagraph (3) (ii) of this paragraph, viz, raising and lowering a lighted lantern or a flag.

(4) When fog prevails by day or by night the draw tender on giving signal (subparagraph (2) (ii), (2) (iv), (3) (ii), or (3) (iv) of this paragraph) that draw will be opened, shall toll a bell continuously during the approach and passage of the vessel.

(5) The draw shall be opened with the least possible delay, upon receiving the prescribed signal: *Provided*, That the drawspan shall not be opened when a train is approaching so closely that it cannot safely be stopped before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the operator of the drawspan.

(6) Trains, wagons, and other vehicles shall not be stopped on a drawbridge for the purpose of delaying its opening, nor shall watercraft or vessels be so manipulated as to hinder or delay the operation of a drawspan, but all passage over, through, or under a drawbridge shall be prompt, to prevent delay to either land or water traffic.

(7) This paragraph shall apply in the cases of all bridges, but to provide for distinctive signals given by vessels to particular bridges, as where two or more are within sight or hearing and but one bridge is desired to be opened, and to provide for closed or open periods when land or water traffic predominates, the special regulations and exceptions in paragraph (b) of this section are prescribed.

(b) Special regulations. (1) The following signals are prescribed for vessels wishing to have the draws opened:

(i) Great Northern Railway bridge, clearance 42 feet at high tide. One long blast of whistle, followed quickly by one short blast.

(ii) Ballard Bridge, clearance 45 feet. One long blast of whistle, followed quickly by one short blast.

(iii) Northern Pacific Railway bridge, clearance 16 feet. One long blast of whistle, followed quickly by three short blasts.

(iv) Fremont Avenue Bridge, clearance 30 feet. One long blast of whistle, followed quickly by one short blast.

(v) University Bridge, clearance 44 feet. One long blast of whistle, followed quickly by three short blasts.

(vi) Montlake Bridge, clearance 46 feet. One long blast of whistle, followed quickly by one short blast.

The bridges listed in subparagraph (1) of this paragraph shall also be opened for the passage of vessels or watercraft of any description propelled by other than steam power, upon like signals given by whistle or trumpet, or upon verbal request of the person or persons in charge of same. If the draw of any of the bridges listed in this subparagraph is ready to be opened immediately when the prescribed signal is given from the vessel, the signal shall be answered immediately by the same prescribed signal from a whistle or horn on the bridge; but if the draw is not ready to be opened immediately upon the prescribed signal being given on the vessel, the signal shall be answered immediately from the bridge by four or more short blasts of a whistle, horn, or megaphone or four or more distinct strokes of a bell.

(2) All vessels when passing any bridge shall be moved as expeditiously as is consistent with established rules governing speed in the Lake Washington Ship Canal.

(3) All vessels, crafts, or rafts, not self-propelled, navigating the Lake Washington Ship Canal, for which the opening of any bridge may be necessary, shall, while passing such bridge, be towed by a suitable self-propelled boat.

(4) The draws in each and every bridge shall, upon the signal prescribed above being given, be opened promptly for the passage of any vessel, or vessels, or other watercraft not able to pass underneath it:

(i) Provided, That the Ballard bridge, Fremont Avenue bridge, University bridge, and Montlake bridge will not be required to open on any day of the week except on Saturdays, Sundays and National Holidays between the hours of 7:00 a.m. and 9:00 a.m. and 4:00 p.m. and 6:00 p.m. for vessels or other watercraft of less than 1,000 gross tons unless such vessel has in tow a vessel of 1,000 gross tons or over, or is required to open the bridge to pick up for towing a vessel of 1,000 gross tons or over, except that openings will be made under emergency conditions upon certification of the Seattle City Engineer by responsible representatives of affected navigation interests, and

(ii) Provided further, That the draw in any of the above four city bridges need not be opened at any time for the passage of any vessel of less than 300 gross tons equipped with a movable stack or mast which can readily be lowered so as to permit its passage under the closed draw, unless it has in tow a vessel which is unable to pass under the closed draw. Any vessel of less than 300 gross tons regularly navigating the canal shall be subject to inspection and measurement by the district engineer, United States Engineer Department at Large, in charge of the locality, and said district engineer is hereby empowered to decide in each case whether or not the vessel shall be equipped with hinged or movable stacks, masts and flagpoles which can be lowered

to enable the vessel to pass under the closed draw of any or all the bridges. If the district engineer decides that such action shall be taken, he shall notify the vessel owner and the bridge owner of his decision, specifying a reasonable time for making the alterations; and after the expiration of the time specified the draw need not be opened for the passage of such vessel unless it has in tow a vessel unable to pass under the closed draw; and

(iii) Provided further, That when the draw in any of the above bridges shall have been opened for 10 minutes, or for such shorter period as may have been necessary for the passage of vessels, or other watercraft, desiring to pass, it shall be closed for the crossing of trains, cars, vehicles, or individuals, if any be waiting to cross, and after being so closed for 10 minutes, or for such shorter time as may be necessary for the said trains, cars, vehicles, or individuals to cross, it shall again be opened promptly for the passage of vessels or other watercraft, if there be any such desiring and authorized hereinabove, to pass at such time.

**§ 203.800 Lake Washington, Wash.; pontoon bridge between Seattle and Mercer Island, Wash.** (a) The owners of or agencies controlling the drawbridge shall provide the appliances and personnel necessary for the safe, prompt, and efficient operation of the draw.

(b) Signals. (1) Call signals for opening of draw—  
(i) Sound signal. One long blast followed by one short blast of whistle, horn, or megaphone, sounded within a reasonable distance of the bridge. As used in the regulations in this section long blast shall mean a blast of four seconds duration, short blast shall mean one of one second duration.

(ii) Visual signal. To be used in conjunction with sound signals when conditions prevent sound signals being heard. A white flag by day, a white light by night, swung in full vertical circles at arm's length in full sight of the bridge and facing the draw.

(2) Acknowledging signals—(i) By bridge operator—  
(a) Sound signals. Draw to be opened immediately: Same as call signal. Draw cannot be opened immediately, or, if open, must be closed immediately: Four or more short blasts of a whistle, horn or megaphone or four or more loud and distinct strokes of a bell, to be repeated at regular intervals until acknowledged by the vessel.

(b) Visual signals. To be used in conjunction with sound signals when conditions prevent sound signals being heard. Draw to be opened immediately: A white flag by day, a white light by night swung up and down vertically a number of times in full sight of the vessel. Draw cannot be opened immediately: A red flag by day, a red light by night swung in full vertical circles at arm's length facing the vessel.

(ii) By the vessel. Vessels or other watercraft having signaled for opening of the draw and having received a signal that the draw cannot be opened immediately, shall acknowledge said signal by four or more short blasts or by swinging in full vertical circles at arm's length a red flag by day or a red light by night.

(c) Automobiles, trucks, or other vehicles shall not be stopped on the draw of the bridge, except in cases of urgent necessity, nor shall vessels or other watercraft be manipulated in a manner hindering or delaying the operation of the draw. All passage over the draw or through the draw opening shall be prompt, in order to prevent delay to either land or water traffic.

(d) All vessels, craft, or rafts, not self-propelled, navigating Lake Washington, for which the opening of the bridge may be necessary, shall, while passing the bridge, be towed by a suitable self-propelled boat.

(e) Upon the signal prescribed in paragraph (b) of this section being given, the draw shall be opened promptly for the passage of any vessel, or vessels, or other watercraft not able to pass through the openings under the fixed spans of the pontoon bridge near each shore, or under the spans of the fixed bridge on the east side of Mercer Island:

(1) Provided, That the bridge will not be required to open on any day of the week between the hours of 7:00 a.m. and 9:00 a.m. and 4:00 p.m. and 6:00 p.m. for any vessel or other watercraft of less than 2,000 gross tons, unless such vessel has in tow a vessel of 2,000 gross tons or over, or a piledriver that is unable to pass under the fixed spans, and

(2) Provided further, That the bridge need not be opened at any time for the passage of any vessel of less than 300 gross tons equipped with a movable stack or mast which can readily be lowered so as to permit its passage under the fixed spans, unless it has in tow a vessel which is unable to pass under the fixed spans. Any vessel of less than 300 gross tons regularly navigating the lake shall be subject to inspection and measurement by the District Engineer, United States Engineer Department at Large, in charge of the locality, and said District Engineer is hereby empowered to decide in each case whether or not the vessel shall be equipped with hinged or movable stacks, masts and flagpoles which can be lowered to enable the vessel to pass under the fixed spans. If the District Engineer decides that such action should be taken, he shall notify the vessel owner and the bridge owner of his decision, specifying a reasonable time for making the alterations; and after the expiration of the time specified, the draw need not be opened for the passage of such vessel unless it has in tow a vessel unable to pass under the fixed spans; and

(3) Provided further, That the bridge will not be required to be opened at any time for any craft towing logs or scows, after the owners of the bridge shall have provided fenders, approved by the Department of the Army, at the openings under the approach span of the pontoon bridge, adjacent to Mercer Island, and under the main span of the fixed bridge between Mercer Island and the mainland east of Lake Washington, unless such craft cannot pass under those spans; and

(4) Provided further, That when the draw shall have been opened for ten minutes, or for such shorter period as may have been necessary for the passage of vessels, or other watercraft, desiring to pass, it shall be closed for the crossing of vehicles or individuals, if any be waiting

to cross, and after being so closed for ten minutes, or for such shorter time as may be necessary for the said vehicles or individuals to cross, it shall again be opened promptly for the passage of vessels or other watercraft, if there be any such desiring, and authorized herein, to pass at such time; and

(5) Provided further, That, at night, between the hours of 9 p.m. and 5 a.m., the draw shall be opened for the passage of all vessels that cannot pass under the fixed spans upon notice given by telephone or otherwise to the bridge operator at least 30 minutes in advance of the time that the vessel desires to pass through the draw.

(f) [Revoked]

(g) The owner of or agency controlling the bridge shall keep conspicuously posted on both the upstream and downstream sides of the bridge, in such a manner that it can be easily read at any time, a copy of the regulations in this section, together with a notice stating exactly how the bridge operator specified in paragraph (e) of this section may be reached.

**§ 203.805 Snohomish River, Steamboat Slough, and Ebey Slough, Wash.; bridges—**(a) Draw tenders and operating machinery. The owners of or agencies controlling drawbridges shall provide the necessary tenders and the proper mechanical appliances for the safe, prompt, and efficient opening of the draws for the passage of vessels in accordance with the regulations in this section. The operating machinery of the draws shall be maintained in a serviceable condition, and the draws shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

(b) Signals—(1) Sound signals. To be used if weather conditions are such that sound signals can be heard.

(i) Call signal for opening of draw. Three long blasts of a whistle, horn, or megaphone, or three loud and distinct strokes of a bell, sounded within reasonable hearing distance of the bridge repeated if necessary, and in time to give due notice to the draw tender: Provided, That distinctive call signals are prescribed for certain bridges as follows:

Snohomish River; State of Washington Department of Highways bridges near the mouth. Three long blasts followed by one short blast (one signal opens both bridges).

Steamboat Slough; Great Northern Railway Company bridge near the mouth. One long blast followed by one short blast and one long blast.

Steamboat Slough; State of Washington Department of Highways bridges near the mouth. Two long blasts followed by one short blast (one signal opens both bridges).

Ebey Slough; State of Washington Department of Highways bridge near the mouth. Three long blasts followed by one short blast.

NOTE: As used in this section, the term "long blast" means a distinct blast of four seconds' duration, and the term "short blast" means a distinct blast of one second's duration.

(ii) Acknowledging signals—(a) When draw can be opened immediately (opening signal). Two long blasts followed by one short blast of a whistle, horn, or megaphone, or three loud and distinct strokes of a bell.

(b) When draw cannot be opened immediately, or when it is open and must be closed immediately. Two long blasts of a whistle, horn, or megaphone, or two loud and distinct strokes of a bell. (This signal may also be used by a vessel to countermand its call signal.) Thereafter, as soon as the draw can be opened, the draw tender shall sound the opening signal.

(2) Visual signals. To be used if weather conditions are such that sound signals may not be heard.

(i) Call signal for opening of draw. A white flag by day or a white lighted lantern by night, swung in vertical circles at arm's length in full sight of the bridge and facing the draw.

(ii) Acknowledging signal when draw can be opened immediately (opening signal). Same as call signal, to be given in full sight of the vessel.

(iii) Acknowledging signal when draw cannot be opened immediately, or when it is open and must be closed immediately. A red flag by day or a red lighted lantern at night, swung in vertical circles at arm's length in full sight of the vessel. (This signal may also be used by a vessel to countermand its call signal.) Thereafter as soon as the draw can be opened, the draw tender shall give the opening signal.

(3) Fog signal. When fog prevails by day or by night, the draw tender, after giving the opening signal, shall toll a bell continuously during the approach and passage of the vessel.

(c) Prompt opening required except when delayed by train. Except as otherwise provided in paragraph (e) of this section, the draw shall be opened with the least possible delay on receiving the prescribed signal: *Provided*, That the draw shall not be opened when a train is approaching so closely that it cannot safely be stopped before reaching the bridge, or when a passenger or mail train is approaching within sight or hearing of the draw tender.

(d) Interference with operation of bridge prohibited. Trains and vehicles shall not be stopped on a drawbridge for the purpose of delaying its opening, nor shall watercraft be navigated so as to hinder or delay the operation of the draw, but all passage over or through a drawbridge shall be prompt to prevent delay to either land or water traffic.

(e) Bridges where constant attendance of draw tenders is not required. (1) The owners of or agencies controlling the bridges listed in subparagraph (5) of this paragraph need not keep draw tenders in constant attendance.

(2) Whenever a vessel, unable to pass under a closed bridge, desires to pass through the draw, advance notice, as specified, of the time the opening is required must be given to the authorized representative of the owner of or agency controlling the bridge to insure prompt opening thereof at the time required.

(3) On receipts of such advance notice, the authorized

representative, in compliance therewith, shall arrange for the prompt opening of the draw on proper signal at approximately the time specified in the notice.

(4) The owners of or agencies controlling each bridge shall keep conspicuously posted on both the upstream and downstream sides thereof, in such manner that it can easily be read at any time, a copy of the regulations in this section pertaining to the bridge together with information as to whom notice should be given when it is desired that the bridge be opened and directions for communicating with such person by telephone or otherwise.

(5) The bridges to which this paragraph applies, and the special regulations applicable in each case, are as follows:

Snohomish River; State of Washington Department of Highways bridges north of Everett, at least 2 hours' advance notice required: Provided, That during freshets a draw tender shall be kept in constant attendance upon order of the District Engineer, Seattle District, Corps of Engineers.

Snohomish River; State of Washington Department of Highways bridge at the foot of Hewitt Avenue, Everett. At least 4 hours' advance notice required: Provided, That during freshets a draw tender shall be kept in constant attendance upon order of the District Engineer, Seattle District, Corps of Engineers.

Snohomish River; bridges of State of Washington Department of Highways, Northern Pacific Railway Company, and Great Northern Railway Company, at Snohomish. At least 24 hours' advance notice required.

Steamboat Slough; bridges of Great Northern Railway Company and State of Washington Department of Highways near Marysville. At least 4 hours' advance notice required.

**§ 203.810 Navigable waters in the State of Washington; bridges where constant attendance of draw tenders is not required.** (a) The owners of or agencies controlling the bridges listed in paragraph (f) of this section will not be required to keep draw tenders in constant attendance.

(b) Whenever a vessel unable to pass under a closed bridge desires to pass through the draw, advance notice, as specified, of the time the opening is required must be given to the authorized representative of the owner of or agency controlling the bridge to insure prompt opening thereof at the time required.

(c) On receipt of such advance notice, the authorized representative, in compliance therewith, shall arrange for the prompt opening of the draw on proper signal at approximately the time specified in the notice.

(d) The owner of or agency controlling each bridge shall keep conspicuously posted on both the upstream and downstream sides thereof, in such manner that it can easily be read at any time, a copy of the regulations of this section pertaining to the bridge together with information as to whom notice should be given when it is desired that the bridge be opened and directions for communicating with such person by telephone or otherwise.

(c) The operating machinery of the draws shall be maintained in a serviceable condition, and the draws shall be opened and closed at intervals frequent enough to make certain that the machinery is in proper order for satisfactory operation.

(f) The bridges to which this section applies, and the regulations applicable in each case, are as follows:

(1) Puyallup Waterway and River, Tacoma Harbor; City of Tacoma highway and street railway bridge at East Eleventh Street, and Chicago, Milwaukee, St. Paul and Pacific Railroad Company bridge near East Eleventh Street. At least four hours' advance notice required.

(2) South Fork, Skagit River; Skagit County highway bridge at Fir. At least 24 hours' advance notice required.

(3) Skagit River; State of Washington Department of Highways bridge and Great Northern Railway Company bridge near Mount Vernon. At least 24 hours' advance notice required.

(4) Wishkah River; City of Aberdeen highway bridge at East Second and Young Streets, Aberdeen. Between sunrise and sunset, at least 24 hours' advance notice required. Between sunset and sunrise the draw need not be opened for the passage of vessels.

(5) Wishkah River; City of Aberdeen bridge at Heron Street and State Department of Highways bridge at Wishkah Street, Aberdeen. Between 9:00 p.m. and 5:00 a.m., at least 8 hours' advance notice required; Provided, That the District Engineer, Corps of Engineers, may require the constant attendance of draw tenders during seasonal activity in the logging and fishing industries.

(6) Hoquiam River; State Department of Highways bridge at Simpson Street, Hoquiam. Between 9:00 p.m. and 5:00 a.m., at least 8 hours' advance notice required.

(7) Chehalis River; State Department of Highways and Union Pacific Railroad Company bridges at South Montesano. Between 9:00 p.m. and 5:00 a.m., at least 8 hours' advance notice required; Provided, That during freshets a draw tender shall be kept in constant attendance upon the order of the District Engineer, Corps of Engineers.

(8) Snake River; Union Pacific Railroad Company bridge at Riparia, and Idaho-Washington Department of Highway bridge at Clarkston. The draws need not be opened for the passage of vessels, and paragraphs (b) to (e), inclusive, of this section shall not apply to these bridges.

**§ 203.815 Clark Fork (Pend Oreille) River, Idaho; bridge of Spokane International Railway Co. near Sandpoint, Idaho.** (a) When at any time during the day a vessel, unable to pass under the closed draw of the bridge, approaches it from a distance of over half a mile, the person in command of such vessel shall cause to be sounded, when said vessel shall be at a distance of not less than half a mile of the bridge, but within signal distance thereof, four blasts of the steam whistle, or horn, or megaphone.

(b) When a vessel is about to leave a landing one-half mile or less from the drawbridge, with the intention of passing through the draw, the person in command of

such vessel shall cause the required signal to be sounded at such interval before leaving the landing that the draw may be opened in time for the boat to pass.

(c) Upon hearing or perceiving the signals prescribed in paragraphs (a) and (b) of this section, the tender of the drawbridge, or the foreman of the section gang of the Spokane International Railway Co. having the bridge in charge, shall immediately take the necessary steps to have the draw opened: Provided, That the draw shall not be opened when there is a train crossing the bridge, but that in no event shall the opening of the draw be delayed more than 6 hours: And provided further, That if 6 hours' previous notice, in writing, or otherwise, shall have been given to the agent of the Spokane International Railway Co. at Sandpoint, Idaho, or to any other agent convenient to the bridge, of such desire, there shall be no delay in opening the draw: And provided further, That the draw need not be opened for the passage of a tug or other craft equipped with a movable stack or mast which can readily be so lowered as to permit its passage under the closed draw unless such craft has in tow a vessel which is unable to pass under the closed draw.

(d) Trains shall not be stopped on the draw of the bridge except in cases of urgent necessity, nor shall vessels be so manipulated as unnecessarily to hinder or delay the closing of the draw.

#### PART 204—DANGER ZONE REGULATIONS:

**§ 204.190 Pacific Ocean, between La Jolla and Solana Beach, Calif.; firing range, Coast Artillery Replacement Training Center, Camp Callan, San Diego—**(a) The danger zone. An area in the Pacific Ocean approximately 10 nautical miles square, bounded on the north by latitude 33°00' (through Solana Beach), on the east by the shore, on the south by latitude 32°52' (through Scripps Pier), and on the west by longitude 117°28'.

(b) The regulations. (1) Any vessel propelled by mechanical power at a speed greater than five miles per hour may proceed through the danger zone to and from points beyond (but not from one point to another in the danger zone) without restriction, except when notified to the contrary.

(2) Fishermen desiring to fish in the danger zone will be required to have written permits which will be issued by the enforcing agency upon application thereto.

(3) On days and nights when firing is in progress, no vessel shall enter or remain in the danger zone except vessels of the United States or vessels proceeding through the danger zone as provided in subparagraph (1) of this paragraph.

(4) Except under unusual circumstances, announcement of which will be made to the surrounding communities, the danger zone will be open throughout the year to the public for fishing and traffic without restriction from 12:00 noon, Saturday, to 8:00 a.m., Monday, and on national holidays from 5:00 p.m. of the day preceding to 8:00 a.m. of the day following the holiday. The area will also be open to the public for fishing and

traffic without restriction on other days when firing is not to be conducted.

(5) Notice of target practice within the firing range will be given by the enforcing agency by one or more of the following methods:

(i) On days when firing is to be held in all or part of the danger zone, large red flags will be displayed from elevated masts in the immediate vicinity of each firing point (near S.W. Range Tower, U.S. Navy) from which fire is to be conducted. These flags will be hoisted not later than 8:00 a.m. of the day on which firing is to be held and will be lowered when firing ceases for the day.

(ii) Notice published in San Diego daily newspapers.

(iii) Telephone advice to such fishermen's organizations as may request, in writing, that such advice be given.

(iv) Telephone advice to such civil aircraft communication stations and naval air bases as may request, in writing, that such advice be given.

(v) Notice to individual craft by a visit of a United States vessel.

(6) During periods when antiaircraft firing is in progress, safety observers will be maintained for the protection of civil and naval aircraft.

(7) This section shall be enforced by the Commanding General, Coast Artillery Replacement Training Center, Camp Callan, California.

**§ 204.195 Anaheim Bay Harbor, Calif.; Naval Ammunition and Net Depot, Seal Beach—**(a) The danger zone. The waters of Anaheim Bay Harbor between the east and west jetties at the United States Naval Ammunition and Net Depot, Seal Beach, California, and the contiguous tidal channel and basin as far east as the Pacific Electric Railway bridge.

(b) The regulations. (1) Transit shall be prohibited to all but regularly documented vessels and power boats having a certificate of award of number. Sailing vessels shall use auxiliary power in Anaheim Bay proper. Rowboats, canoes, kayaks, etc., are specifically prohibited.

(2) All boats shall proceed as expeditiously as possible by the shortest practicable route through the danger zone. Fishing, landing, and stopping except in actual emergency are specifically prohibited.

(3) The name and address of the owner, and the number, description, color, and size of the craft shall be registered with the enforcing agency.

(4) Passage shall be made only upon the express permission of the enforcing agency (through the Depot Duty Officer) in each instance, date and time of expected return to be given. This permission shall be obtained by telephone or otherwise not less than one hour before seaward transit in order that security personnel may be properly notified and to avoid interference with scheduled operations.

(5) To permit identification all passages, except such as are necessitated by stress of weather, shall be made between the beginning of morning twilight and the end of evening twilight. If after evening twilight the boat

shall stop at the dock and clear with the Duty Officer (through sentry).

(6) Both entrances to the bay will be suitably posted.

(7) All craft of whatever category shall have the right at any time to seek shelter in these waters because of stress of weather.

(8) This section shall be enforced by the Commanding Officer of the Naval Ammunition and Net Depot, Seal Beach, California, and such agencies as he may designate.

(9) Nothing in this section shall be construed as relieving the owner or person in charge of any vessel or plant from the penalties of the law for obstructing navigation or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights or signals, or for otherwise violating law.

**§ 204.197 Pacific Ocean in vicinity of San Pedro, Calif.; practice firing ranges for United States Army Reserve, National Guard, and Coast Guard units—**(a) The

danger zones—(1) Zone A. An area extending south and west from Whites Point, described as follows: Beginning at the shore Whites Point, latitude 33°42'48", longitude 118°19'00"; thence southwesterly to latitude 33°41'54", longitude 118°19'24"; thence northwesterly to latitude 33°42'42", longitude 118°21'24"; thence northeasterly to latitude 33°43'12", longitude 118°21'06", thence 90° true to a point on the shore at longitude 118°19'36"; and thence southeasterly along the shore to the point of beginning.

(2) Zone B. An area extending southwest and northwest from Point Vicente described as follows: Beginning at Point Vicente Light, latitude 33°44'30", longitude 118°24'36"; thence southwesterly to latitude 33°43'42", longitude 118°25'24"; thence northwesterly to latitude 33°46'30", longitude 118°27'06"; thence southeasterly to the shore, latitude 33°44'54", longitude 118°24'42"; and thence southerly along the shore to the point of beginning.

(b) The regulations. (1) Intermittent firing may take place in Zones A and B on any day from sunrise to sunset.

(2) Except as otherwise provided in this paragraph, the danger zones will be open to fishing and general navigation. When firing is not scheduled the danger zones may be occupied without restriction. When firing is in progress safety observers will be maintained to warn all vessels. Notice to vacate the area, or to stop at the boundaries, will be given by siren, patrol vessel, or other effective means, and such notice shall be promptly obeyed. All vessels permitted to enter a danger zone during a firing period, other than those owned by and operated by or under the direction of the United States Government, shall proceed across the area by the most direct route and clear the area with the greatest possible dispatch. No vessel, fishing boat, or recreational craft shall anchor in the danger zones during an actual firing period.

(3) Nothing in this section shall be construed as relieving the owner or person in charge of a vessel from

any penalties for obstructing navigation, or for obstructing or interfering with range lights, or for not complying with the navigation laws in regard to lights and fog signals, or for otherwise violating any law or regulations.

(4) The regulations in this section shall be enforced by the Commanding Officer, Fort MacArthur, California, and such agencies as he may designate.

**§ 204.200 Pacific Ocean at San Clemente Island, Calif.; Navy shore bombardment area in vicinity of Pyramid Cove**—(a) The danger zone. Shoreward of a line beginning at White Washed Rock on the beach bearing 199° true, 540 yards, from Pyramid Head Light; thence 160°30' true, 1.17 nautical miles; thence 243°30' true, 2.35 nautical miles; and thence 307° true to the beach.

(b) The regulations. (1) This area is used for shore bombardment by the United States Navy and all vessels shall promptly vacate the area when ordered to do so by the Navy or Coast Guard. Vessels shall not enter the area during periods scheduled for firing as published in local Notice to Mariners.

(2) Except in an emergency, no vessel shall anchor in the area without first obtaining permission from the Commandant, Eleventh Naval District, or from the Senior Officer present in the anchorage who may grant permission to anchor not exceeding the period he himself is authorized to remain there. The Senior Officer present shall advise the Commandant, Eleventh Naval District, when and to whom he assigns a berth.

**§ 204.201 Pacific Ocean in vicinity of Port Hueneme, Calif.; naval small arms firing range**—(a) The danger zone. A triangular area extending westerly into the waters of the Pacific Ocean from a point on the beach north of Port Hueneme, California, described as follows: Beginning at latitude 34°10'58", longitude 119°13'59"; thence southwesterly approximately 4,000 yards to latitude 34°09'41", longitude 119°15'47"; thence northwesterly approximately 2,250 yards to latitude 34°10'41", longitude 119°16'21"; thence northeasterly to the point of beginning.

(b) The regulations. (1) Range firing will normally take place between 8:00 a.m. and 4:30 p.m., Monday through Friday of each week. Within the above period firing will be conducted when it is determined by the Commanding Officer, U.S. Naval Construction Battalion Center, Port Hueneme, California, and the representative of the local commercial fishing interests that firing will not be detrimental to local commercial fishing.

(2) When firing is scheduled or in progress a large red flag will be displayed from the control tower situated at latitude 34°10'58", longitude 119°13'59", so as to be clearly visible for a distance of at least three (3) miles offshore. Safety observers will be on duty at all times when the warning flag is being displayed from the tower.

(3) Vessels or other craft shall not enter or remain in the danger zone when the warning flag is being displayed unless authorized to do so by the range officer in the control tower.

(4) Radio facility, ship-to-shore, will be maintained, for direct communication with vessels. Through navigation of surface craft will be permitted at all times. When a vessel requests authority to proceed through the area the officer in charge of gunnery operations shall cause the cessation or postponement of fire until the vessel has cleared that part of the area within the range of the weapons being used. The vessel shall proceed on its normal course and not delay its progress.

(5) When the warning flag is not being displayed from the control tower the danger zone will be open to all vessels and craft without restriction.

(6) The regulations in this section shall be enforced by the Commandant, Eleventh Naval District, San Diego, California, and such agencies as he may designate.

**§ 204.205 Monterey Bay, Calif.—(a) Firing range, Fort Ord, Calif.**—(1) The danger zone. (i) A rectangular area in Monterey Bay, the southerly limit of which is an extension seaward of the southerly line of the Fort Ord Military Reservation boundary and bears 307° true, 8,000 yards from a point on the shore at latitude 36°37'47", longitude 121°50'28", and the northerly limit of which is a line bearing 307° true, 8,000 yards, from a point on the shore at latitude 36°41'57", longitude 121°48'30", opposite Marina, Monterey County, California. The seaward boundary is a straight line joining the outer ends of the southerly and the northerly boundaries at the 8,000 yard range and is approximately parallel to the shore.

(ii) The danger zone is divided into a short range area, extending seaward from the shore a distance of 5,000 yards measured along the southerly and northerly boundaries, and a long range area embracing the entire danger zone.

(2) The regulations. (i) The 5,000 yard short range area is prohibited to all vessels and craft, except those authorized by the enforcing agency, each week, between dawn and midnight from Monday through Friday and between dawn and dusk on Saturday and Sunday.

(ii) The area between the 5,000 yard short range and the 8,000 yard seaward boundary of the danger zone may be used at all times for navigation and fishing, except when advance notice of intention to use this area has been given by the enforcing agency by one or more of the following means.

(a) Notice published in Monterey County and Santa Cruz County daily newspapers, at least two days in advance of the date of said use.

(b) Display of red flags at Indian Head Beach and near the Point Pinos Lighthouse.

(c) Radio Broadcast.

(d) Notice to individual craft by a visit of a United States vessel.

(e) Telephone advice to such fishermen's organizations as may request, in writing, that such advice be given.

(iii) The regulations in this paragraph will be enforced by the Commanding General, Fort Ord, California.

(b) Navy mining operations area—(1) The danger zone. Shoreward of a line beginning at the stack at about

latitude 36°58'06", longitude 121°54'06"; thence 230° true, 6.0 miles; thence 140° true, 7.5 miles; thence 50° true to the shore.

(2) The regulations. The danger zone will be used for training in various phases of mine warfare operations. During the period from August 1 to February 15, inclusive, each year, no operations will be carried on which will involve placing any obstructions in the water nor will any operations be carried on at night. During the period from February 16 to July 31, inclusive, each year, operations may be carried on which will involve laying exercise mines and other moored or bottom obstructions. In each case when moored or bottom obstructions are laid a Notice to Mariners will be issued giving notice of their approximate location within the danger zone, and vessels shall keep clear.

**§ 204.215 San Pablo Bay, Calif.; target practice area, Mare Island Navy Yard, Mare Island**—(a) The danger zone. A sector in San Pablo Bay adjacent to the westerly shore of Mare Island with a radius of 3,900 yards, centered at a point bearing 316° true, 3,605 yards, from Mare Island Dike No. 14 Light, with limiting true bearings from that center of 266°30' and 222°.

(b) The regulations. The Commanding Officer, Mare Island Navy Yard, will conduct target practice in the area at intervals of which the public will be duly notified. At such time vessels shall stay clear.

**§ 204.219 Naval Aircraft Operating Area, Pacific Ocean off Tomales Point, Calif.; Naval Air Station, Alameda**—(a) The area. The waters of the Pacific Ocean within the following boundaries: Beginning at latitude 38°13'36", longitude 122°59'51", thence to latitude 38°09'21", longitude 122°57'36", thence to latitude 38°08'50", longitude 122°59'11", thence to latitude 38°10'36", longitude 123°01'07", thence to latitude 38°13'09", longitude 123°01'07"; thence to the point of beginning. The area will be used by naval aircraft for simulated mine laying operations.

NOTE: This operating area is subject to review after a five-year period of use to determine the further need thereof.

(b) The regulations. (1) Operations are to be limited to daylight hours between 8:00 a.m. and 4:00 p.m., Monday through Friday, legal holidays excepted, and then only for periods when conditions permit surveillance of the entire area from shore stations and aircraft.

(2) No explosives will be used. During mine laying exercises small wooden markers will be dropped from the planes. The release of the markers will be stopped, if and when any surface craft may be endangered through such dropping operations.

(3) Radio communications will be maintained at all times with operating aircraft and red flags will be displayed at the shore stations during periods when markers are being dropped.

(4) From July 1 to September 15, both dates inclusive, operations will be limited to practice runs. No markers will be dropped during such period.

(5) A minimum of three days' notification will be made in local "Notice to Mariners" prior to the conduct of mine laying exercises. Telephone advice of scheduled operations will be given to such organizations as may request, in writing, that such advice be given.

(6) The regulations in this section shall be enforced by the Commandant, Twelfth Naval District, and such agencies as he may designate.

**§ 204.221 Strait of Juan de Fuca, Wash.; naval operations area for non-explosive air-to-surface target practice**—(a) The danger zone. (1) Beginning at a point at latitude 48°16'30", longitude 123°03'00"; thence east to latitude 48°16'30", longitude 122°55'00"; thence northwesterly to latitude 48°21'00", longitude 122°57'00"; thence to latitude 48°21'00", longitude 123°05'00"; thence southeasterly to the point of beginning.

(2) The area will be used for air to surface target practice using non-explosive projectiles.

(3) All runs will be made under weather conditions which will insure that the pilot can determine from the air that the area is clear, and firing will be in a direction from any vessels near the area in order to eliminate all possibility of danger to property or life.

(4) No firing shall take place until the area is clear of all watercraft except those taking part in the practice.

(b) The regulations. (1) Between 8:00 a.m., and 4:00 p.m., Pacific standard time, no vessel or other craft shall enter or remain within the designated area except as authorized by the enforcing agency.

(2) Prior to the conducting of each practice the area will be patrolled by Naval vessels flying a "Baker" (red) flag, and unauthorized vessels found therein will be contacted and warned to immediately leave the area.

(3) Upon application, the Navy will grant special permission to others to pass through or otherwise use the area if no interference to the Navy's use of the area is evident.

(4) This section shall be enforced by the Commandant of the Thirteenth Naval District or his authorized representative.

**§ 204.222 Hood Canal and Dabob Bay, Wash.; naval non-explosive torpedo testing areas**—(a) The areas. (1) All waters of Hood Canal between latitude 47°46'00" and latitude 47°42'00", exclusive of navigation lanes one-fourth nautical mile wide along the west shore and along the east shore south from the town of Bangor (latitude 47°43'28").

(2) All waters of Dabob Bay between latitude 47°47'00" and latitude 47°42'00" west of the line of 10-fathom depth along the west shore of the Toandos Peninsula, and east of a line projected in a southwesterly direction from a point one-fourth nautical mile off the southeast shore of Bolton Peninsula at latitude 47°47'00", passing Pulali Point approximately one-fourth nautical mile off-shore, to latitude 47°42'00", longitude 122°51'48".

(b) The regulations. (1) The areas will be used intermittently by the Navy for non-explosive torpedo rang-

ing. Launching will be conducted only between 8:00 a.m. and sunset on days other than Saturdays, Sundays, and holidays. At no times will the navigation lanes generally paralleling the shore be closed to navigation.

(2) Navigation will be permitted within the areas at all times except when naval exercises are in progress. No vessel shall enter or remain in either area when such exercises are in progress in that area. Prior to commencement of an exercise, the Navy will make an aerial or surface reconnaissance of the area it intends to use. Vessels under way and laying a course through the area will not be interfered with, but they shall not delay their progress. Vessels anchored or cruising in the area and vessels unobserved by the Navy reconnaissance which enter or are about to enter the area while a torpedo is in the water will be contacted by a Navy patrol boat and advised to steer clear. Torpedoes will be tested only when all vessels or other craft have cleared the area.

(3) When operations are in progress, use of the area will be indicated by the presence of Naval vessels flying a "Baker" (red) flag.

(4) Notices of temporary suspension and revival of operations will be published in local newspapers and in Notice to Mariners published by the United States Coast Guard.

(5) The regulations in this section shall be enforced by the Commandant, Thirteenth Naval District, and such agencies as he may designate.

**§ 204.223 Pacific Ocean, Hawaiian Islands; danger zones—**(a) Danger zones—(1) Low level aerial radar target off Kahuku Point, Island of Oahu, T.H. The waters within a circular area with radius of three (3) miles having its center at latitude 21°43'00", longitude 157°56'30".

(2) Low level aerial bombing target north of Laau Point, Island of Molokai, T.H. Beginning at the shore at approximately latitude 21°8'37", longitude 157°17'35"; thence to latitude 21°09'34", longitude 157°20'29"; thence to latitude 21°10'40", longitude 157°20'04"; thence to latitude 21°09'35", longitude 157°16'48"; thence along the shore to the point of beginning.

(3) High and low level aerial bombing target surrounding Mokuhooniki Rock, Island of Molokai, T.H. The waters within a circular area with a radius of one and one-half (1½) miles having its center on Mokuhooniki Rock at latitude 21°08'10", longitude 156°42'20".

(4) Aerial bombing and strafing target surrounding Kaula Rock, T.H. The waters within a circular area with a radius of three (3) miles having its center on Kaula Rock at latitude 21°39'30", longitude 160°32'30".

(5) Aerial bombing target and naval shore bombardment area, Kahoolawe Island, T.H. The waters adjacent to Kahoolawe Island within the area encompassed by the following coordinates beginning at latitude 20°37'30", longitude 156°32'48"; thence to latitude 20°34'48", longitude 156°30'24"; thence to latitude 20°28'54",

longitude 156°30'30"; thence to latitude 20°28'06", longitude 156°41'48"; thence to latitude 20°30'30", longitude 156°44'12"; thence to latitude 20°33'12", longitude 156°44'30"; thence to latitude 20°37'30", longitude 156°36'24"; thence to the beginning coordinates.

(b) The regulations. (1) No vessel or other craft shall enter or remain in any of the areas at any time except as authorized by the enforcing agency or as provided in subparagraph (2) of this paragraph.

(2) The low level aerial bombing target north of Laau Point, Island of Molokai, T.H. is released for the use of surface craft during the periods beginning at midnight before Saturday and ending at midnight after Sunday, and similarly from midnight before to midnight after Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Christmas Day, New Year's Day, Washington's Birthday, and Memorial Day.

(c) Enforcing agency. The regulations in this section shall be enforced by the Commandant, Fourteenth Naval District, and such agencies as he may designate.

#### PART 207—NAVIGATION REGULATIONS:

**§ 207.612 San Diego Harbor, Calif.; restricted areas—**(a) The seaplane restricted area—(1) The area.

(i) That portion of the central part of San Diego Bay, opposite National City, inclosed by lines connecting the following points, which are rectangular coordinates and are referred to the U.S. Coast and Geodetic Survey Station "Old Town" as their origin:

"a"—S. 25,015.85, E. 12,419.60

"b"—S. 27,720.44, E. 16,258.02

"c"—S. 30,489.60, E. 18,072.88

"d"—S. 31,932.83, E. 18,239.47

"e"—S. 34,403.93, E. 19,132.03

"f"—S. 39,271.04, E. 19,556.43

"g"—S. 41,814.54, E. 14,009.32

"h"—S. 41,454.18, E. 13,835.53

"i"—S. 40,893.33, E. 14,862.42

"j"—S. 35,648.50, E. 12,581.33

"k"—S. 36,228.63, E. 11,316.10

"l"—S. 33,132.35, E. 9,649.61

"m"—S. 32,481.78, E. 9,250.19

"n"—S. 32,378.63, E. 9,274.87

"o"—S. 31,654.25, E. 8,830.15

"p"—S. 31,629.57, E. 8,726.99

"q"—S. 30,966.36, E. 8,319.81

"r"—S. 30,897.59, E. 8,336.26

"s"—S. 30,812.37, E. 8,283.94

"t"—S. 30,795.92, E. 8,215.17

"u"—S. 30,135.58, E. 7,809.77

(ii) The area will be marked by the United States Navy by marine contact seadrome lights flashing amber.

(2) The regulations. (i) The area is hereby set aside for the use of seaplanes and their attendant plant and, except as provided in subdivision (ii) of this subpara-

graph, navigation within the area is restricted to seaplanes, their attendant plant, and vessels under the control of the United States.

(ii) At such periods as the area may not be required for the use of seaplanes and their attendant plant, navigation by other craft may be permitted, provided permission is obtained in advance from the Commandant, Eleventh Naval District, San Diego, California.

(b) Restricted area between Ballast Point and Zuniga Point—(1) The area. An area in San Diego Bay between Ballast Point and Zuniga Point inclosed by lines connecting the following stations:

A—32°41'17" N., 117°13'58" W.

B—32°41'19" N., 117°13'36.5" W.

C—32°41'01" N., 117°13'34" W.

D—32°40'59" N., 117°13'55" W.

E—32°41'03" N., 117°13'56" W.

A—32°41'17" N., 117°13'58" W.

(2) The regulations. (i) No vessel shall anchor within the restricted area at any time.

(ii) Dredging, dragging, seining, other fishing operations, and other activities not under the direction of the United States, which might foul underwater installations within the restricted area, are prohibited.

(iii) All tows entering the restricted area shall be streamed and shortened to the seaward of the area and towing appendages and catenaries shall not be dragged along the bottom while proceeding through the area.

(iv) All vessels entering the restricted area shall proceed across the area by the most direct route and without unnecessary delay.

(v) The regulations in this section shall be enforced by the Commandant, Eleventh Naval District, San Diego, California, and such agencies as he may designate.

**§ 207.612a Pacific Ocean off Point Loma, Calif.; naval restricted area**—(a) The area. The waters of the Pacific Ocean within an area extending southerly from Point Loma, California, described as follows: Beginning at latitude 32°39'54", longitude 117°13'18"; thence southeasterly to latitude 32°34'31", longitude 117°09'41"; thence 270° true to longitude 117°16'40"; thence due north to latitude 32°39'54"; and thence 90° true to the point of beginning.

(b) The regulations. (1) No vessel shall anchor within the restricted area at any time without specific permission of the enforcing agency.

(2) Dredging, dragging, seining, and other similar operations within the restricted area are prohibited.

(3) The regulations in this section shall be enforced by the Commandant, Eleventh Naval District, San Diego, California, and such agencies as he may designate.

**§ 207.613 Pacific Ocean; U.S. Navy restricted area in vicinity of Scripps Institution of Oceanography Pier, La Jolla, Calif.**—(a) The restricted area. An area in the Pacific Ocean at La Jolla, California, bounded as fol-

lows: Beginning at the seaward end of the Scripps Institution of Oceanography Pier, about 1.5 miles northeast of Point La Jolla Light; thence 205°07' true, 1,000 feet; thence 270°00' true, 4,009 feet; thence 00°00' true, 2,628 feet; thence 78°34' true, 3,563 feet; thence 138°00' true, 2,040 feet; thence 205°07' true, 1,009 feet, to the point of beginning. The corners of the restricted area will be plainly marked with lighted marker buoys by the United States Navy.

(b) The regulations. (1) No vessels, other than vessels operated by or for the United States or the Scripps Institution of Oceanography, shall anchor within the restricted area at any time.

(2) Dredging, dragging, seining, other fishing operations, and other activities not under the direction of the United States or the Scripps Institution of Oceanography, which might foul underwater installations within the restricted area, are prohibited.

(3) All vessels entering the restricted area, other than vessels operated by or for the United States or the Scripps Institution of Oceanography, shall proceed across the area by the most direct route and without unnecessary delay.

(4) This section shall be enforced by the Commandant, Eleventh Naval District, San Diego, California, and such agencies as he may designate.

**§ 207.614 Pacific Ocean off the east coast of San Clemente Island, Calif., Naval restricted area**—(a) The area. The waters of the Pacific Ocean within an area extending easterly from the east coast of San Clemente Island, California, described as follows: The northerly boundary to be a continuation, to seaward of the existing southerly boundary of the Naval Restricted Anchorage Area, as described in § 202.218 of this chapter (Anchorage Regulations), to latitude 33°00.3' N., longitude 118°31.1' W.; thence to latitude 32°58.8' N., longitude 118°30.0' W.; thence to latitude 32°57.9' N., longitude 118°31.3' W. on the shoreline; thence northerly along the shoreline to point of beginning.

(b) The regulations. (1) No vessels, other than Naval Ordnance Test Station craft, and those cleared for entry by the Naval Ordnance Test Station, shall enter the area at any time except in an emergency, proceeding with extreme caution.

(2) Dredging, dragging, seining or other fishing operations within these boundaries are prohibited.

(3) No seaplane, other than those approved for entry by Naval Ordnance Test Station, may enter the area.

(4) The regulations in this section shall be enforced by security personnel attached to the Naval Ordnance Test Station, Pasadena Annex, Pasadena, California, and by such agencies as may be designated by the Commandant, Eleventh Naval District, San Diego, California.

**§ 207.615 Pacific Ocean, around San Nicolas Island, California, naval restricted area**—(a) The area. The waters of the Pacific Ocean around San Nicolas Island,

California, extending about 3 miles seaward from the shoreline, described as follows:

<i>Latitude</i>	<i>Longitude</i>
33°10'10"	119°24'20"
33°10'10"	119°31'10"
33°12'00"	119°35'30"
33°14'20"	119°37'40"
33°16'40"	119°38'10"
33°19'10"	119°37'10"
33°20'10"	119°31'10"
33°17'40"	119°24'50"
33°13'50"	119°21'50"
33°10'10"	119°24'20"

(b) The regulations. (1) No vessels other than Naval Air Missile Test Center craft and those cleared for entry by the Commander, Naval Air Missile Test Center, or the Officer-in-Charge, San Nicolas Island, shall enter the area at any time except in an emergency, proceeding with extreme caution.

(2) Dredging, dragging, seining, or other fishing operations within these boundaries are prohibited.

(3) No seaplanes, other than those approved for entry by the Naval Air Missile Test Center, may enter the area.

(4) The regulations shall be enforced by personnel attached to the Naval Air Missile Test Center, Point Mugu, California, and by such agencies as may be designated by the Commandant, Eleventh Naval District, San Diego, California.

**§ 207.616 Los Angeles and Long Beach Harbors, Calif.; naval restricted area**—(a) The area. The waters of Los Angeles and Long Beach Harbors lying westerly of the Naval Base Mole and extending north from the westerly prolongation of the southern side of the mole and east from the eastern side and the southerly prolongation of the eastern side of non-anchorage Area I.

(b) The regulations. (1) No vessels, other than vessels operated by or for the United States, shall anchor within the area at any time.

(2) Dredging, dragging, seining, other fishing operations, and other activities not under the direction of the United States which might foul underwater installations are prohibited.

(3) All vessels entering the area, other than vessels operated by or for the United States, shall proceed across the area by the most direct route and without unnecessary delay.

(4) Only naval vessels and seaplanes shall enter the basin lying inside the jetty in front of the Naval Air Station, except as authorized by the enforcing agency.

(5) The regulations in this section shall be enforced by the Commander, U.S. Naval Base Los Angeles, Long Beach, California, and such agencies as he may designate.

**§ 207.617 Long Beach Harbor, Calif.; naval restricted area**—(a) The area. All the waters between the Navy mole and Terminal Island to the westward of longitude 118°13'10".

(b) The regulations. (1) The area is reserved exclusively for use by naval vessels. Permission to enter the area must be obtained from the enforcing agency.

(2) This section shall be enforced by the Commanding Officer, United States Fleet Operating Base, Terminal Island, California, and such agencies as he may designate.

**§ 207.618 Long Beach Harbor, Calif.; seaplane restricted area**—(a) The area. The waters of San Pedro Bay within the following described area. Beginning at a point at latitude 33°45'17", longitude 118°10'24"; thence to latitude 33°44'54", longitude 118°08'02"; thence to latitude 33°44'39", longitude 118°08'06"; thence to latitude 33°45'02", longitude 118°10'27"; thence to the point of beginning.

(b) The regulations. (1) Seaplane landings may be made in the area on one hour's notice. All vessels, naval or commercial, anchoring in the area will be required to move within one hour's notice at any time, day or night.

(2) The area will be patrolled by small craft on the approach of seaplanes intending to land. During the hours of darkness, whenever seaplanes are approaching the area for landings, the area will be marked by flat-type rubber buoys showing fixed green lights. Seaplanes will ordinarily approach the area from the east, landing in the east-to-west direction. Prevailing wind at the time of the intended landings will determine the direction of approach.

(3) The regulations in this section shall be enforced by the Commanding Officer, U.S. Fleet Operating Base, Terminal Island, and such agencies as he may designate.

**§ 207.620 Pacific Ocean in vicinity of Santa Catalina Island, Calif.; seaplane restricted area near Avalon**—(a) The area. Beginning at White Rock; thence 55° true, 5,000 feet; thence 325° true, 5,000 feet; thence 235° true, 5,400 feet; thence southeasterly along the shore line to the point of beginning.

(b) The regulations. This area is reserved for the use of seaplane landings and take-offs. Floats or buoys are prohibited, except those authorized by the Department of the Army. Anchoring of vessels is prohibited. Vessels are not prohibited from passing through this area provided they proceed as expeditiously as practicable by the most direct route, and give seaplanes the right-of-way at all times.

**§ 207.640 San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay, San Joaquin River, and connecting waters, Calif.**—(a) San Francisco Bay north of Alcatraz Island; submarine operating area—(1) The area. Bounded as follows: North boundary, latitude 37°50'38"; east boundary, longitude 122°25'00"; south boundary, latitude 37°50'00"; west boundary, longitude 122°23'10".

(2) The regulations. Prior notification of the dates and times of all operations will be made by local notice to mariners. A patrol boat will direct the movement of

vessels passing in the vicinity of the operating area by means of signal light and loud hailer. Vessels traversing this area shall be alert and comply with the orders of the patrol boat. The regulations in this paragraph shall be enforced by the Commandant, Twelfth Naval District, and such agencies as he may designate.

(b) San Francisco Bay in the vicinity of Alcatraz Island; restricted area—(1) The area. All waters within 200 yards of the shore of Alcatraz Island.

(2) The regulations. The use or navigation of the waters within this area by any vessel or craft other than vessels controlled and operated by the United States Government is prohibited unless authorized by an officer of the Department of Justice empowered by the Attorney General of the United States to grant such authority.

(c) San Francisco Bay in vicinity of Hunters Point; naval restricted area—(1) The area. Bounded by the shore of the San Francisco Naval Shipyard and the following lines: Beginning at a point on the northerly shore of the Shipyard bearing 202°40', 950 yards, from Hunters Point Light; thence 35°27', 730 yards, to the U.S. Pier-head Line; thence 142°55', 1,300 yards, along the Pier-head Line; thence 180°, 2,450 yards, to the San Francisco-San Mateo County Line; thence 270°, 430 yards, along the County Line; thence 305°27', 1,313 yards, to and along the southwesterly side of South Basin; and thence due north, 413 yards, to the southwesterly shore of the Shipyard.

NOTE: All bearings in this section are referred to true meridian.

(2) The regulations. No vessel or other craft, except vessels of the United States Government or vessels duly authorized by the Commander, San Francisco Naval Shipyard, shall navigate, anchor, or moor in this area.

(d) San Francisco Bay at South San Francisco; seaplane restricted area—(1) The area. Bounded by the westerly shore of South San Francisco Bay and the following lines: Beginning at a point on shore bearing 152°30', 1,750 yards, from Aviation Beacon "Aero" at San Francisco Airport; thence to points which are the following bearings and distances from Aviation Beacon "Aero": 99°30', 9,070 yards; 81°30', 6,530 yards; 41°30', 6,100 yards; and 347°30', 3,400 yards.

(2) The regulations. No surface watercraft shall be operated or anchored in this area except by specific permission of the Commanding Officer, Coast Guard Air Station, South San Francisco. Persons desiring to navigate vessels across the area shall give advice of their intention to do so and make request to the Commanding Officer not less than four hours in advance of the time they desire to take the vessel across the area.

(e) San Francisco Bay; seaplane restricted area, Naval Air Station, Alameda—(1) The seaplane restricted area. The waters of San Francisco Bay south of the Naval Air Station, Alameda, bounded on the north by the breakwater and turning basin at the Naval Air Station, and a line from Air Station Channel Lighted Buoy 6 to Air Station Channel Entrance Lighted Buoy 2; bounded on the west, south, and east by lines connecting Air Station Channel Entrance Lighted Buoy 2 and points which are

the following bearings and distances from Hunters Point Light: 17°, 4,050 yards; 85°, 5,300 yards; 86°, 7,075 yards; 73°, 9,160 yards; and 70°30', 9,300 yards; and bounded on the northeast by a line running from the last-described point 299° to the breakwater.

(2) The take-off zone. The area in San Francisco Bay southeast of the southeast boundary of General Anchorage 8 (described in § 202.224(a) of this chapter); north of the north boundary of General Anchorage 9 (described in § 202.224(a) of this chapter); northwest of the seaplane restricted area described in subparagraph (1) of this paragraph; and southwest of the southwest boundary of General Anchorage 9-A (described in § 202.224(a) of this chapter).

(3) The regulations. (i) Except as provided in subdivision (ii) of this subparagraph, no surface watercraft shall be operated or anchored in the seaplane restricted area except those attendant upon seaplane operations of the United States Navy or such other watercraft as have been given specific permission by the enforcing agency.

(ii) Surface watercraft may pass through the northerly part of the seaplane restricted area in a channel-way 800 feet wide adjacent to the southerly side of the breakwater protecting the turning basin at the Naval Air Station, turning at the western end of the breakwater, in a northwesterly direction, and connecting with the channel to the turning basin. Craft navigating this channel-way shall pass directly through and shall obey such verbal instructions regarding passage as may be given from the naval surface vessel patrolling the seadrome restricted area.

(iii) Vessels entering the take-off zone shall proceed through as necessary without delay. This area shall not be used for such purposes as drills, swinging ship, or other operations which would delay the vessel beyond the time required for normal transit. The enforcing agency may make exceptions to the provisions of this subparagraph if seaplane operations permit.

(iv) The regulations in this paragraph shall be enforced by the Commander, Naval Air Station, Alameda, and such agencies as he may designate.

(f) San Francisco Bay and Oakland Inner Harbor; restricted areas in vicinity of Naval Air Station, Alameda—(1) The areas. (i) The waters of San Francisco Bay within 100 yards of the Naval Air Station, Alameda.

(ii) The waters of the entrance channel to Oakland Inner Harbor (San Antonio Estuary) between the westerly end of the rock wall on the south side of the channel and the easterly boundary of the Naval Air Station.

(2) The regulations. (i) No vessel or other craft, except vessels of the United States Government or vessels duly authorized by the Commandant, United States Naval Air Station, Alameda, shall navigate, anchor, or moor in the area described in subparagraph (1) (i) of this paragraph.

(ii) No vessel without special authority from the Commander, Twelfth Coast Guard District, shall lie, anchor, or moor in the area described in subparagraph (1) (ii) of this paragraph. Vessels may proceed through the entrance channel in process of ordinary navigation or

may moor alongside wharves on the Oakland side of the channel.

(g) Oakland Harbor in vicinity of Naval Supply Center, Oakland; navigation. (1) All vessels over 1,000 tons displacement, bound for the Naval Supply Center, Oakland, shall use a qualified pilot regularly licensed for the waters of Oakland Harbor.

(2) All vessels over 1,000 tons displacement, bound for the Naval Supply Center, Oakland, shall, before navigating the entrance channel, receive a signal that the channel is clear. This signal will be a black ball between sunrise and sunset and a green light at night, displayed from the yard arm on top of a signal tower which is located on Pier 3, north side of the Naval Supply Center.

(g-1) San Francisco Bay between Treasure Island and Yerba Buena Island; naval restricted area—(1) The area. All the water of the cove bounded by the south shore of Treasure Island, the north shore of Yerba Buena Island, and the connecting causeway, west of a line extending from the southeast corner of the most southerly of the four finger piers along the east side of Treasure Island, at about latitude  $37^{\circ}49'11''$ , longitude  $122^{\circ}21'40''$ , approximately  $153^{\circ}20'$  to the northeasterly point of Yerba Buena Island, at about latitude  $37^{\circ}48'55''$ , longitude  $122^{\circ}21'30''$ .

(2) The regulations. No vessel or other craft, except vessels owned or operated by the United States Government or vessels duly authorized by the Commanding Officer, Naval Station, Treasure Island, shall enter the restricted area.

(g-2) San Francisco Bay adjacent to northeast corner of Treasure Island; naval restricted area—(1) The area. Beginning at the intersection of Pier 21 and the bulkhead line, thence northwesterly along the bulkhead to the northernmost point of Treasure Island; thence  $288^{\circ}$  true, 290 yards; thence  $26^{\circ}$  true, 475 yards; thence  $115^{\circ}30'$  true, 520 yards; thence  $152^{\circ}$  true, 500 yards to Pier 21; thence along the pier to the point of beginning.

(2) The regulations. No vessels, except those engaged in naval operations, shall lie, anchor, moor or unnecessarily delay in the area. Vessels may pass through the area in the process of ordinary navigation except as directed by patrol boats. The regulations in this paragraph shall be enforced by the Commandant, Twelfth Naval District, and such agencies as he may designate.

(h) San Francisco Bay in vicinity of Naval Net Depot, Tiburon; restricted area—(1) The area. Beginning at Bluff Point; thence approximately  $53^{\circ}$ , 1,300 yards, to California City Lighted Horn Buoy 1; thence approximately  $323^{\circ}$ , 1,800 yards, to California City Lighted Horn Buoy 3; thence  $270^{\circ}$ , approximately 3,000 yards, to the shore; and thence southeasterly along the shore to the point of beginning.

(2) The regulations. No vessels except those engaged in naval operations shall navigate or anchor in this area without the permission of the Commander, Twelfth Coast Guard District.

(i) San Francisco Bay in vicinity of Naval Fuel Annex, Molate Point; restricted area—(1) The area. Bounded by the easterly shore of upper San Francisco Bay and

the following lines: Beginning at a point on shore bearing  $17^{\circ}$ , 800 yards, from "Tree" at Molate Point; thence  $270^{\circ}$ , 870 yards; thence  $180^{\circ}$ , 1,100 yards; and thence  $123^{\circ}$  to the shore.

(2) The regulations. Vessels not operating under supervision of the local military or naval authority or public vessels of the United States shall not enter this area except by specific permission of the Commander, Twelfth Coast Guard District.

(j) Pinole Shoal Channel, San Pablo Bay; use, administration, and navigation. (1) The use of Pinole Shoal Channel is reserved for navigation of vessels of greater draft than 20 feet or by towboats with tows drawing more than 20 feet. Vessels operated by either sail or power and tows drawing less than 20 feet are not permitted to use this channel or to cross it at any point between San Pablo Bay Lighted Buoy 5 and San Pablo Bay Lighted Bell Buoy 13.

(2) Vessels permitted to use Pinole Shoal Channel under subparagraph (1) of this paragraph shall proceed through the channel at a reasonable speed so as not to endanger other vessels or interfere with any work which may become necessary in maintaining, surveying, or buoying the channel, and they shall not anchor in the channel, except in cases of emergency such as fog or accident which would render progress unsafe or impossible.

(3) This paragraph shall not be construed as prohibiting any necessary use of the channel by any Government boats while on Government duty, or in emergencies by pilot boats, whether steam or sail, or by police boats, or by the vessels of passenger steamship lines operated on regular schedules.

(k) San Pablo Bay, Carquinez Strait, and Mare Island Strait in vicinity of U.S. Naval Shipyard, Mare Island; restricted area—(1) The area. The waters of San Pablo Bay, Carquinez Strait, and Mare Island Strait, within 100 yards of the shore of that part of the Navy Yard. Mare Island, south of the causeway between the City of Vallejo and Mare Island and extending continuously therefrom southeasterly, southwesterly, and northwesterly around the Navy Yard to its northwesterly limit on the waters of San Pablo Bay, and the waters within 50 yards of any part of the berthing piers at the Navy Yard.

(2) The regulations. No vessel or other craft, except vessels of the United States Government or vessels duly authorized by the Commandant, U.S. Navy Yard, Mare Island, shall navigate, anchor, or moor in this area.

(l) Carquinez Strait in vicinity of Benecia Arsenal, Benecia; restricted area—(1) The area. Within 100 yards of the shore or of the wharf at the Benecia Arsenal.

(2) The regulations. No vessel or other craft, except vessels of the United States Government or vessels duly authorized by the Commander, Twelfth Coast Guard District, shall enter this area.

(m) Suisun Bay at Port Chicago; naval magazine restricted area—(1) The area. Beginning at a point on the shore and on the easterly side of the mouth of a small slough bearing  $98^{\circ}30'$ , 2,133 yards, from Point Edith Light; thence  $340^{\circ}30'$ , 400 yards, to the high

water shore line of the most southerly of Seal Islands; thence 69°30', 2,050 yards; thence 83°30', 866 yards; thence 102°30', 2,000 yards; thence 98°, 1,365 yards; thence 180°, 400 yards, to the high water shore line; thence following the high water shore line in a general southwesterly direction to the point of beginning.

(2) The regulations. Vessels not operating under the supervision of the local military or naval authority shall not enter this area except by specific permission of the Commander, Twelfth Coast Guard District.

(n) San Joaquin River Deep Water Channel between Suisun Bay and the easterly end of the channel at Stockton; use, administration, and navigation—(1) Maximum speed. The maximum speed for all ocean-going craft shall not exceed 10 miles per hour above the lower end of New York Slough, seven miles per hour above Criminal Point, or five miles per hour while passing any wharf, dock, or moored craft. As used in this subparagraph, the speed of a vessel when navigating with the current shall be its rate of movement in excess of the velocity of the current.

(2) Passing. All craft passing other boats, barges, scows, etc., in motion, moored or anchored, shall slow down and take every necessary precaution to avoid damage.

(3) Right of way. (i) United States dredges, tugs, launches, derrick boats, and similar plant of contractors executing river and harbor improvement work for the United States, and displaying the signals prescribed by the regulations contained in Part 201 of this chapter shall have the right of way and other craft shall exercise special caution to avoid interference with the work on which the plant is engaged. Dredges, whether Federal or contractors' plant, working the channel must, however, take special care to give ocean-going vessels sufficient room for passing, and must lift both spuds and the ladder, and pull clear, if an adequate width of clear channelway cannot otherwise be provided. Ocean-going vessels may show at the masthead a black ball not more than 20 inches in diameter as a signal to the dredge, and may also blow five long blasts of the whistle when within reasonable hearing distance of the dredge, such signal to be followed at the proper time by the passing signal described in the local pilot rules. The dredge shall promptly acknowledge both signals in the usual manner.

(ii) Light-draft vessels when meeting or being overtaken by ocean-going vessels, shall give the right of way to such vessels by making use of the shallower portions of the waterway.

(iii) Rafts and tows must promptly give the channel side demanded upon proper signal by a vessel, and must be handled in such a manner as not to obstruct or interfere with the free use of the waterway by other craft.

(4) Collisions. (i) Ocean-going vessels in collision in the channel or turning basin must, if still afloat and in a condition making anchorage necessary, be immediately removed to an approved anchorage ground, or if in such condition that beaching is necessary, they shall

be temporarily beached on the northwest side of Mandeville Island or in the Old River.

(ii) Light-draft vessels suffering collision shall be disposed of as directed by the District Engineer, Corps of Engineers, or his authorized representative.

(5) Wrecks. In no case following accidents of fire or collision will a vessel be allowed to remain either anchored or grounded in the channel, or beached at any place where it endangers other vessels, while settlement is pending with the underwriters.

(6) Other laws and regulations. In all other respects, the existing Federal laws and rules and regulations affecting navigable waters of the United States will govern in this channel.

**§ 207.642 Lake Tahoe, Calif.; restricted areas along south shore.**—(a) The areas—(1) Baldwin Beach, under the control of the Forest Service, Department of Agriculture. The waters of Lake Tahoe shoreward of a line described as follows: Beginning at the intersection of the high water line with the west boundary line of Lot 2, Section 26, Township 13 North (Mount Diablo Base Line), Range 17 East (Mount Diablo Meridian); thence north 300 feet; thence southeasterly about 2,850 feet to the east line of Section 26 at a point 300 feet north of the high water line; thence northeasterly 1,740 feet to a point 300 feet north of the high water line; thence southeasterly about 1,810 feet to the projected east line of the former Baldwin property at a point 300 feet north of the high water line; and thence south 300 feet to the high water line.

(2) Pope Beach, under the control of the Forest Service, Department of Agriculture. The waters of Lake Tahoe shoreward of a line described as follows: Beginning at the intersection of the high water line with the west line of the former Pope property, about 750 feet westerly of the west boundary line of Lot 2, Section 6, Township 12 North (Mount Diablo Base Line), Range 18 East (Mount Diablo Meridian), thence north 300 feet; thence southeasterly 4,200 feet to a point 300 feet north of the high water line; and thence south 300 feet to the high water line.

(3) El Dorado County Beach. The waters of Lake Tahoe shoreward of a line described as follows: Beginning at the intersection of the high water line with the west boundary line of Lot 1, Section 32, Township 13 North (Mount Diablo Base Line), Range 18 East (Mount Diablo Meridian); thence north 500 feet; thence northeasterly about 1,350 feet to the projected east line of Lot 1 at a point 500 feet north of the high water line; and thence south 500 feet to the high water line.

(b) The regulations. No sail or machine-propelled watercraft, except vessels owned or controlled by the United States Government and vessels duly authorized by the United States Coast Guard, shall navigate or anchor in the restricted areas.

**§ 207.643 Lake Tahoe, Nevada; restricted area adjacent to Nevada Beach.**—(a) The restricted area. The

waters of Lake Tahoe shoreward of a line described as follows: Beginning at the intersection of the high water line with a line projected in a general southerly direction 200 feet from a point lying 310 feet west of section corner common to section 15, 16, 21, and 22, Township 13 North (Mt. Diablo Base Line), Range 18 East (Mt. Diablo Meridian); thence 300 feet lakeward at right angles to the high water line; thence southeasterly approximately 2,170 feet to the projected south boundary line of the Forest Service property at a point 300 feet west of the high water line; and thence east 300 feet to the high water line.

(b) The regulations. No sail or motor propelled water craft, except vessels owned or controlled by the United States Government and vessels duly authorized by the United States Coast Guard shall navigate or anchor in the restricted area.

§ 207.655 **Rogue River, Oregon, logging.** The dumping of logs into the Rogue River or upon its banks, below the high water line, and the rafting of logs, or floating of loose logs, sack rafts of timber and logs, and the towing of log rafts on Rogue River, is hereby limited to the period from November 1, of each year to March 31, of the following year (both dates inclusive). Parties engaged in logging operations on the Rogue River shall arrange their work so that the channel of the river shall be free from floating logs or debris, caused by their operation, from April 1, to October 31, of each year (both dates inclusive).

§ 207.660 **Coquille River, Oreg.; logging on North Fork between its mouth and Gravel Ford, at the junction of the North and East Forks.** During the 144 hours extending from midnight of each Wednesday to midnight of the following Tuesday loose timber and logs, and sack rafts (so called) of timber and logs, may be run, and parties engaged in this business may use the waterway in such reasonable manner as may be necessary for the proper transaction of such business: *Provided*, That during any other period than that designated above said parties shall so arrange their work as to leave the channel of said section of the river free from floating logs and timber and shall not obstruct or delay any other navigation interest.

§ 207.663 **South Fork of Coos River, Oreg.; logging in tidal section.** (a) During the months of August, September, and October loose timber and logs and sack rafts of timber and logs, hereinafter referred to as logs, may be floated in the tidal section of the South Fork of Coos River above the mouth of Bessie Creek, at the times and under the conditions hereinafter prescribed, on Monday only of each week: *Provided*, That if it is impracticable because of insufficient stream flow above the tidal section to float logs into the tidal section on any Monday, they may be floated in the tidal section, at the times and under the conditions hereinafter prescribed, on the first day between that Monday and the following Monday when the stream flow will permit.

(b) From November to July, both inclusive, logs may be floated in the tidal section of the South Fork of Coos River above the mouth of Bessie Creek, at the times and under the conditions prescribed in paragraphs (c) to (j) of this section on Tuesday and Friday only of each week.

(c) On any of the days designated in paragraphs (a) and (b) of this section when the floating of logs is permitted in the tidal section above the mouth of Bessie Creek, they may be floated into the tidal section, at or near the head of tidewater, not more than two hours before the time of high tide at the point of entry, and be floated to the mouth of Bessie Creek: *Provided*, That such movement is handled expeditiously, and is entirely completed within five hours after the time of high tide at the point of entry.

(d) Two high tides normally occur each day. The high tide upon which logs may be floated into the tidal section above the mouth of Bessie Creek shall be the tide that reaches high slack at the point of entry nearest 12:00 o'clock meridian, Pacific standard time. The time of high tide at the head of the tidal section, for the purpose of this section, shall be considered as two hours and forty minutes after the predicted time of high tide at Humbolt Bay, California, the port of reference for Coos Bay, as published by the Coast and Geodetic Survey, Department of Commerce.

(e) In order that the river may be cleared in advance of an anticipated freshet, whenever the river stage above the tidal section rises more than two feet above the normal winter level as determined by the District Engineer, Corps of Engineers, in charge of the waterway, logs may be floated in the tidal section above the mouth of Bessie Creek.

(f) A single floating sheer boom shall be swung across the river above the mouth of Bessie Creek, at a location approved by the District Engineer, for the purpose of catching logs being floated as prescribed in paragraph (e) of this section: *Provided*, That such boom shall be in place only during the period in which the floating of logs is under way: *Provided further*, That at all times when such boom is swung across the river so as to obstruct or interfere with navigation a competent operator shall be in attendance who shall, upon the approach of any craft or tow desiring to pass either upstream or downstream, promptly swing the boom so as to clear the channel and allow such craft or tow to pass.

(g) A written or printed notice giving the day and hour at which time the floating of logs is contemplated in accordance with paragraphs (a) and (b) of this section shall be posted at least twenty-four hours prior thereto at such place at or near the mouth of the South Fork as shall be prescribed by the District Engineer, and shall also be attached to the warning flag pole provided for in paragraph (h) of this section.

(h) At all times between sunrise and sunset when logs are being moved in the tidal section above the mouth of Bessie Creek, and during a period of three hours before such movement is to begin, a red flag not less than three feet square shall be flown from a staff on the river bank

near the mouth of Bessie Creek, so located that it can be plainly seen by operators of river craft proceeding upstream in that vicinity, and said flag shall not be flown at any time other than herein designated. Between sunset and sunrise a red light, instead of a red flag, shall be so displayed. After completion of each movement of logs the red signal shall be promptly removed.

(i) In that portion of the South Fork below the mouth of Bessie Creek, the floating of logs shall be prohibited at all times, and rafts shall not exceed 650 feet in length and 45 feet in width.

(j) This section shall not affect the liability of persons in charge of logging operations for any damages resulting therefrom.

**§ 207.670 Columbia and Willamette Rivers; navigation.** (a) No steam vessel shall be navigated on the Willamette River between Ross Island and the head of Swan Island at a speed of more than 8 statute miles per hour.

(b) No steam vessel shall be navigated on the Willamette River between the head of Swan Island and the Associated Oil Company's dock, north of Linnton, at a speed of more than 12 statute miles per hour.

(c) Every steam vessel passing dredges or other plant, that may be employed on the river improvement or at anchor, in the Willamette and Columbia Rivers shall be navigated under a slow bell at a speed not more than 6 statute miles per hour.

**§ 207.680 Willamette River, Oreg.; use, administration, and navigation of canal and locks at Willamette Falls, Oreg.—**(a) Administration—(1) Administrative jurisdiction. The canal and locks and all appurtenances shall be in charge of the District Engineer, Portland District, Corps of Engineers, Department of the Army, 628 Pittock Block, Portland, Oregon. The representative of the District Engineer at the locality shall be the lock master, who shall receive his orders and instructions from the District Engineer. In case of emergency, however, the lock master shall have authority to take such steps as may be immediately necessary without waiting for instruction from the District Engineer.

(2) Operational jurisdiction. The lock master shall be charged with the immediate control and management of the canal and locks and the grounds and public property pertaining thereto. He shall see that all laws, rules are duly complied with, to which end he is authorized to and regulations, for the use of the canal and grounds give all necessary orders and directions in accordance therewith, both to employees of the Government and to any and every person within the limits of the canals and locks or grounds pertaining thereto, whether navigating the canal or not. In case of the absence or disability of the lock master, his duty shall be performed by an assistant or other employee to be designated by the District Engineer.

(b) Use and navigation—(1) Authority of lock master. The lock master or his assistants shall direct the movement, operation, and moorage of all vesels, boats, rafts, barges, or other floating things using the locks,

while they are in the locks, the canal basin, or in either the upstream or downstream lock approaches. Crews of vessels, boats, rafts, barges, or other floating things seeking lockage shall render such assistance as the lock master or his assistants may require.

(2) Signals. All vessels desiring lockage shall signal the same by one long and one short blast of the whistle, delivered at a distance of approximately 1,000 feet from the locks. Requests for lockage may also be made by telephoning or otherwise notifying the lock master's office. Notice to vessels desiring lockage will be given by red and green traffic lights. Vessels may enter locks on green lights, but must await green signal when lights are red. Permission to leave the lock will be given in the same manner. In the event a failure occurs and the referenced lights cannot be operated, the lock master will indicate by voice or by hand or lantern signals when vessels may enter or leave the locks.

(3) Controlling dimensions. For lockage purposes the maximum length of space available is 175 feet and the maximum clear width available is 37 feet. All vessels, boats, rafts, barges, or other floating things of less size than the foregoing dimensions can pass through the locks. The controlling water depth over the intermediate miter sills throughout the locks is 6.5 feet. However, the depth on the sill of the upstream gate at low water is 7.5 feet and over the downstream sill is 8.4 feet. The elevation of the upstream sill is 43.7 feet and of the downstream sill is -6.4 feet, corresponding to the elevations shown on the gages provided at both the downstream and upstream approaches to the locks. All vessels, boats, rafts, barges, and other floating things of which the dimensions or draft are greater than will permit clearing any of the above indicated elevations shall be prohibited from entering the locks. All vessels, boats, rafts, barges or other floating things entering the locks in violation of the above shall be responsible for all resulting damages.

(4) Preference at locks. Ordinarily the vessel, boat, raft, barge, or other floating thing arriving first at the lock will be locked through first. In the event of a simultaneous approach from opposite directions ascending craft will ordinarily be locked through first. When several boats are to be passed through the locks, the order of precedence shall be as follows:

- (i) To boats owned by the United States or employed upon river and harbor improvement work.
- (ii) To passenger boats.
- (iii) To freight and tow boats.
- (iv) To rafts.
- (v) To small vessels and pleasure craft.

The lock master shall have authority to digress from the above precedence in order to eliminate reversing the flow of traffic through the locks when both upbound and downbound lockages are in waiting.

(5) Entrance to locks. The lock master shall decide whether one or more vessels may be locked through at the same time. No one shall attempt to enter the locks with a vessel or attempt to cause a vessel to enter the locks until he is authorized by the lock master to do so. No one shall take a vessel, or cause a vessel to be taken,

within the limits of 500 feet above the upper gate and 300 feet below the lower gate, except for the purpose of entering the locks; and not for this purpose until it has been indicated to him by a proper person by signal that the lock is ready to receive the vessel. All vessels within the foregoing limits must be operated under "slow bell" and be kept constantly under control.

(6) Lockage of small boats. Pleasure boats, skiffs, fishing boats, and other small craft may be passed through the locks singularly, in groups, or as part of a lockage of other than pleasure craft. A continual flow of traffic in one direction will not be interrupted or reversed to accommodate these small pleasure boats. However, any such small boat will be accommodated at such time as the lock master upon receipt of a request for lockage deems such action will not interfere with other traffic. The decision of the lock master shall be final as to whether craft requesting lockage is defined as a pleasure boat.

(7) Use of canal and locks. No person, unless authorized by the lock master or his assistants, shall open or close any bridge, lock gate, wicket gate, or operate any lock machinery, or in any way interfere with any mechanism or appliance connected with the operation of the locks, nor shall anyone interfere with the employees in the discharge of their duties. The lock master or his assistants may call for aid from the persons in charge of any craft, vessel, or raft using the lock, should such aid be necessary. Persons rendering such assistance shall be strictly under the orders of the lock masters. The Government reserves the right to refuse lockage to any vessel, craft or raft when the persons in charge thereof refuse to give such assistance when it is requested. The persons in charge of vessels with tows or rafts, barges and other craft must provide sufficient personnel, lines and towing equipment of sufficient power to insure at all times full control of such tows, rafts, barges and other craft while moving into and through the locks, unless otherwise prearranged with the lock master. A copy of these regulations shall be kept at all times on board each vessel regularly engaged in navigating the locks. Copies may be obtained without charge from the lock master or from the District Engineer, Corps of Engineers, Department of the Army, 628 Pittock Block, Portland 5, Oregon.

(8) Petroleum vessels. All tankers, barges, and other floating equipment, used for transporting inflammable liquids, either with or without cargo, shall be equipped with fixed timber fenders and, if not so equipped, shall have aboard an adequate number of suitable fenders of timber, rubber, or rope which are to be placed between the vessel and unfendered lock structures. All such barges or other vessels navigating without power within the canal or locks must be assisted by one or more tugs of sufficient power to insure full control at all times whether passing upstream or downstream through the locks with or without cargo.

(9) Mooring in locks. All boats, barges, rafts, and other craft when in the locks shall be moored by head and spring lines and such other lines as may be necessary to the fastenings provided for that purpose; and the lines

shall not be unloosed until the signal is given for the vessel to leave the lock.

(10) Mooring while waiting for lockage. The mooring of boats, tows or other craft in the approaches to the locks where such mooring will interfere with navigation or other vessels to or from the locks is prohibited.

(11) Delays. Boats, barges, rafts, or other craft must not obstruct navigation by unnecessary delay in entering or leaving the locks. Vessels failing to enter the locks with reasonable promptness, when signaled to do so, and vessels arriving at the locks with their tows in such shape so as to impede lockage shall forfeit their turn.

(12) Landing of freight. No freight or baggage shall be unloaded on or over the walls of the canal or locks. Freight and baggage consigned to the Willamette Falls locks shall be unloaded only at such places as may be provided for this purpose or as directed by the lock master.

(13) Refuse in canal or locks. No refuse or other material shall be thrown or dumped from vessels into the canal and locks, or deposited in the lock area, or placed on the berm of the canal so that it is liable to be thrown or washed into the waterway. Violations of this subparagraph shall be subject to sections 13 and 16 of the River and Harbor Act of March 3, 1899 (33 U.S.C. 407, 411).

(14) Damage to locks or other structures. The regulations contained in this section shall not affect the liability of the owners and operators of vessels for any damage caused by their operations to the locks or other structures. Persons in charge of vessels and log rafts passing through the locks must use great care to prevent the vessels or log rafts from striking any gate or appurtenance thereto. All boats or barges with metal nosings, or projecting irons, or rough surfaces, and log rafts with dragging cables that may damage any part of the lock structures will not be permitted to enter the locks unless said craft are provided with suitable protective buffers and fenders and log rafts are free of loose, dragging cables.

(c) Statistics. Masters or pursers of vessels shall, upon each passage through the locks or upon each passage to an intermediate point of terminus within the locks system, furnish the lock master with information concerning the number of passengers, the amount of freight, the net registered tonnage and such other statistics as may be required on the prescribed forms which shall be furnished by the lock master for this purpose. Failure to furnish such information shall be construed as sufficient cause to refuse the offending vessel passage through the locks.

(d) Trespass. No one shall trespass on the grounds or buildings, and everyone shall be deemed guilty of trespass within the meaning of this paragraph who shall willfully or carelessly damage or disfigure the canal and locks or any part thereof, or any building or appliance on the grounds, or who shall carry on business or trading of any sort, or shall build any fishing stand or lead, or set any fish net within the limits of the reservation, or do any act to or on the grounds or buildings which would be recognized by law as a trespass.

(e) Definitions. Except as otherwise provided in subparagraph (6) of paragraph (b) of this section, whenever such a word as "vessel", "boat", "barge", "raft", or the like is used in this section, it shall include all types of floating things which may be subject to lockage. Failure to refer specifically to a type of floating thing by its name shall not mean exclusion thereof from applicability of this section.

§ 207.690 Yamhill Lock, Yamhill River, Oreg.; use, administration, and navigation. (a) The lock and all its appurtenances shall be in charge of the officer of the Corps of Engineers, United States Army, detailed for that duty by the Secretary of the Army. His representative at the locality shall be the lock master, who shall customarily receive his orders and instructions from the Engineer officer in charge. In case of emergency, however, the lock master shall have authority to take such steps as may be immediately necessary without waiting for instructions from the Engineer officer in charge, but shall inform him of such action as soon as practicable thereafter.

(b) The lock master shall be charged with the immediate control and management thereof, and of the grounds and public property pertaining thereto. He shall see that all laws, rules, and regulations for the use of the lock and grounds are duly complied with, to which end he is authorized to give all necessary orders and directions in accordance therewith, both to employees of the Government and to any and every person within the limits of the lock or the grounds pertaining thereto, whether navigating the lock or not. In case of the absence or disability of the lock master his duty shall be performed by such other employee to be designated by the Engineer officer in charge.

(c) The lock master is enjoined to be diligent and attentive in the performance of his duties, courteous but firm to all with whom he comes in contact, and never to lose sight of the fact that the purpose of his employment is to facilitate the use of the lock.

(d) Authority of lock master. No one shall cause any movement of any steamboat, barge, or other floating thing, in the lock, except by or under the direction of the lock master or his assistants.

(e) Signals. All steamboats desiring lockage shall signal the same by one long and two short blasts of the whistle; the signal for leaving the lock will be one short blast of the whistle.

(f) Use of lock. When two or more steamboats of the same class are ready at the same time to be passed through the lock they shall be passed through in the order in which they arrived and became so ready, unless it is otherwise directed by the lock master in immediate charge at the time. If boats are waiting at both ends of the lock, lockages will be made in alternate directions, unless the lock master in immediate charge at the time should decide that it would better facilitate navigation for them to be made otherwise.

(g) Entrance to locks. (1) The lock master in immediate charge shall decide whether one or more boats may be locked through at the same time, and no boat

shall attempt to enter the lock until the signal to do so is given by the lock master. All boats shall run under "slow bell" when approaching or leaving the lock.

(2) No boat of any kind shall enter the lock drawing more water than is shown by the lock gages.

(h) Mooring in locks. When a boat is in the lock the person in charge of it shall fasten one head line, one spring line, and such other lines as may be necessary to the snubbing hooks provided for the purpose, and the lines shall not be loosed until the signal is given for the boat to leave the lock.

(i) Delays. No person in charge of a boat shall permit it to in any way obstruct the locks or free navigation of the lock, or to delay in entering or leaving the lock after the proper signal is given; and the willful neglect of any lawful order by anyone in charge of a boat in the lock shall be construed as permitting the boat to obstruct the free navigation of the lock.

(j) Tows. Persons in charge of a boat having a tow shall take the same ahead or alongside at a distance of at least 300 feet from the gate nearest the end of the lock which the tow is approaching and keep it in such position until clear of the last gate at the end out of which it is passing.

(k) Mooring outside the lock. Boats shall be moored to the lock walls or revetments by persons in charge of them only at such places as may be provided by the lock master, and then only in such a manner as not to interfere with navigation.

(l) Landing of freight. No one shall land freight or baggage on or over the walls of the lock so as to in any way delay or interfere with navigation or the operation of the lock; and freight and baggage consigned to Yamhill Lock shall be landed only at the place provided at the upper end of lock, or on the revetment below the lower end of west wall.

(m) Refuse in lock. No materials of any kind shall be thrown or swept into lock.

(n) Injury to lock or fixtures. Persons in charge of boats must use great care to prevent them from striking any gate or appurtenance thereto; and no one shall take any boat into the lock or have one therein, which is not at the time free from projecting irons and rough surfaces that would be liable to damage the gates, lock walls, etc. All boats must be provided with suitable fenders.

(o) Handling the gates and machinery. No person, other than those duly authorized by the United States Engineer office in charge of the lock, shall open or close any valve or gate, or interfere with any mechanism or appliance connected with the operation of the lock, or located on the lock grounds, nor shall anyone interfere with the employees in the discharge of their duties, except that in case the lock master deems assistance necessary he may call therefor upon the master of any boat using the lock, and when so called upon such master shall render the assistance called for, or cause it to be rendered.

(p) Statistics. Masters or pursers of vessels shall make to the lock master on each passage such written statement of passengers, freight, and registered tonnage as may be indicated by blanks approved by the Secretary of

War, and furnished such masters or pursers by the lock master in charge.

(q) **Trespass.** No one shall trespass on the grounds or buildings, and everyone shall be deemed guilty of trespass within the meaning of this paragraph who shall willfully or carelessly damage or disfigure the lock or dam or any part thereof, or any building or appliance on the grounds, or who shall carry on any business or trading of any sort, or do any act to or on the grounds or buildings of the United States which would be recognized by law as a trespass.

(r) **Effective date.** This section shall be in force on and after October 31, 1899.

**§ 207.700 Bonneville Dam Navigation Lock and Approach Channels, Columbia River, Oregon and Washington; use, administration and navigation—**(a) **General.** The lock and its approach channels, and all its appurtenances, shall be in charge of the District Engineer, U.S. Army Engineer District, in charge of the locality. His representative at Bonneville Dam shall be the Project Engineer who shall customarily give orders and instructions to the lock master and assistant lock masters in charge of the lock at any given time. In case of emergency and on all routine work in connection with the operation of the lock, the lock master shall have authority to take such steps as may be immediately necessary without waiting for instructions from the Project Engineer.

(b) **Immediate control.** The lock master shall be charged with the immediate control and management of the lock, and of the area set aside as the lock area, including the lock approach channels. He shall see that all laws, rules and regulations for the use of the lock and lock area are duly complied with, to which end he is authorized to give all necessary orders and directions in accordance therewith, both to employees of the Government and to any and every person within the limits of the lock or lock area, whether navigating the lock or not. It shall be the duty of the Project Engineer to establish lines of succession for the men operating the lock on all shifts in order that in case of absence or accident to the designated lock master, one of his assistants will immediately assume the position of lock master.

(c) **Authority of lock master.** No one shall cause any movement of any vessel, boat, or other floating thing in the lock or approaches except by or under the direction of the lock master or his assistants.

(d) **Signals—**(1) **Sound.** All craft desiring lockage shall signal by two long and two short blasts of the whistle, delivered at a distance of one-half mile from the lock. When the lock is ready for entrance, notice will be given by one long blast. Permission to leave the lock will be given by one short blast.

(2) **Visual.** Lights are located at only the upstream end of the lock and will be used in conjunction with the sound signals for downstream bound traffic. When a green light is on, the lock is ready for entrance by all craft except log rafts, and vessels may enter under full control. When a red light is on, the lock cannot be made

ready immediately and the vessel shall stand clear. When an amber light is on, log rafts only may enter the lock.

(3) **Radio.** The lock is equipped with two-way radio operating on frequencies of 2182 and 2784 kc. These frequencies will be monitored by the lock master. Vessels equipped with two-way radio may communicate with the crew operating the lock, but communications or signals so received will only augment and not replace the sound and visual signals.

(e) **Permissible dimensions of boats.** The lock chamber is 76 feet wide by 500 feet long in the clear. Single tows of lesser dimensions will be permitted to lock through without disassembly. If desired, a tow of dimensions greater than 76 feet by 500 feet may be rearranged to less than clear lock dimensions prior to entering the lock, and be passed through the lock in one lockage. Such rearrangements may be done at the moorage in the downstream lock approach channel or along the upstream guide wall if it will not interfere with other river traffic. If other river traffic will be hindered, upstream rearrangement should be done above the guide wall. During periods when other river traffic will not be held up, and, if in the opinion of the lock master vehicular and pedestrian traffic over the swing bridge or other Bonneville Project functions will not be appreciably affected, rearrangement of craft within the lock chamber will be permitted provided that rearrangement maneuvers will not result in barges or tugs wedging against or striking the miter gates in their recesses. Maneuvering of craft in the lock chamber will be permitted only when both miter gates at the open end of the lock are in the recesses in the block walls. Tows wider than 50 feet will not be permitted to enter the lock during extreme high water when tailwater at the lock is higher than 35 feet above m.s.l. since the downstream guide wall will be inundated at that stage and will offer no guidance.

(f) **Depths.** At normal pool elevation of 72 feet above m.s.l., the depth of water over the upstream miter gate sill will be 32 feet. The downstream miter gate sill has an elevation of 16 feet below m.s.l. The depth of water over the downstream miter gate sill will depend upon the flow in the river but will usually exceed 24 feet which would exist at a tailwater elevation of 8 feet above m.s.l. Gauges reading in elevation above m.s.l. are located on the south wall of the lock adjacent to each lock gate. A boat must not attempt to enter the lock if its draft exceeds the depth indicated by references to the gauges, with due allowances for clearance.

(g) **Precedence at lock.** Ordinarily the boat arriving before all others at the lock will be locked through first; however, depending upon whether the lock is full or empty, this precedence may be modified at the discretion of the lock master if boats are approaching from the opposite direction and are within reasonable distances of the lock at the time of the approach by the first boat. When several boats are to pass through the locks precedence shall be given as follows:

First: Boats and craft owned by the United States and engaged upon river and harbor improvement work.

Second: Freight and towboats.

Third: Rafts.

Fourth: Passenger boats.

Fifth: Small vessels and pleasure boats.

(h) Loss of turn. Boats that fail to enter the lock with reasonable promptness, after being authorized to do so, shall lose their turn.

(i) Multiple lockage. The lock master shall decide whether one or more vessels may be locked through at the same time.

(j) Speed. Vessels shall not be raced or crowded alongside another in the approach channels. When entering the lock, speed shall be reduced to a minimum consistent with safe navigation. As a general rule, when a number of vessels are entering the lock, the following vessel shall remain at least 200 feet astern of the vessel ahead.

(k) Lockage of small boats. In general the lockage of pleasure boats, skiffs, fishing boats, and other small craft will be coordinated with the lockage of commercial craft other than barges handling petroleum products or highly hazardous materials. If no combined lockage can be scheduled within a reasonable time not to exceed one hour after the arrival of the small craft at the lock, separate lockage will be made for such small craft.

(l) Mooring in lock. All boats, rafts and other craft when in the locks shall be moored by head and spring lines and such other lines as may be necessary to the fastenings provided for that purpose, and the lines shall not be let go until the signal is given for the vessel to leave the lock.

(m) Mooring in approaches prohibited. The mooring or anchoring of boats or other craft in the approaches to the lock where such mooring will interfere with navigation of the lock is prohibited. Rafts to be passed through the lock shall be moored in such a manner as not to interfere with the navigation of the lock or its approaches, and if the raft is to be divided into sections for locking, the sections shall be brought into the lock as directed by the lock master. After passing through the lock, the sections shall be reassembled at such a distance from the entrance as not to obstruct or interfere with navigation of the lock and approaches.

(n) Waiting for lockage. Boats and tows waiting downstream of the dam for lockage shall wait in the clear downstream of the navigation lock approach channel, or contingent upon prior radio clearance of the lock master, may at their own risk lie at the downstream moorage facility on the south shore downstream from the guide wall, provided that a 100-foot wide open channel is maintained. Vessels waiting upstream of the dam for lockage may lay to against the guide wall provided they remain not less than 400 feet upstream of the upstream lock gate; or contingent upon prior radio clearance by the lock master they may tie to the upstream guide wall.

(o) Delay in lock. Boats or barges must not obstruct navigation by unnecessary delay in entering or leaving the lock.

(p) Damage to lock or other structures. The owners and masters of vessels shall be liable for any damage caused by their operation to the lock or other structures.

They must use great care not to strike any part of the lock, any gate or appurtenance thereto, or machinery for operating the gates, or the walls protecting the banks of the approach channels. All boats with metal nosings or projecting irons, or rough surfaces that would be liable to damage the gates or lock walls, will not be permitted to enter the lock unless provided with suitable buffers and fenders.

(q) Tows. Persons in charge of a vessel that is towing a second vessel or barge by lines, shall take the second vessel or barge alongside at a distance of at least 500 feet from the lock and keep it alongside until at least 500 feet clear of the lock.

(r) Crew to move craft. The masters in charge of tows and the persons in charge of rafts and other craft must provide a sufficient number of men to move barges, rafts, and other craft into and out of the lock easily and promptly.

(s) Handling valves, gates, bridges, and machinery. No person, unless authorized by the lock master shall open or close any bridge, gate, valve, or operate any machinery in connection with the lock, but the lock master may call for assistance from the master of any boat using the lock, should such aid be necessary, and when rendering such assistance the men so employed shall be strictly under the orders of the lock master.

(t) Landing of freight. No one shall land freight or baggage on or over the walls of the lock so as in any way to delay or interfere with navigation or the operations of the lock; and freight and baggage consigned to Bonneville Project shall be landed only at such places as are designated by the lock master or his assistants.

(u) Refuse in lock. No material of any kind shall be thrown or discharged into the lock, and no material of any kind shall be deposited in the lock area.

(v) Statistics. On each passage through the lock, masters or pursers of vessels shall make to the lock master such written statement of passengers, freight, and registered tonnage and other information as are indicated on forms furnished such masters or pursers by the lock master.

(w) Persistent violation of regulations. If the owner or master of any boat persistently violates the regulations in this section after due notice of the same, the boat or master may be refused lockage by the lock master at the time of violation or subsequent thereto if deemed necessary in the opinion of the lock master to protect the Government property and works in the vicinity of the lock.

(x) Restricted areas. (1) All waters described in subparagraph (2) of this paragraph are restricted to all boats, except those of the United States Coast Guard and Corps of Engineers.

(2) All waters of the Columbia River and Bradford Slough within 1,000 feet above and 2,000 feet below the spillway dam and 500 feet above and 600 feet below the powerhouse are hereby designated as restricted areas. No vessel or other floating craft shall enter or remain in any of the restricted areas at any time without first obtaining permission from the District Engineer, U.S.

Army Engineer District, Portland, or his duly authorized representative. The restricted areas will be designated by signs posted in conspicuous and appropriate places.

**§ 207.705 Dalles Dam navigation lock and approach channels, Columbia River, Wash.; use, administration and navigation—**(a) General. The lock and its approach channels, and all its appurtenances, shall be in charge of the District Engineer, Corps of Engineers, United States Army, in charge of the locality. His representatives at the Dalles Dam shall be the Project Engineer who shall customarily give orders and instructions to the lock master and assistant lock masters in charge of the lock. In this section, the term "lock master" shall be used to designate the lock official in immediate charge of the lock at any given time. In case of emergency and on all routine work in connection with the operation of the lock, the lock master shall have authority to take such steps as may be immediately necessary without waiting for instructions from the Project Engineer.

(b) Immediate control. The lock master shall be charged with the immediate control and management of the lock, and of the area set aside as the lock area, including the lock approach channels. He shall see that all laws, rules and regulations for the use of the lock and lock area are duly complied with, to which end he is authorized to give all necessary orders and directions in accordance therewith, both to employees of the Government and to any and every person within the limits of the lock or lock area, whether navigating the lock or not. It shall be the duty of the Project Engineer to establish lines of succession for the men operating the lock on all shifts in order that in case of absence or accident to the designated lock master, one of his assistants will immediately assume the position of lock master.

(c) Authority of lock master. No one shall cause any movement of any vessel, boat, or other floating thing in the lock or approaches except by or under the direction of the lock master or his assistants.

(d) Signals—(1) Sound. All craft desiring lockage shall signal by two long and two short blasts of the whistle, delivered at a distance of one-half mile from the lock. When the lock is ready for entrance, notice will be given by one long blast. Permission to leave the lock will be given by one short blast.

(2) Visual. Lights are located outside each lock gate and will be used in conjunction with the sound signals. When a green light is on, the lock is ready for entrance and vessels may enter under full control. When a red light is on, the lock cannot be made ready immediately and the vessel shall stand clear.

(3) Radio. The lock is equipped with two-way radio operating on frequencies of 2182 and 2784 kc. These frequencies will be monitored by the lock master. Vessels equipped with two-way radio may communicate with the crew operating the lock, but communications or signals so received will only augment and not replace the sound and visual signals.

(e) Permissible dimensions of boats. The lock chamber is 86 feet wide by 675 feet long in the clear. Single

tows aggregating 650 feet in length will be permitted to lock through without disassembly. At normal pool elevation of 160 feet above m.s.l., the depth of water over the upstream miter gate sill will be 20 feet. The downstream miter gate sill has an elevation of 54.5 feet above m.s.l. The depth of water over the downstream miter gate sill will depend upon the flow in the river but will usually exceed fifteen feet. Gauges reading in elevation above m.s.l. are located on the north wall of the lock adjacent to each lock gate and at the end of the approach channel immediately downstream of the downstream gate. A boat must not attempt to enter the lock if its beam and length are greater than above indicated, or if its draft exceeds the depth indicated by reference to the gauges, with due allowance for clearance.

(f) Precedence at lock. Ordinarily the boat arriving before all others at the lock will be locked through first; however, depending upon whether the lock is full or empty, this precedence may be modified at the discretion of the lock master if boats are approaching from the opposite direction and are within reasonable distance of the lock at the time of the approach by the first boat. When several boats are to pass precedence shall be given as follows:

(1) First. Boats and craft owned by the United States and engaged upon river and harbor improvement work.

(2) Second. Freight and towboats.

(3) Third. Rafts.

(4) Fourth. Passenger boats.

(5) Fifth. Small vessels and pleasure boats.

(g) Loss of turn. Boats that fail to enter the lock with reasonable promptness, after being authorized to do so, shall lose their turn.

(h) Multiple lockage. The lock master shall decide whether one or more vessels may be locked through at the same time.

(i) Speed. Vessels shall not be raced or crowded alongside another in the approach channels. When entering the lock, speed shall be reduced to a minimum consistent with safe navigation. As a general rule, when a number of vessels are entering the lock, the following vessel shall remain at least 200 feet astern of the vessel ahead.

(j) Lockage of small boats. In general the lockage of pleasure boats, skiffs, fishing boats, and other small craft will be coordinated with the lockage of commercial craft other than barges handling petroleum products or highly hazardous materials. If no combined lockage can be scheduled within a reasonable time not to exceed one hour after the arrival of the small craft at the lock, separate lockage will be made for such small craft.

(k) Mooring in lock. All boats, rafts and other craft when in the locks shall be moored by head and spring lines and such other lines as may be necessary to the fastenings provided for that purpose, and the lines shall not be let go until the signal is given for the vessel to leave the lock.

(l) Mooring in approaches prohibited. The mooring or anchoring of boats or other craft in the approaches to the lock where such mooring will interfere with navigation of the lock is prohibited. Rafts to be passed through

the lock shall be moored in such a manner as not to interfere with the navigation of the lock or its approaches, and if the raft is to be divided into sections for locking, the sections shall be brought into the lock as directed by the lock master. After passing through the lock, the sections shall be reassembled at such a distance from the entrance as not to obstruct or interfere with navigation of the lock and approaches.

(m) Waiting for lockage. Boats and tows waiting downstream of the dam for lockage shall wait in the clear downstream of the navigation lock approach channel, or, contingent upon prior radio clearance of the lock master, may at their own risk lie inside the approach channel alongside the offshore guard wall provided that a 100-foot wide open channel is maintained between the boat or tow and the guide wall on the Washington shore side. Vessels waiting upstream of the dam for lockage may lay to against the offshore guide wall provided they remain not less than 400 feet upstream of the upstream lock gate; or contingent upon prior radio clearance by the lock master they may tie to the upstream guide wall on the Washington shore. In either event, a clear channel not less than 100 feet wide shall be kept open to accommodate passing traffic.

(n) Delay in lock. Boats or barges must not obstruct navigation by unnecessary delay in entering or leaving the lock.

(o) Damage to lock or other structures. The regulations contained in this section shall not affect the liability of the owners and operators of vessels for any damage by their operations to the lock or other structures. They must use great care not to strike any part of the lock, any gate or appurtenance thereto, or machinery for operating the gates, or the walls protecting the banks of the approach channels. All boats with metal nosing or projecting irons, or rough surfaces that would be liable to damage the gates or lock walls, will not be permitted to enter the lock unless provided with suitable buffers and fenders.

(p) Tows. Persons in charge of a vessel towing a second vessel or barge by lines, shall take the second vessel or barge alongside at a distance of at least 500 feet from the lock gate which the vessel is approaching and keep it alongside until at least 500 feet clear of the gate at the end from which it is passing.

(q) Crew to move craft. The masters in charge of tows and the persons in charge of rafts and other craft must provide a sufficient number of men to move barges, rafts and other craft into and out of the lock easily and promptly.

(r) Handling valves, gates, bridges, and machinery. No person, unless authorized by the lock master shall open or close any bridge, gate, valve, or operate any machinery in connection with the lock, but the lock master may call for assistance from the master of any boat using the lock, should such aid be necessary, and when rendering such assistance the men so employed shall be strictly under the orders of the lock master. Masters of boats refusing to give assistance when it is requested of them may be denied the use of the lock by the lock master.

(s) Landing of freight. No one shall land freight or baggage on or over the walls of the lock so as in any way to delay or interfere with navigation or the operations of the lock; and freight and baggage consigned to The Dalles project shall be landed only at such places as are designated by the lock master or his assistants.

(t) Refuse in lock. No material of any kind shall be thrown or discharged into the lock, and no material of any kind shall be deposited in the lock area.

(u) Statistics. On each passage through the lock, masters or pursers of vessels shall make to the lock master such written statement of passengers, freight, and registered tonnage and other information as are indicated on forms furnished such masters or pursers by the lock master.

(v) Persistent violation of regulations. If the owner or master of any boat persistently violates the regulations of this section after due notice of the same, the boat or master may be refused lockage by the lock master at the time of violation or subsequent thereto if deemed necessary in the opinion of the lock master to protect the Government property and works in the vicinity of the lock.

(w) Restricted areas. (1) All waters described in subparagraphs (2) and (3) of this paragraph are restricted to all boats except those of the United States Coast Guard and Corps of Engineers.

(2) All downstream waters other than those of the Navigation Lock Downstream Approach Channel which lie between the Wasco County Bridge and the project axis including those waters between the powerhouse and the Oregon shore.

(3) All upstream waters other than those of the Navigation Lock Upstream Approach Channel which lie between the project axis and a line projected from the upstream end of the Navigation Lock Guide Wall to the junction of the concrete structure with the earth fill section of dam near the upstream end of the powerhouse.

**§ 207.715 McNary Dam Navigation Lock and approach channels, Columbia River, Washington; use, administration, and navigation.**

(a) General. The lock and its approach channels, and all its appurtenances, shall be in charge of the District Engineer, Corps of Engineers, United States Army, in charge of the locality. His representative at McNary Dam shall be the Project Engineer who shall customarily give orders and instructions to the lock master and assistant lock masters in charge of the lock. Hereinafter, the term "lock master" shall be used to designate the lock official in immediate charge of the lock at any given time. In case of emergency and on all routine work in connection with the operation of the lock, the lock master shall have authority to take such steps as may be immediately necessary without waiting for instructions from the Project Engineer.

(b) Immediate control. The lock master shall be charged with the immediate control and management of the lock, and of the area set aside as the lock area, including the lock approach channels. He shall see that all laws, rules, and regulations for the use of the lock and

lock area are duly complied with, to which end he is authorized to give all necessary orders and directions in accordance therewith, both to employees of the Government and to any and every person within the limits of the lock or lock area, whether navigating the lock or not. It shall be the duty of the Project Engineer to establish lines of succession for the men operating the lock on all shifts in order that in case of absence or accident to the designated lock master, one of his assistants will immediately assume the position of lock master.

(c) Authority of lock master. No one shall cause any movement of any vessel, boat, or other floating thing in the lock or approaches except by or under the direction of the lock master or his assistants.

(d) Signals—(1) Sound. All craft desiring lockage shall signal by two long and two short blasts of the whistle, delivered at a distance of one-half mile from the lock. When the lock is ready for entrance, notice will be given by one long blast. Permission to leave the lock will be given by one short blast.

(2) Visual. Visual signals are located outside each lock gate and will be used in conjunction with the sound signals. When the green semaphore arm is up or a green light is on, the lock is ready for entrance and vessels may enter under full control. When the red semaphore arm is up or a red light is on, the lock cannot be made ready immediately and the vessel shall stand clear.

(3) Radio. The lock is equipped with two-way radio operating on a frequency of 2738 kc. The frequency is monitored by the lock master. Vessels equipped with two-way radio may communicate with the crew operating the lock but communications or signals so received will only augment and not replace the sound and visual signals.

(e) Permissible dimensions of boats. The lock chamber is 86 feet wide by 683.5 feet long in the clear. Single tows aggregating 675 feet in length will be permitted to lock through without disassembly. At normal pool elevation of 340 feet above m.s.l., the depth of water over the upstream miter gate sill will be 20 feet. The depth of water over the downstream miter gate sill will depend upon the flow in the river but will usually exceed 14 feet. Gauges are located on the south wall of the lock adjacent to each miter gate and at the end of the approach channel immediately downstream of the downstream miter gate. The gauges indicate the depth of water over the downstream miter gate sill. A boat must not attempt to enter the lock if its beam and length are greater than above indicated, or if its draft exceeds the depth indicated by the gauges, with due allowance for clearance.

(f) Precedence at lock. Ordinarily the boat arriving before all others at the lock will be locked through first; however, depending upon whether the lock is full or empty, this precedence may be modified at the discretion of the lock master if boats are approaching from the opposite direction and are within reasonable distance of the lock at the time of the approach by the first boat. When several boats are to pass precedence shall be given as follows:

First: Boats and craft owned by the United States and engaged upon river and harbor improvement work.

Second: Rafts.

Third: Freight and tow boats.

Fourth: Passenger boats.

Fifth: Small vessels and pleasure boats.

(g) Loss of turn. Boats that fail to enter the lock with reasonable promptness, after being authorized to do so, shall lose their turn.

(h) Multiple lockage. The lock master shall decide whether one or more vessels may be locked through at the same time.

(i) Speed. Vessels shall not be raced or crowded alongside another in the approach channels. When entering the lock, speed shall be reduced to a minimum consistent with safe navigation. As a general rule, when a number of vessels are entering the lock the following vessel shall remain at least 200 feet astern of the vessel ahead.

(j) Lockage of small boats—(1) General. The lockage of pleasure boats, skiffs, fishing boats, and other small craft will be coordinated with the lockage of commercial craft. If no commercial craft are scheduled to be locked through within a reasonable time not to exceed one hour after the arrival of the small craft at the lock, separate lockage will be made for such small craft.

(2) Signals. Signals stations which are connected to a horn located on the lock are located on the upstream and downstream guidewalls to provide facilities for small boats to notify the lockmaster they desire lockage through the lock. The upstream station is located near the upstream end of the north guidewall. The downstream station is located near the first ladder on the north guidewall about 400 feet below the mitre gate. Small boats desiring to use the lock will sound two long and two short blasts of the horn. When the lock is ready for the entrance, the lockmaster will notify the small boat by one long blast of the horn. Permission to leave the lock will be given by one short blast of the horn.

(k) Mooring in lock. All boats, rafts and other craft when in the locks shall be moored by head and spring lines and such other lines as may be necessary to the fastenings provided for that purpose, and the lines shall not be let go until the signal is given for the vessel to leave the lock.

(l) Mooring in approaches prohibited. The mooring or anchoring of boats or other craft in the approaches to the lock where such mooring will interfere with navigation of the lock is prohibited. Rafts to be passed through the lock shall be moored in such a manner as not to interfere with the navigation of the lock or its approaches, and, if the raft is to be divided into sections for locking, the sections shall be brought into the lock as directed by the lock master. After passing through the lock, the sections shall be reassembled at such a distance from the entrance as not to obstruct or interfere with navigation of the lock and approaches.

(m) Waiting for lockage. Boats and tows waiting for lockage downstream of the dam may wait alongside the moorage wall provided that the 250-foot-wide channel

between the moorage wall and downstream guard wall is not restricted to less than 150-foot width at any point by such moorage. Vessels waiting for lockage upstream of the dam may wait in the area between a line 200 feet north of the upstream guard wall and the Washington shore; or they may tie to the upstream guard wall at points at least 800 feet upstream of the upstream lock gate.

(n) Delay in lock. Boats or barges must not obstruct navigation by unnecessary delay in entering or leaving the lock.

(o) Damage to lock or other structures. The regulations contained in this section shall not affect the liability of the owners and operators of vessels for any damage by their operations to the lock or other structures. They must use great care not to strike any part of the lock, any gate or appurtenance thereto, or machinery for operating the gates, or the walls protecting the banks of the approach channels. All boats with metal nosings or projecting irons, or rough surfaces that would be liable to damage the gates or lock walls, will not be permitted to enter the lock unless provided with suitable buffers and fenders.

(p) Tows. Persons in charge of a vessel towing a second vessel or barge by lines, shall take the second vessel or barge alongside at a distance of at least 300 feet from the lock gate which the vessel is approaching and keep it alongside until at least 300 feet clear of the gate at the end from which it is passing.

(q) Crew to move craft. The masters in charge of tows and the persons in charge of rafts and other craft must provide a sufficient number of men to move barges, rafts and other craft into and out of the lock easily and promptly.

(r) Handling valves, gates, bridges, and machinery. No person, unless authorized by the lock master shall open or close any bridge, gate, valve, or operate any machinery in connection with the lock, but the lock master may call for assistance from the master of any boat using the lock, should such aid be necessary, and when rendering such assistance the men so employed shall be strictly under the orders of the lock master. Masters of boats refusing to give assistance when it is requested of them may be denied the use of the lock by the lock master.

(s) Landing of freight. No one shall land freight or baggage on or over the walls of the lock so as in any way to delay or interfere with navigation or the operations of the lock; and freight and baggage consigned to McNary project shall be landed only at such places as are designated by the lock master or his assistants.

(t) Refuse in lock. No material of any kind shall be thrown or discharged into the lock, and no material of any kind shall be deposited in the lock area.

(u) Statistics. On each passage through the lock, masters or pursers of vessels shall make to the lock master such written statement of passengers, freight, and registered tonnage and other information as are indicated on forms furnished such masters or pursers by the lock master.

(v) Persistent violation of regulations. If the owner

or master of any boat persistently violates these regulations after due notice of the same, the boat or master may be refused lockage by the lock master at the time of violation or subsequent thereto if deemed necessary in the opinion of the lock master to protect the Government property and works in the vicinity of the lock.

(w) Restricted areas. (1) All waters described in subparagraphs (2) and (3) of this paragraph are restricted to all boats except those of the United States Coast Guard and Corps of Engineers.

(2) All of the waters downstream of the dam which are bounded on the east by the dam, on the north by a guardwall, on the south by the shore of the river and on the west by a line approximately  $\frac{3}{4}$  mile downstream of the dam, the north end of which is indicated by red and white squares painted on rocks on the Washington shore and the south end of which is marked by a tetrahedron on the Oregon shore. The riverside face of the tetrahedron is painted with red and white squares.

(3) All waters within a distance of about 3,000 feet above the dam lying south of the guardwall and a line extending about 1,600 feet from the upstream end of the guardwall to a buoy, and north of a line marked by a series of three nun buoys approximately parallel to and 800 feet from the Oregon shore.

**§ 207.720 Willapa Bay and tributaries, Wash.; logging.** (a) The floating of loose logs, or sack rafts of timber and logs, is prohibited in Willapa Bay and at or below points on tributary streams as specified in the following list:

North Fork of Willapa River, below Willapa city.

South Fork of Willapa River, below a point 1 mile above the Northern Pacific Railway bridge.

North River, below the lower end of McGowan's boom, about 1 mile above mouth.

Smith Creek, at its mouth.

Querquellin River, at its mouth.

Palix River, at its mouth.

North Nemah River, below the boom of the Nemah River Logging Co., about 1 mile above mouth.

South Nemah River, at its mouth.

Nasel River, below Nasel boom, about 3 miles above mouth.

Bear River, below new county bridge, about 3 miles above mouth.

(b) Hemlock logs that will not float with at least 6 inches of butt out of water shall not be floated in any of the streams tributary of Willapa Bay, and no boat shall tow any raft containing any log of this character, unless such log is securely fastened so as to prevent its escape from the raft.

(c) This section shall take effect and be in force on and after July 15, 1922.

**§ 207.730 Grays Harbor and tributaries, Wash.; logging.** (a) Before operating on Grays Harbor or tributary streams all loggers, river drivers, log towboats, and log towboat companies shall register at the United States engineer office, Seattle, Wash., giving the firm

name, name of manager, and postoffice address. They shall also register annually thereafter on July 1 of each year.

(b) No logs shall be dumped into the rivers or released from storage or sorting booms without being turned over to a registered driving or towboat company, firm, or individual.

(c) River drivers authorized to operate on the streams tributary to Grays Harbor must maintain a sufficient organization of boats and experienced workmen to care for the drivers of their customers.

(d) River drivers shall so conduct their operations that all parts of the rivers upon which they operate will be effectively patrolled and the formation of jams prevented.

(e) Should a blockade of logs occur below the head of tidewater in any of the rivers at any time, each logger operating on the river above the location of said blockade shall discontinue dumping logs into the river until the blockade shall be broken.

(f) Log drivers must not indifferently operate or delay the transit of logs.

(g) Loggers who entrust their logs to river drivers will be required to satisfy themselves that their logs are being driven in accordance with this section.

(h) The floating of loose logs or of sack rafts of timber and logs is prohibited in the Chehalis River below Preachers Slough; in the Hoquiam River below the forks; and also in the Wishkah River below a point 4 miles above the mouth.

(i) The floating of rafts or tows of timber and logs which exceed 700 feet in length and 60 feet in width is prohibited in the Chehalis River between the Oregon-Washington Railroad Co. bridge at Aberdeen and the Northern Pacific Railroad Co. bridge at Cosmopolis, and also in the Hoquiam River below the forks; and the floating of rafts or tows of timber and logs which exceed 700 feet in length and 55 feet in width is prohibited in the Wishkah River below the North Aberdeen Bridge.

(j) Hemlock logs that will not float with at least 6 inches of butt out of water shall not be floated in any of the streams tributary to Grays Harbor, and no boat shall tow any raft containing any log of this character unless such log is securely fastened so as to prevent its escape from the raft.

(k) This section shall take effect and be in force on and after October 15, 1920.

**§ 207.750 Puget Sound Area, Wash.**—(a) Strait of Juan de Fuca, eastern end; naval restricted area—(1) The area. Off the westerly shore of Whidbey Island, shoreward of a line extending from West Point 270°, approximately 1.9 miles, to Lawson Reef Bell Buoy; thence approximately 222°, 6.3 miles to Minor Island Light; thence 162°, 6.3 miles to Point Partridge on the westerly shore of Whidbey Island at approximately latitude 48°13'30". Sector A, within the area, lies shoreward of a line extending from West Point 270° approximately 1.9 miles to Lawson Reef Bell Buoy; thence ap-

proximately 222° and 900 yards; thence approximately 143° and 6,300 yards to Whidbey Island. Sector B, within the area lies shoreward of a line beginning on the westerly shore of Whidbey Island about 88.5° and 9,600 yards from Minor Island Light; thence 300° and 1,050 yards; thence 216° and 3,400 yards; thence 128° and about 1,300 yards to the shore of Whidbey Island.

(2) The regulations. Except as modified for Sectors A and B, the area is open to transit except from noon to 4:30 p.m. on week days. Sector B is open to transit except from 8:00 a.m. to 4:30 p.m. on week days. No vessels other than naval vessels shall enter the area or navigate therein at times other than those stated without permission of the Commandant, Thirteenth Naval District, or his authorized representative. Until further notice from the Commandant, Sector A is open to transit at all times.

(b) Oak Harbor and Crescent Harbor, Whidbey Island; naval restricted area—(1) The area. Beginning at Point Polnell at N. latitude 48°16'21" and W. longitude 122°33'27"; thence approximately 179°, 1.3 miles through the Point Polnell buoy to N. latitude 48°15' and W. longitude 122°33'24"; thence approximately 239°, 1.3 miles to N. latitude 48°14'24" and W. longitude 122°35'; thence approximately 272°, 1.8 miles to N. latitude 48°14'30" and W. longitude 122°37'42"; thence approximately 338°, 1.7 miles to the navigation light at N. latitude 48°16'06" and W. longitude 122°38'37"; thence approximately 332°, 0.6 miles to the navigation light at N. latitude 48°16'40" and W. longitude 122°39'03"; thence approximately 44°, 0.9 miles to the shore of Oak Harbor; thence along the high water line of Oak Harbor, Forbes Point and Crescent Harbor to the point of beginning.

(2) The regulations. No vessel shall enter this area or navigate therein without permission of the Commandant, Thirteenth Naval District, or his authorized representative.

(c) Admiralty Inlet, entrance; naval restricted area—(1) The area. Beginning at Point Wilson Light thence southwesterly along the coast line to latitude 48°07' N.; thence northwesterly to a point at latitude 48°15' N., longitude 123°00' W.; thence due east to Whidbey Island; thence southerly along the coast line to latitude 48°12.5' N.; thence southerly to the point of beginning.

(2) The regulations. (i) Use of any equipment such as anchors, fishing gear, grapnels, etc., which may foul underwater installations within the restricted area, is prohibited. Dumping of any non-buoyant objects in this area is prohibited.

(ii) The regulations of this paragraph shall be enforced by the Commandant, Thirteenth Naval District, or his duly appointed representative.

(d) Waterway connecting Port Townsend and Oak Bay; use, administration, and navigation—(1) Works to which, regulations apply. The "canal grounds" when used in this paragraph shall mean that area between the south end of the jetties in Oak Bay and the northerly end of the dredge channel approximately 400 yards north-

west of Port Townsend Canal Light. The "canal" is the water lying between these limits and the banks containing the same.

(2) Speed. The speed limit within the canal grounds shall not exceed five miles per hour.

(3) Signals. All boats desiring to use the canal shall give one long and one short whistle. Southbound boats shall sound the signal within 600 yards of Port Townsend Canal Light. Northbound boats shall sound this signal at least 500 feet south from the end of the jetties in Oak Bay. If no other boat answers the signal the first boat shall have the right of way through the canal. Any approaching boat that is in the canal shall answer by giving the same signal and the first boat shall not enter the canal until the second boat shall have passed through the canal. In the case of boats going in the same direction the boat which is in the canal shall not answer the signal of the boat desiring to enter.

(4) Passing. Steamers shall not under any circumstances attempt to pass each other in the canal, either when going in the same or opposite directions.

(5) Anchoring. No steamers or boats shall anchor or tie up within the canal grounds unless they are well over on the tide flats to the west of the dredged channel, and off the right of way belonging to the United States.

(6) Tows. No tow shall enter or pass through the canal with a towline more than 200 feet in length.

(7) Statistics. At the end of each month masters or clerks of vessels or boats that have used the canal during the month shall report to the District Engineer, Corps of Engineers, Seattle, upon prescribed forms, a statement of passengers, freight, and registered tonnage, and such other statistical information as may be required by the blank forms which are issued to them for that purpose.

(8) Trading, landing, etc. No business, loading, or landing of freight or baggage will be allowed on or over the canal piers or bulkheads.

(9) Refuse. No person shall throw material of any kind into the canal.

(10) Delaying traffic. No person shall cause or permit any vessel or boat of which he is in charge, or on which he is employed, to obstruct the canal in any way or delay in passing through it.

(11) Obstructions. On the canal's being obstructed by a vessel, raft, or other craft, by sinking, grounding, or otherwise, the District Engineer, Seattle, shall be notified by telephone or telegraph as soon as possible by the person in charge of the obstructing vessel, raft, or craft.

(e) Hood Canal, Bangor; naval restricted area—(1) The area. All waters within 500 yards of the Navy pier and mooring buoys Nos. 1, 2, 3, and 4, lying southerly thereof, and all remaining waters along the easterly shore of Hood Canal within 200 feet of the high water line between latitude 47°46'20" and latitude 47°43'28". The buoys are located in the following positions: Buoy No. 1, latitude 47°44'37.5", longitude 122°43'49"; buoy No. 2, latitude 47°44'32", longitude 122°43'55"; buoy No. 3, latitude 47°44'29", longitude 122°44'03"; buoy No. 4, latitude 47°44'25.5", longitude 122°44'10".

(2) The regulations. No vessel shall enter this area without permission from the Commandant, Thirteenth Naval District, or his authorized representative.

(f) Puget Sound, Point Jefferson; naval restricted area—(1) The area. Shoreward of a line beginning at a point on shore about 340° and 480 yards from the Navy dock between Point Jefferson and President Point; thence about 90° and 1,000 yards to Buoy A; thence about 103° and 950 yards to Buoy B; thence about 195° and 2,000 yards to Buoy C; thence about 283° and 950 yards to Buoy D; thence about 283° and 850 yards to Point Jefferson. A small boat fairway has been established within the area and is bounded by a line beginning at a point on shore about 340° and 480 yards from the Navy dock between Point Jefferson and President Point; thence about 90° and 1,000 yards to Buoy A; thence about 195° and 2,000 yards to Buoy D; thence about 283° and 850 yards to Point Jefferson; thence about 51° and 1,050 yards; thence about 335° and 1,200 yards to shore.

(2) The regulations. (i) Except as modified for the small boat fairway, no vessel shall enter or navigate within the area without permission from the enforcing agency. Whenever the degaussing ranges are not in actual operation, the small boat fairway will be open to small boats and pleasure craft, but is closed at all times to other vessels and tows, fishing, and anchoring. Flashing red lights directed toward the northern and southern entrances to this fairway are mounted on the dock and at Range "B" respectively. When energized, these lights indicate that the small boat fairway is closed to transit.

(ii) The regulations in this paragraph shall be enforced by the Commandant, Thirteenth Naval District, and such agencies as he may designate.

(g) Lake Washington Ship Canal; use, administration, and navigation—(1) Definitions. The term "canal" as used in the regulations in this paragraph shall include the water area in the locks and channel and adjacent waters from a point 5,500 feet northwest of the Great Northern Railway Company bridge to the east end of the channel opposite Webster Point, Lake Washington. The term "canal grounds" shall include all grounds set aside for the use of the canal or occupied in its construction.

(2) Supervision. The canal and all its appurtenances shall be in charge of the District Engineer, Corps of Engineers, Seattle. The District Engineer will detail as many assistants as may be necessary for the efficient operation of the canal and the enforcement of the regulations in this paragraph. The movement of all vessels and other floating things in the canal and approaches thereto shall be under the direction of the District Engineer and his authorized assistants. All orders given under the regulations to any master or person in charge of any vessel, raft, or other watercraft by the District Engineer or his authorized assistants, either in person or through any canal operative, shall be acknowledged and obeyed. Failure to see, understand, or comply with signals or instructions shall constitute a violation of the regulations. Any person refusing to comply with the regulations or any orders given in pursuance thereof may be denied the privileges of the canal or canal grounds.

(3) Speed. To avoid damage to other vessels and to property along the shores, all vessels shall proceed at reduced speed in the canal as follows:

(i) From the white flash light on the extreme point of high land about 3,000 feet from the west canal entrance to the Great Northern Railway Company bridge, the speed shall not exceed six miles per hour.

(ii) From the Great Northern Railway Company bridge to the east end of the east guide pier, the speed shall not exceed four miles per hour.

(iii) From the Northern Pacific Railway Company bridge to a point 400 feet east of the Fremont Bridge, the speed shall not exceed six miles per hour.

(iv) From the red buoy west of the University Bridge to the east end of the Montlake (Portage) Cut, the speed shall not exceed six miles per hour.

(v) In all other portions of the canal, the speed shall not exceed 10 miles per hour.

NOTE: Speed signs are located along the canal to indicate areas where reduced speeds are required.

(4) Traffic signal lights. In addition to the lock signal lights described in subparagraph (5) (ii) of this paragraph, two red lights, one vertically above the other, and two green lights, one vertically above the other, are installed on the west side of the Ballard Bridge, on the east side of the Fremont Bridge, 1,000 feet west of the Montlake Bridge, and 1,000 feet east of the Montlake Bridge, for the guidance of vessels approaching the sections of the canal between Salmon Bay and Lake Union and between Lake Union and Lake Washington, respectively. Vessels of 300 gross tons and over and all vessels with tows, except as hereinafter provided, shall not pass the red lights. The green lights will indicate that vessels may proceed. Vessels of less than 300 gross tons without tows may disregard these signals, but they shall travel at very slow speed when passing other vessels. Vessels of 300 gross tons and over and vessels with tows, except logs, whose destination is between the Ballard Bridge and the Northern Pacific Railway Company bridge, may pass the red signals on the Ballard Bridge: Provided, Such passage will not interfere with approaching traffic from Lake Union.

(5) Approaching and passing through locks—(1) Signals for locks. Vessels with tows desiring to use the locks shall so indicate by two long and three short blasts of a whistle, horn, or megaphone. All other vessels desiring to use the locks shall so indicate by two long and two short blasts.

NOTE: The term "long blasts" means blasts of four seconds' duration, and the term "short blasts" means blasts of one second's duration. Signals for the opening of drawbridges are prescribed in § 203.790 of this chapter.

(ii) Lock signal lights. Red and green signal lights are installed on the guide pier west of the Great Northern Railway Company bridge below the locks. The green light will indicate to vessels bound for the large lock that the lock has been made ready. If the red light is burning, vessels bound for the large lock shall moor at the pier. Vessels bound for the small lock shall obtain instructions from the pierman on the end of the pier as to which lock

to use and shall be guided into the small lock by traffic signals thereon. The masters of all vessels approaching the locks from Puget Sound shall be alert to receive and shall immediately comply with instructions by voice or signal from the employee on the west pier.

(iii) Precedence at locks. All vessels approaching the locks shall stop at the points indicated by signs placed on the canal piers or as directed by a canal operative until ordered to proceed into the lock. Unless otherwise directed by the District Engineer or his authorized assistants, vessels owned or operated by the United States or the City of Seattle and passenger vessels operating on a regular schedule shall have precedence over all others in passing through the locks. Registered merchant vessels shall have precedence over pleasure craft, which shall pass through in the order of their arrival at the locks, and both shall have precedence over vessels towing floated timber or logs. Tows of floated timber and logs may be denied the use of the locks during certain hours when both locks are busy passing other traffic. However, advance notice will be given towboat companies as to the periods when log tows will be denied lockage.

(iv) Entering locks. Masters of vessels shall exercise the greatest care when entering either lock. The forward movement of vessels while taking position in the locks shall be very slow, and boats entering the small lock shall reduce their speed to not more than two and one-half miles per hour when within 200 feet of the outer gate and come to practically a full stop before entering the lock so that in case the engine mechanism fails to operate properly the momentum of the boat may be stopped easily by its lines. The masters of vessels entering either lock from either direction shall be alert to receive and shall immediately comply with instructions by voice or signal from the lock attendants.

(v) Mooring in locks. Vessels and rafts while in the lock shall be moored at the top of the lock wall, adequate lines at least 50 feet in length being required fore and aft. Lines shall not be released until the signal has been given by the lock force to leave the lock, after which there shall be no delay in leaving. All vessels not equipped to handle tie-up lines with power winches shall be equipped with suitable mooring lines of manila or other suitable fiber, of sufficient size and strength to hold the vessel against the currents to be met within the lock chamber. The use of wire rope for tie-up lines by vessels not equipped to handle such lines with power winches is prohibited. Vessels may be denied the use of the locks if their lines are not in good condition, or if the mooring bits on barges are not accessible or are not equipped to prevent lines from slipping off when the water is lowered in the lock. All vessels entering the locks should have, in addition to the master, at least one person on deck to handle lines. Persons attempting to take vessels through the locks without assistance on deck may be required to wait until the lock is clear of other traffic before passing through. All operators of vessels are especially cautioned to use extreme care while crowded in the locks to avoid accident or fire on their boats. Operators of small vessels and larger vessels op-

erating in the proximity of each other shall be alert to the danger arising from the limited maneuverability of the larger vessels, and shall exercise all precautions to prevent accident.

(6) Damage to locks or other structures. The regulations in this paragraph shall not affect the liability of the owners and operators of vessels for any damage caused by their operations to the locks or other structures. The sides and corners of all vessels and rafts passing through the locks should be free from spikes or projections of any kind which might damage the locks or other structures. Vessels with appurtenances or projections which might damage the locks or other structures shall be fitted with adequate fenders. The operators of vessels shall use care to avoid striking the guide walls or other structures pertaining to the canal.

(7) Commercial statistics. (i) On each passage through the locks, as required by section 11 of the River and Harbor Act of September 22, 1922 (42 Stat. 1043; 33 U.S.C. 555), the master or clerk of any vessel or other craft shall furnish, upon prescribed forms provided for the purpose and obtainable at the locks, a statement of the passengers, freight, and tonnage, and such other statistical information as may be required by the forms. The total cargo carried must be reported showing separately the tonnage in transit, and the tonnage, kind, and destination of cargo to be unloaded.

(ii) Reports of log rafts passing through the canal shall show the number of sections in the lock at each passage and, in the case of boom sticks, poles, or piles, the number of sticks in the tow. For logs, poles, or piles in cribs or in built-up rafts of more than one layer, the report shall show the total board feet in the raft.

(iii) Except by special permit, no vessel will be allowed to pass through the lock until a correct statement is furnished of the passengers, freight, and tonnage, and such other statistical information as may be required by the prescribed forms provided for the purpose.

(8) Rafts. (i) No log raft exceeding 700 feet in length or 76 feet in width shall pass through the canal. Boom sticks shall be smooth, with rounded ends, and securely tied together with cables, chains, or log swifters to prevent the raft from spreading while in the lock. Rafts containing logs that do not float above water for their entire length, or are in danger of being submerged when they enter fresh water, shall not be towed in the canal until such logs are securely fastened so as to prevent their escape from the raft.

(ii) Whenever required, log rafts passing in through the lock will be given a number that shall be fastened on one of the logs in the raft. This number will identify the raft and shall not be removed until the logs are used.

(iii) Two floats are maintained in Shilshole Bay near the entrance of the canal channel to facilitate the handling of logs in the canal. Rafts bound for the canal may be moored at one of these floats, only the portion of the raft that is to be taken through at a single lockage being brought into the canal. The remainder of the raft may be left at the float until the first portion has been towed to its destination above the lock.

(9) Tows. All vessels engaged in towing shall use tow lines of the least practicable length and shall have full control of their tows at all times. Towing more than one craft abreast is forbidden if the total width of the tow, including the towboat, exceeds 70 feet.

(10) Obstructing navigation. (i) All vessels and tows passing through the canal shall be kept as close as practicable to the center or, when safer, to the right side of the waterway, except when passing other craft or preparing to moor at a pier or wharf. Slowly moving log rafts, tows, or vessels shall, whenever practicable, pull out of the way when meeting other vessels or when other traffic proceeding in the same direction desires to pass. Vessels are forbidden to obstruct the canal in any way or to delay by slow passage through the canal the progress of other vessels. Small and readily maneuverable vessels operating in the vicinity of larger, less maneuverable vessels shall, in all cases, keep clear and operate with caution in order that the larger vessels may maintain safe steerage way and that hazards to all vessels may be reduced. All vessels shall operate with extreme caution and movements shall be made only when adequate precautions for the safety of other vessels and property are being effectively employed.

(ii) The placing of logs, vessels, or other floating objects within the limits of the dredged channels or anywhere in the canal where they may interfere with navigation to or from piers or industrial plants is prohibited.

(11) Turning. Vessels exceeding 100 feet in length shall not turn around, or attempt to turn around, in the portion of the canal between the Northern Pacific Railway Company bridge and a point 400 feet east of the Fremont Bridge, or in the Portage Cut.

(12) Excessive working of propellers or engines. Excessive working of the propellers of a vessel for purposes of testing or for other purposes when this creates objectionable or dangerous currents in the canal is forbidden. In case of grounding, the rapid or strong working of the vessel's engines is forbidden.

(13) Landing or mooring. No business, trading, or landing of passengers, freight, or baggage will be allowed on or over the canal piers or lock walls, or over the piers or grounds forming a part of the canal or its appurtenances. All persons in charge of or employed on any boat are prohibited from landing or mooring such boat at any of the canal piers, unless in transit through the canal or specially permitted to do so by the District Engineer or his authorized assistants.

(14) Deposit of refuse. The deposit, either from watercraft or from the shore, of any oil or refuse matter in the canal or upon the canal grounds is prohibited, nor shall water discharged from the side of a vessel be allowed to spill on the lock wall.

(15) Aids to navigation. Persons in charge of log rafts or other tows, and the masters of vessels and boats using the canal, shall keep a careful watch when passing buoys or other aids to navigation and promptly report to the District Engineer or his authorized assistants any displacement or damage to such aids.

NOTE: Aids to navigation and other related data are

shown on United States Coast and Geodetic Survey Chart No. 6447.

(h) Lake Washington; seaplane restricted area, U.S. Naval Air Station, Sand Point, Seattle—(1) The area.

(i) Beginning at a point bearing  $346^{\circ}07'15''$ , 2,113.75 yards, from the tower at the northeast corner of Hangar No. 1, U.S. Naval Air Station, Seattle; thence  $347^{\circ}$ , 2,000 yards; thence  $77^{\circ}$ , 500 yards; thence  $167^{\circ}$ , 2,000 yards; and thence  $257^{\circ}$ , 500 yards, to the point of beginning.

(ii) The area will be marked by special pneumatic buoys as follows: Seven each on the easterly and westerly lines, equally spaced, forming two parallel rows 500 yards apart. Each corner buoy will be equipped with a yellow light and all other buoys with green lights. These lights will be lighted only during night flying operations. Each buoy will be marked in addition by black and yellow vertical stripes.

(2) The regulations. (i) This area shall be restricted to seaplanes for use in landing.

(ii) No vessel shall operate or anchor in the area except those attendant upon seaplane operations.

(iii) All other watercraft shall exercise due caution in navigating across the lake in the waters to the north and to the south of the restricted area, as there may be danger from planes about to land.

(iv) The regulations in this paragraph shall be enforced by the Commandant, Thirteenth Naval District, or his authorized representative.

(1) Elliott Bay, Smith Cove; naval restricted area—(1) The area. Beginning at the southwest corner of Great Northern Railway Pier 89, Smith Cove; thence  $180^{\circ}$ , 150 yards; thence  $270^{\circ}$ , 625 yards; thence due north to the shore of Smith Cove.

(2) The regulations. No vessel shall enter this area without permission of the Commandant, Thirteenth Naval District, or his authorized representative.

(j) Port Orchard; naval restricted area—(1) The area. Shoreward of a line beginning at a point on the west shoreline of Port Orchard bearing  $90^{\circ}$  from stack (at latitude  $47^{\circ}42'01''$ , longitude  $122^{\circ}36'54''$ ); thence  $90^{\circ}$ , approximately 190 yards, to a point 350 yards from stack; thence  $165^{\circ}$ , 6,000 yards, to a point bearing  $179^{\circ}$ , 1,280 yards, from Battle Point Light; thence westerly to the shoreline at latitude  $47^{\circ}39'08''$  (approximate location of the Brownsville Pier).

(2) The regulations. (i) No vessel shall, at any time, anchor or tow a drag of any kind in this area.

(ii) The regulations in this paragraph shall be enforced by the Commandant, Thirteenth Naval District, or his authorized representative.

(k) Sinclair Inlet; naval restricted area—(1) The area. All the waters of Sinclair Inlet westerly of a line drawn from the Bremerton Ferry Landing (approximately latitude  $47^{\circ}33'49''$ , longitude  $122^{\circ}37'19''$ ) to the Annapolis Ferry Landing (approximately latitude  $47^{\circ}32'59.5''$ , longitude  $122^{\circ}36'52''$ ).

(2) The regulations. No vessel of more than 100 gross tons shall enter this area or navigate therein with-

out permission from the Commandant, Thirteenth Naval District, or his authorized representative.

(1) West Waterway, Seattle Harbor; navigation. (1) The movement of vessels of 250 gross tons or over and all vessels with tows of any kind through the narrow section of West Waterway between the bend at Fisher's Flour Mill dock and the bend at the junction of East Waterway with Duwamish Waterway, and through the draws of the City of Seattle and Northern Pacific Railway Company bridges crossing this narrow section, shall be governed by red and green traffic signal lights mounted on the north and south sides of the west tower of the City Light power crossing at West Spokane Street.

(2) Two green lights, one vertically above the other, displayed ahead of a vessel, shall indicate that the waterway is clear. Two red lights, one vertically above the other, displayed ahead of a vessel, shall indicate that the waterway is not clear.

(3) A vessel approaching the narrow section and drawbridges from either end of the waterway shall give one long blast of a whistle and shall not enter the narrow section until green lights are displayed.

(4) One vessel may follow another vessel in either direction, but the channel shall not be kept open in the same direction for an unreasonable time if a vessel is waiting at the other end.

(5) Tugs, launches, and small craft shall keep close to one side of the channel when vessels or boats with tows are passing.

(6) All craft shall proceed with caution. The display of a green light is not a guarantee that the channel is clear of traffic, and neither the United States nor the City of Seattle will be responsible for any damage to vessels or other property which may be chargeable to mistakes in the operation of the signal lights or to their failure to operate.

(m) Tacoma Harbor; naval restricted area—(1) The area. The waters surrounding the Naval Station, Tacoma, as follows: Hylebos Waterway and Port-Industrial Waterway (formerly known as Wapato Waterway) within 200 feet of the shore or of structures along the shore or within 100 feet of the outboard face of vessels moored thereto; and Commencement Bay northwesterly of the Naval Station within 1,000 feet of Naval Station buildings and piers or of vessels moored thereto.

(2) The regulations. (i) No fishing vessel or pleasure craft shall enter or remain in the restricted area.

(ii) The regulations in this paragraph shall be enforced by the Commandant, Thirteenth Naval District, or his authorized representative.

(n) Carr Inlet, naval restricted area—(1) The area. The waters of Carr Inlet bounded on the southeast by a line running from Gibson Point on Fox Island to Hyde Point on McNeil Island, on the northwest by a line running from Green Point (at latitude  $47^{\circ}16'54''$  N., longitude  $122^{\circ}41'33''$  W.) to Penrose Point; plus that portion of Pitt Passage extending from Carr Inlet to Pitt Island, and that portion of Hale Passage extending from Carr

Inlet southeasterly to a line drawn perpendicular to the channel 100 yards northwesterly of the Warren dock.

(2) The regulations. (i) The area shall be used as an acoustic range for research studies and special noise trials. No explosives shall be used.

(ii) No marine craft of any type shall at any time approach or remain within one hundred yards of the hydrophone buoys or the hydrophone cable connection house. The hydrophone buoys will be anchored in Carr Inlet on a line perpendicular to the course line opposite Ketner's Point, and about one mile from the Fox Island shore. The course line, or range, will bear 134°38'21'' (314°38'21'') true, and will be marked by range beacons erected near the shore line approximately one mile north-northeast of Steilacoom and approximately two miles north-northeast of Home. The cable connection house will be framed on piling in Carr Inlet approximately 20 yards off the Fox Island shore, opposite Ketner's Point.

(iii) The remainder of the area shall be open to navigation at all times except when the range is in use or when hydrophones are being calibrated. When the range is in use or hydrophones are being calibrated, revolving beacon lights will be displayed on the following signal towers:

Tower No. 1, Gibson Point, visible sector 039° to 285° true.

Tower No. 2, Fox Island, 2,500 yards northwest of Ketner's Point, visible sector 295° to 111° true.

Tower No. 3, Green Point, visible 135° to 339° true.

Tower No. 4, Penrose Point, visible sector 319° to 120° true.

Tower No. 5, Pitt Island, visible sectors 000° to 050° and 199° to 225° true.

Tower No. 6, Hyde Point, visible sector 059° to 235° true.

The beacon lights on Towers Nos. 1, 4, 5, and 6 will be red, and on Towers Nos. 2 and 3 will be either red or green. The beacon lights will show 1 quick flash every 10 seconds. The lights will be obscured except for the above tabulated visible sectors. The ranging of vessels or calibration of hydrophones requiring restrictions will be conducted at intervals during two 3-hour periods, that is, between the hours of 9 a.m. to 12 noon and 1 p.m. to 4 p.m., Monday through Friday, except for national holidays consisting of New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, and Christmas Day, and will total approximately 150 days spread throughout the year. Shutting off of beacon lights will indicate termination of use of the range for the remainder of that period. Insofar as possible, the schedule of operations giving the days the range will be in use for each forthcoming month will be published in local newspapers and in the local U.S. Coast Guard Notice to Mariners.

(iv) When the red beacon lights are displayed indicating that the range is in use or hydrophones are being calibrated, navigation within the area will be restricted as follows:

(a) As used in this section, the words "operate, power vessel and non-power vessel" are defined as follows:

(1) "Operate": To be physically present in the designated area.

(2) "Power vessel": A vessel propelled principally by a mechanical propulsion system (i.e., gasoline, Diesel, steam or electric drive to a propeller, pump jet, paddle wheel or other device), and being propelled by that means.

(3) "Non-power vessel": A vessel not equipped with a mechanical propulsion system, such as a rowboat, canoe or sailboat propelled by oars, paddles, or sails, respectively.

(b) Power vessels shall not operate within the area, except that traffic in either direction between Hale Passage and upper Carr Inlet, within 200 yards of the low water mark off Green Point, will be cleared by signal for approximately 15 minutes total time within this area at the termination of individual ranging runs, while the vessel being ranged takes position for the next run. Clearance to traverse the area around Green Point will be indicated by extinguishing the red beacon lights and displaying the green beacon lights on Signal Tower No. 2 on Fox Island and Signal Tower No. 3 on Green Point.

(c) Non-powered marine craft shall not operate within one mile of the course line bearing 134°38'21'' (314°38'21'') true, and within two miles to the southeast and two miles to the northwest of the hydrophone buoys situated in Carr Inlet opposite Ketner's Point: Provided, however, Non-powered craft may operate within four hundred yards of the low water mark on the northeast side of McNeil Island, within two hundred yards of the low water mark at Green Point, and within two hundred yards of the low water mark on the southwest shore of Fox Island except for maintaining the required one-hundred yard clearance around the cable connection house. (See subdivision (ii) of this subparagraph.)

(d) Towboats shall have free access and egress to designated tow havens within Carr Inlet, as follows: The Navy will establish and maintain suitable mooring buoys for the use of tugs and their tows at the following points: (1) Approximately 1,500 yards northwest of Gibson Point Light and approximately 400 yards offshore from the low water mark on the Fox Island shore; (2) approximately 1,500 yards northwest of Hyde Point and approximately 400 yards offshore from the low water mark on McNeil Island shore; (3) and at a point midway between the north point of Gertrude Island and the northwest point of Still Harbor. Towboats will signal by radio, telephone or visual flag hoist as far in advance as possible of the time they enter the tow haven, such signals to be directed to the range instrument vessel to be located on the Fox Island side of Carr Inlet. The Navy shall promptly suspend operations when necessary to permit the access and egress of such tow traffic, and shall signal the tows when the area is clear.

(e) Through commercial traffic, including tows, to points within Carr Inlet, and through Carr Inlet, Pitt Passage and Hale Passage to adjacent waters will be permitted free access and egress, as follows: Such traffic will signal by radio, telephone or visual flag hoist as far in advance as possible of the time they enter the area, such

signals to be directed to the range instrument vessel to be located on the Fox Island side of Carr Inlet. The Navy shall promptly suspend operations when necessary to permit the passage of such traffic, and the instrument vessel shall signal when the area is clear for passage.

(f) The warden of the McNeil Island penitentiary and his authorized representatives shall be permitted to operate within the area at any time, as may be necessary, for the patrol and search for escaped convicts.

(g) Red or green signal flags will be displayed on the signal towers in case of failure of the red or green beacon lights. The display of the signal flags at the top of the flag masts will have the same significance as the beacon lights.

(3) The regulations in this paragraph shall be enforced by the Commandant, Thirteenth Naval District, and such agencies as he may designate.

(o) Dabob Bay, Whitney Point, Naval Restricted Area—

(1) The area. Beginning at the high water line along the westerly shore of Dabob Bay, 100 yards northerly of the Naval control building located at approximately N. latitude 47°45'36" and W. longitude 122°51'00", thence S. 89°59' E. 2000 yards, thence to S. 00°01' W. 200 yards, thence N. 89°50' W. approximately 2000 yards to the high water line 100 yards southerly of the control building.

(2) The regulations. (i) No vessel shall, at any time, anchor or tow a drag of any kind in this area.

(ii) The regulations in this paragraph shall be enforced by the Commandant, Thirteenth Naval District, or his authorized representative.

**§ 207.770 Snoqualmie and Snohomish Rivers, Wash.; logging.** Loose logs may be floated in navigable parts of the Snoqualmie and Snohomish Rivers under the following conditions:

(a) All loggers and river drivers operating on the Snoqualmie and Snohomish Rivers shall be required to register at the United States Engineer office, Seattle, Wash., giving the firm name, manager's name, and post-office address.

(b) No logs shall be dumped into the rivers or released from storage booms without being turned over to a registered driving company, firm, or individual.

(c) River drivers authorized to operate on these streams must maintain a sufficient organization of boats and experienced workmen to care for the drives of their customers.

(d) River drivers shall so conduct their operations that all parts of the river will be effectively patrolled and the formation of jams prevented.

(e) During times of freshet, river drivers shall increase their force and station men at critical points where jams are liable to form.

(f) Loggers who entrust their logs to river drivers will be required to satisfy themselves that their logs are being driven in accordance with this section, and if continued unconcern on their part results in confusion, the privilege of dumping logs into the stream shall be denied to them.

(g) Hemlock logs that will not float for their entire length shall not be deposited in the rivers.

**§ 207.780 Sammamish River, Wash.; Logging.** Logs may be floated on Sammamish River between Lakes Sammamish and Washington under the following conditions:

(a) At least once every 6 months all loggers, log owners, and river drivers operating on the Sammamish River shall be required to register at the United States Engineer office, Seattle, Wash., giving full name and postoffice address.

(b) Logs run from Lake Sammamish shall be in charge of a competent driving crew and kept continuously on the move while in transit.

(c) Loggers putting logs into Sammamish River shall inclose their logs in pocket booms along the bank of the river, and these pocket booms shall be so arranged that a free passageway of ruling depth, at least 12 feet wide, shall be left between the boom and opposite shore.

(d) When logs are released from pocket booms they shall be placed in charge of a competent driving crew and kept continuously on the move to Lake Washington or to the mills located on Sammamish River.

(e) Should a blockade of logs occur in the river at any time, each logger whose brand appears on any of the logs in said blockade shall discontinue dumping logs into the river until the blockade has been broken.

(f) Log drivers who indifferently operate, or who delay the transit of logs, will be denied the privilege of operating in such capacity on this stream.

(g) To make unnecessary the present practice of storing logs in the Sammamish River, no logs will be started down this stream until provision has been made for boom sticks at the mouth sufficient to hold the entire drive or other means of storage provided.

**§ 207.805 Pacific Ocean southwest of Laau Point, Molokai, T.H.; Navy drill mine field—**(a) The restricted area. A square area in the Pacific Ocean southwest of Laau Point, Molokai, having sides 1,000 yards long running due north-south and east-west, with its northeast corner at latitude 21°03'09", longitude 157°20'20", bearing approximately 210° true, 3.5 miles, from Laau Point Light. Nonexplosive mines will be placed in the area at alternate depths of 30 feet and 90 feet.

(b) The regulations. All vessels with draft in excess of 20 feet, except those duly authorized by the Commander, Hawaiian Sea Frontier, United States Navy, are prohibited from navigating or anchoring in the restricted area.

**§ 207.900 Restricted areas in vicinity of Maritime Administration Reserve Fleets.** (a) The regulations in this section shall govern the use and navigation of waters in the vicinity of the following National Defense Reserve Fleets of the Maritime Administration, Department of Commerce:

- (1) Hudson River Reserve Fleet, Jones Point, New York.
  - (2) James River Reserve Fleet, Fort Eustis, Virginia.
  - (3) Wilmington Reserve Fleet, Brunswick River near Wilmington, North Carolina.
  - (4) Mobile Reserve Fleet, Tensaw River near Bay Minette, Alabama.
  - (5) Beaumont Reserve Fleet, Neches River near Beaumont, Texas.
  - (6) Suisun Bay Reserve Fleet near Benicia, California.
  - (7) Astoria Reserve Fleet, Cathlamet Bay near John Day Point, Oregon.
  - (8) Olympia Reserve Fleet, Budd Inlet at Olympia, Washington.
- (b) No vessels or other watercraft, except those owned or controlled by the United States Government, shall cruise or anchor between Reserve Fleet units, within 500 feet of the end vessels in each Reserve Fleet unit, or within 500 feet of the extreme units of the fleets, unless specific permission to do so has first been granted in each case by the enforcing agency.
- (c) The regulations in this section shall be enforced by the respective Fleet Superintendents and such agencies as they may designate.

### 3. CALIFORNIA, OREGON, AND WASHINGTON

The California-Oregon-Washington coast of the United States, between Mexico on the south and Canada's British Columbia on the north, is mostly rugged and mountainous, with high land rising abruptly from the sea in many places. South of San Francisco Bay the mountains are usually bare or covered with chaparral and underbrush. North of the bay the mountains are generally well timbered, and in some places, especially northward of the Columbia River, the timber is particularly dense and heavy.

**Depths** in the approaches to this coast are too great to determine readily without an echo sounder. The slope downward from the 100-fathom curve is very abrupt, as is also the slope in many places between the 30- and 100-fathom curves. The 100-fathom curve lies at an average distance of less than 10 miles from shore, but this distance is exceeded in the approaches to San Francisco Bay, Heceta Bank, Columbia River, and the Strait of Juan de Fuca.

**Anchorage**, affording shelter from the severe northwesterly winds of summer, may be had in a number of places along the coast. In southeast and southwest weather there are few places where shelter is available; San Diego Bay, Los Angeles Harbor, the lee side of the Channel Islands, and Monterey Bay are the only places south of San Francisco Bay. North of San Francisco, good shelter is found in Humboldt Bay, Coos Bay, Tillamook Bay, Columbia River, Willapa Bay, and Grays Harbor; but most of these places must be made before the sea rises, as afterward the bars become impassable. Neah Bay, just inside the entrance to the Strait of Juan de Fuca, is used considerably by vessels in westerly or southerly weather.

**Dangers**.—There are few outlying dangers, the principal ones being Bishop Rock, westward of San Diego; Noonday Rock and the Farallon Islands, off San Francisco Bay; and Blunts, St. George, Rogue River, Orford, and Umatilla Reefs, northward of San Francisco. The Channel Islands, off southern California, are the largest, most prominent, and the farthest offshore of any along the coast.

**Kelp** grows on nearly every danger with a rocky bottom and is particularly heavy at various points in Santa Barbara Channel and in the vicinity of San Diego Bay. It will be seen on the surface of the water during the summer and autumn months; during the winter and spring it is not always to be seen, especially where it is exposed to a heavy sea. Many rocks are not marked by kelp, because a heavy sea will occasionally tear it away and a moderate current will draw it under water so that it will not be seen. When passing on the side of a kelp

patch from which the stems stream away with the current, care should be taken to give it a good berth. Dead, detached kelp floats on the water curled in masses, while live kelp, attached to rocks, streams away level with the surface. Live kelp is usually an indication of depths less than 10 fathoms.

**Aids to navigation** are numerous, and there are few places along the coast where a vessel is not in sight of one or more lights. Lightships are stationed off San Francisco Bay, Blunts Reef, Columbia River, Umatilla Reef, and Swiftsure Bank. The critical dangers are buoyed and generally are marked by kelp. Radiobeacons are located at the principal light stations and on all the lightships.

**Fishweirs**.—Regulations prescribe that fishing structures and appliances in navigable waters of the United States shall be lighted for the safety of navigation. The lights shall be displayed between sunset and sunrise. They shall be placed at each end of the structure excepting where the inner end terminates in such situation that there is no practicable navigation between it and the high water line of the adjacent coast, in which case no inner light shall be displayed. The outer light shall be white and the inner light shall be red. The size, capacity, and manner of maintenance of the lights shall be such as may be specified in the Army Department permit authorizing the erection of the structure or appliance. When several structures or appliances are placed on one line with no navigable passage between them, they will be considered, for lighting purposes, as one structure.

**Boundary Lines of Inland Waters**.—At all buoyed entrances from seaward to bays, sounds, rivers, or other estuaries for which specific lines are not described, **Inland Pilot Rules** apply shoreward of the outermost buoy or other aid to navigation of any system of aids; **International Pilot Rules** apply outside the aids. Specific lines are described in **Part 82, Chapter 2**.

**Tides**.—A very important characteristic of the tides along the western coast of the United States is the large inequality in the heights of the two high waters and of the two low waters of each day. On the outer coast the average difference between the heights of the two high waters of the day is from 1 to 2 feet, and the average difference in the heights of the two low waters from 2 to 3 feet. It was because of this large difference in the low-water heights that the mean of the lower low waters, rather than the mean of all low waters, was adopted as the plane of reference for the charts of this region.

This inequality changes with the declination of the moon. When the moon is near the Equator the inequality is relatively small; but when the moon is near its

greatest north or south declination, the difference in the heights of the two high waters or of the two low waters of each day reaches a maximum. The tides at this time are called **tropic tides**.

Off the outer coast the mean rise of the tide above the plane of reference varies from 5 feet off southern California to about  $7\frac{1}{2}$  feet off the coast of Washington. Extreme variations from 3 feet below to 10 feet above the datum may reasonably be expected.

At the entrance to San Francisco Bay the mean rise of the tide is about 5 feet above the plane of reference. At the southern end of the bay the tide occurs about  $1\frac{1}{2}$  hours later, and the mean rise is about  $2\frac{1}{2}$  feet greater than at the entrance to the bay. Passing northward into San Pablo Bay, the tide occurs from 1 to 2 hours later than at the Golden Gate, with a mean rise of about  $\frac{1}{2}$  foot greater than at the latter place. In Suisun Bay the time of tide is about 3 hours later than at the Golden Gate, with a mean rise about the same. It requires about 4 hours for high water to pass from Suisun Bay to Stockton, on the San Joaquin River, and about 5 hours from Suisun Bay to Sacramento, on the Sacramento River. The mean rise of the tide above the plane of reference at Stockton is about  $3\frac{1}{2}$  feet, and at Sacramento is about  $2\frac{1}{2}$  feet.

In Humboldt Bay the tide is from  $\frac{1}{2}$  to 1 hour later than on the outer coast. The mean rise is about 6 feet above the plane of reference.

In Coos Bay the tide is from  $\frac{1}{2}$  to  $1\frac{1}{2}$  hours later, and the rise of high water about the same as in Humboldt Bay.

In Yaquina Bay the mean rise is about 7 feet above the plane of reference.

At the entrance to the Columbia River the mean rise is about 7 feet above the plane of reference. It requires about 6 hours for high water to pass from the entrance to the Columbia River to the mouth of the Willamette River. In passing up the Columbia River the range of tide decreases until it is only about  $1\frac{1}{2}$  feet at the mouth of the Willamette. Above this point the tidal range becomes too small to be of practical importance. There are, however, large fluctuations in the level due to the meteorological conditions. An extreme variation of  $24\frac{1}{2}$  feet has been noted at St. Johns on the Willamette River. The river is usually highest during the months of May, June, and July, and lowest during the months of September, October, and November.

In Willapa Bay and in Grays Harbor the mean rise is about 9 feet above the plane of reference.

Passing through the Strait of Juan de Fuca, the tide occurs about 4 hours later at Port Townsend than at Cape Flattery. The mean rise increases from 7 feet above the datum at Cape Flattery to  $7\frac{1}{2}$  feet at Port Townsend. There is an increase in the average inequality between the two low waters of each day from 3 feet at Cape Flattery to 5 feet at Port Townsend. The average inequality between the two high waters of each day at both places is about  $1\frac{1}{2}$  feet.

In Puget Sound the tide is about  $\frac{1}{2}$  to 1 hour later than at Port Townsend. The mean rise increases from  $7\frac{1}{2}$  feet above the datum of mean lower low water at Port Townsend to  $13\frac{1}{2}$  feet at Olympia. In Puget Sound the

average difference between the two low waters of each day is 6 feet. At Seattle an extreme range from  $4\frac{1}{2}$  feet below the datum of mean lower low water to 15 feet above the same datum has been observed. At Olympia, in the southern part of the sound, an extreme high water 18 feet above the datum has been noted.

In San Juan Archipelago the mean rise of the tide varies from  $6\frac{1}{2}$  to 8 feet above the plane of reference. An extreme range from  $4\frac{1}{2}$  feet below the plane of reference to 12 feet above the same datum may reasonably be expected.

**Caution.**—In using the Tide Tables, slack water should not be confused with high or low water. For ocean stations there is usually little difference between the time of high or low water and the beginning of ebb or flood currents; but for places in narrow channels, landlocked harbors, or on tidal rivers the time of slack water may differ by several hours from the time of high or low water stand. The relation of the times of high and low water to the turning of the current depends upon a number of factors, hence no simple rule can be given. For predicted times of slack water or strength of current, see the Pacific Coast Tidal Current Tables.

**Currents.**—A current, the outer limit of which extends offshore more than 300 miles, flows approximately parallel to the Pacific coast of the United States from  $50^\circ$  to  $30^\circ$  north latitude. The direction of the current is generally southward throughout the year except as noted below. Its velocity, which averages about  $\frac{1}{4}$  knot, is greatly influenced by prevailing winds, northerly winds increasing it and southerly winds diminishing it.

North of latitude  $45^\circ$  the set is usually northward from November through February.

Along the coast during certain periods there is a weak northerly flow known as the **Davidson Inshore Current**, which is evident between San Diego and Point Conception from July through February and between Point Conception and Cape Flattery from November through February.

Along the coast of Vancouver Island there is usually a northwestward flow, which as measured at Swiftsure Bank Lightship has an average velocity of nearly  $\frac{1}{2}$  knot at all seasons.

The above statements apply to general or average conditions. The currents, particularly offshore, at a specific time depend largely upon prevailing winds, whereas alongshore and off the entrances to inland waterways they depend also upon tidal and drainage effects.

For detailed information, consult the Pacific Coast Tidal Current Tables. This publication also discusses currents at lightships.

**ROUTES.**—The route along the California-Oregon-Washington coast frequently must be navigated in thick weather. Most of the courses are long, and the effect of currents is uncertain. The radio direction finder has given the navigator a means of determining his position in any weather; but there are conditions under which radio bearings may be subject to error, so soundings should always be taken in critical places. A vessel

equipped with an echo sounder may establish a fairly accurate position from continuous soundings.

**San Diego to Strait of Juan de Fuca.**—Vessels can proceed on rhumb lines through the following positions:

- 32°37' N., 117°16' W.; off San Diego.
- 33°40' N., 118°18' W.; off Los Angeles Harbor.
- 34°04' N., 119°20' W.; NNE of Anacapa Island.
- 34°25' N., 120°29' W.; off Point Conception.
- 34°33' N., 120°42' W.; off Point Arguello.
- 36°17' N., 121°57' W.; off Point Sur.
- 37°10' N., 122°26' W.; off Pigeon Point.
- 37°44' N., 122°43' W.; off San Francisco Bay.
- 37°58' N., 123°03' W.; off Point Reyes.
- 38°55' N., 123°50' W.; off Point Arena.
- 40°26' N., 124°32' W.; off Blunts Reef.
- 42°50' N., 124°44' W.; off Cape Blanco.
- 46°11' N., 124°12' W.; off Columbia River.
- 48°10' N., 124°52' W.; off Umatilla Reef.
- 48°26' N., 124°47' W.; off Cape Flattery.

**Caution.**—Strict adherence to tracks through positions listed above could result in collision of meeting vessels. It is suggested that southbound vessels shape courses through positions a mile farther off the mainland.

**San Diego to Panama.**—Proceed on rhumb lines through the following positions:

- 32°38' N., 117°13' W.
- 28°00' N., 116°00' W.
- 24°40' N., 112°30' W.
- 20°00' N., 107°30' W.
- 7°05' N., 81°45' W.

**San Diego to Honolulu.**—Rhumb line from 32°37' N., 117°16' W., to 21°14' N., 157°39' W.

**Los Angeles to Honolulu.**—Proceed on rhumb lines through the following positions:

- 33°40' N., 118°18' W.
- 33°44' N., 120°07' W.
- 21°14' N., 157°39' W.

**San Francisco to Honolulu.**—Rhumb line from 37°44' N., 122°43' W., to 21°14' N., 157°39' W.

**Strait of Juan de Fuca to Honolulu.**—Great Circle from 48°26' N., 124°47' W., to 21°14' N., 157°39' W.

**Strait of Juan de Fuca to Unimak Pass.**—Great circle from 48°31' N., 125°00' W., to 54°00' N., 163°00' W.; thence on rhumb line to 54°20' N., 164°45' W.

**WEATHER.**—The Appendix includes climatological tables for nine Pacific coast ports and a table of fog-signal operation. Also listed are Weather Bureau offices, storm warning displays, and radio stations which transmit weather information.

**General.**—The Pacific coastal region of the United States and the adjacent ocean areas are located along the eastern portion of the Pacific high pressure system. This HIGH, when well developed, forms the principal circulation control forcing most of the LOWS that develop to follow a course northward of the United States. This action damps out weather changes that might otherwise occur and brings to the weather along the coast a stability factor that would not otherwise exist. Air which reaches the coast as a result of the prevailing westerly

winds has acquired much water vapor during its passage over the ocean with resultant high humidities over the coastal regions. The marine influence is also evidenced in a cooling effect in summer and warming influence in winter.

**Pressure and annual changes in the weather pattern.**—During the summer months the North Pacific HIGH reaches its greatest development. In July the center, with highest pressure about 1,025 millibars, is located in the latitude of San Francisco near 150° W. Average pressure in excess of 1,015 millibars prevails over most of the ocean area north of 20° N. almost to Alaska and west from the Pacific coast to about 160° E. At this season of the year the Aleutian LOW is almost nonexistent.

By October the HIGH has contracted, particularly on the north in the direction of the Aleutian LOW which has formed over Alaska and the Bering Sea with pressures of 1,002.5 millibars and below prevailing over southwestern Alaska including the Aleutian Islands. This low-pressure area which appears as a permanent system on the charts is actually the result of frequent migratory lows that move through the area during the winter season.

In October, the Pacific HIGH extends from the U.S. coast across the Pacific Ocean and into the Asiatic Continent and reaches a maximum of 1,020 millibars in the vicinity of 30°–35° N. and 135°–140° W. Weakening of the HIGH continues with the approach of the winter season and by November it is little more than a weak belt of high pressure lying between the Aleutian LOW and the equatorial belt of low pressure. Lows continue to form along the polar front and tend to make their path through the area covered by the Aleutian LOW. In winter these traveling depressions moving eastward cause considerable day to day variation in pressure, particularly in the area north of 40° N.

During the spring months there is a gradual return to the summer pattern with the HIGH spreading northward and the LOW becoming further contracted. Migratory LOWS become less frequent and enter the continent farther north. Day-to-day fluctuations in pressure are much smaller than in the winter months.

**Winds.**—Over the northern portion of the Pacific HIGH north of 40° N., and including the Oregon and Washington coasts, the prevailing direction of the wind is westerly. There is a tendency for the winds to shift to the north of west during the summer when pressure over the United States is lower than that over the Pacific Ocean, and to the south of west during the winter when pressure over the continent is higher than it is over the ocean. These prevailing westerly winds north of the HIGH extend westward across the entire North Pacific and reach northward throughout the area of this summary and on toward the Arctic Circle.

Along the California coast south of 40° N. the prevailing wind during the greater part of the year is from the northwest, a direction that brings it nearly parallel to the coast. The average velocity of these winds off the ocean is generally low during the greater part of the

year. There are, however, occasions when warm dry descending winds from the northeast and east come roaring through the major passes of the coastal mountains. These winds, often accompanied by desiccating temperatures, may exceed a speed of 50 miles an hour and at times carry considerable dust.

**Gales.**—There is considerable difference in frequency of gales between the northern and southern portions of this coast. Gales are most frequent in the winter months, averaging 5 to 8 percent of observations along the Washington coast and only about 1 percent along the southern California coast. In summer, the coastal area of Washington averages less than one percent of observations with gales while the coast of Oregon southward to central California averages 1 to 2 percent. Gales are very infrequent along the southern California coast in summer.

The direction from which gales blow shows a marked seasonal variation. In winter they may occur from any direction but more blow from the southeast, south, or southwest than all other directions combined. Few or none come from the northeast or east. In summer gales are almost exclusively from the northwest and north.

Along the coast of Washington (45° to 50° N.) the season of maximum gales extends from early October until April. This is the period when differing air masses and fronts address the coast. The fact that most gales during this period are from the southeast, south, or southwest indicates that they occur in the warm sector of the LOW. During June, July, and August, gales from any direction are rare. From northern Oregon to northern California (40° to 45° N.) the season of maximum gales along the coast lasts from November through February. During these months most of the gales blow from the southeast and south with a few from the north and northwest. March and October are transition months. From April through September gales are fewer and those that do occur are usually from the northwest or north.

Farther south along the California coast (35° to 40° N.), northwest gales are more frequent and occur at all seasons although they are most frequent from March through July. Northwest gales are as frequent or more frequent than gales from any other direction in all months. There is a secondary maximum of southeast and south gales from November through March.

The coastal waters of southern California (south of 35° N.) have gales so infrequently that they are recorded in only one percent of the observations in January and December. No direction stands out as predominant.

**Local winds.**—The mountains along the coast form such an effective barrier to the free exchange of air between the ocean and the interior that when there is a considerable pressure gradient between the continent and the ocean, strong winds develop in the passes and valleys. Notable among these surface winds that are caused by topography and that affect navigation are the winds in the Strait of Juan de Fuca and the Santa Ana near Los Angeles.

Winds in the Strait of Juan de Fuca as measured at

Tatoosh Island are so modified by topography that it is not always obvious what pressure gradients will produce strong east winds at Tatoosh Island. The frequency of easterly winds increases with the coming of winter until, in January, about half the time the wind is due east and the average speed about 20 knots. The minimum frequency is in July and August when winds are east only 8 to 10 percent of the time, and the average speed has dropped to about 10 knots.

Under the influence of an anticyclone, the easterly winds may blow out of the Strait of Juan de Fuca at high speeds for several days at a time, with unclouded skies and otherwise pleasant weather. Much of the force of the easterly wind is apparently local and due to the configuration of the strait. The shoreline on the south side for 5 miles eastward extends almost due east and west.

An important difference between the easterly winds and westerly winds is their respective effect on the waves. The swell is normally propagated from west to east, or onshore. Any westerly wind tends to heighten the waves. An easterly wind, on the contrary, beats the sea down until a speed of about 47 knots is attained, after which the wind produces an offshore wave of comparatively slight intensity.

The **Santa Ana** is an offshore desert wind usually occurring in or near San Pedro Bay. While infrequent, it may be violent. These winds are most apt to occur in late autumn or winter and at times may reach a speed of 52 knots.

Meteorological conditions are favorable for a desert wind whenever a strong area of high barometric pressure moves in or develops over the Plateau region, and the barometric gradient calls for northeast or east winds over southern California. The air moving outward from this high-pressure area streams through Cajon Pass into the Great Valley of southern California. If the pressure difference between Nevada and southern California is only moderate, the desert winds are usually confined to rather narrow belts extending from the mouths of the passes to the ocean by the lowest and least obstructed routes.

These airstreams from Cajon Pass usually maintain their identity in a remarkable manner. They move out over the valley floor, swing toward the southwest, and either follow the Santa Ana River Canyon through the Santa Ana Mountains, or move directly over the low mountains south of the canyon and then follow a well-defined path over the almost level plains of Orange County and reach the ocean in the vicinity of Newport. The stream may shift its position slightly from time to time, but appears to change only little in width or velocity as it follows a well-defined path to the ocean. It often comes over the south foothills at the western entrance to Santa Ana Canyon, appearing to come down the hillsides in strong gusts directly along the ground.

These winds diminish little, if any, immediately after passing over water, and some reports credit them with blowing considerable distances at sea. However, beyond 50 miles from shore they are usually of no particular concern.

Aside from weather forecasts broadcast by radio, the mariner has only short notice of the approach of a Santa Ana. The barometer is almost useless when its readings are taken alone, for there is little pressure variation, although a gale may spring up and blow for hours. For some hours before a Santa Ana, there is usually a period of good visibility and unusually low humidity. Shortly before its arrival on the coast, the Santa Ana may be observed as an approaching dark-brown dust cloud. This will often give from 10 to 30 minutes warning, and is always one of the positive indications.

The Santa Ana may come any time during the 24 hours, but its strength is reinforced or opposed by the ordinary land and sea breezes. The reinforcement by the land breeze tends to produce the greatest velocity between 7 a.m. and 9 a.m., and its force can be expected to lessen after 10 a.m.

**Tropical storms.**—The southern portion of the Pacific coast may be affected by tropical storms which originate in or near the Gulf of Tehuantepec in late summer and autumn. An average of about eight of these storms occurs each year although few come far enough north to affect U.S. coastal waters. Most of these storms have lost hurricane intensity by the time they reach these waters and most are short lived. These storms may bring unseasonable rains and squally weather to extreme southern California, but they seldom affect the area farther north. The coasts of Baja California, Sonora, and Sinaloa in Mexico suffer the greatest damage from these tropical storms.

**Fog.**—Both summer- and winter-type fogs are common along the Pacific coast, with the summer type being more frequent and extensive. The generally light anticyclonic winds which prevail during the warm months, when the North Pacific HIGH remains stable, are conducive to both the formation and maintenance of fog.

During most of the year the temperature of the water off the coast is lower than that of the ocean farther to the west, the greatest differences occurring in July, August, and September. The cooling effect of these coastal waters upon the easterly moving air above it is a primary factor in the prevalence of summer fogs. Under these conditions the warm, moist air from the westward easily attains its dewpoint and the resulting fog drifts toward the coast and moves inland.

In winter fog is much less prevalent than during the summer months. It is more local in character and, although it may extend over a considerable range in latitude, it seldom extends any great distance to sea. However, when the so-called summer or advection type of fog, which may also occur in winter, unites with fog which has formed over the land, a sheet of fog may extend a considerable distance to sea.

The seaward extent of fog varies greatly. The band of densest and most frequent fog occurs over the narrow stream of colder water just off the coast and is frequently limited to a band of 50 miles or less. At other times fog covers large areas both in latitude and in longitude, and may extend for hundreds of miles to sea.

The months of maximum occurrence of fog off the Pacific

coast vary somewhat with the different localities and, of course, with the individual year. Fog is most prevalent over Puget Sound in the late summer and fall months. Over the Strait of Juan de Fuca, sea fog predominates and its greatest frequency is in August and September. Fog occurs with almost equal frequency over the strait throughout the other months. Along the coast proper, from Tatoosh Island to the lower California coast, the period of most frequent fog is from July to October, and that of least frequent from December to May. On the lower coast of California, that is, from Los Angeles southward, the foggiest months are those from September to February, and the least foggy, from May to August. In the San Francisco Bay region the incidence of low visibility (less than 2 miles) rises sharply in the fall months, rather than in the summer, because of the occurrence of radiation fog.

Over the Puget Sound area radiation fog predominates. During the late summer and fall months there are a great number of nights with clear skies and very little movement of the air. During the night, as heat is lost from the earth by radiation, the air cools to its dewpoint temperature, and fog results. In the late summer, the nights are shorter and the opportunity for radiation cooling is not quite so great; consequently, the fog is not so thick and dissipates rather early in the morning. As the nights lengthen during autumn, the fog will form earlier and to a greater depth and will not dissipate so early in the morning; in fact, under very stagnant conditions in October it is not uncommon for fog to hang over this region for several days. Not until a storm approaches the coast which will cause sufficient wind to blow out the fog, is this region free from it.

There is not so much fog in November and December because the increase in cloudiness prevents the radiation cooling necessary to form fog, and there is too much wind. The less common type of fog in this area, advection fog, usually accompanies frontal systems or is a result of the movement of the warm moisture-laden air from the southern latitudes of the ocean over the colder water and land to the north.

Offshore near the Strait of Juan de Fuca, thick fog banks sometime rear themselves almost perpendicularly, facing clear weather inshore, thus allowing a vessel to arrive at destination without difficulty. At other times, the bank will move slowly into the strait, enveloping both shores for some distance, then perhaps leaving the Vancouver shore to the northward and clinging to the Washington shore. Port Angeles, about halfway between the Pacific coast and the junction of the strait with Puget Sound, has water on three sides, and is subjected to both sea and radiation fog. Sea fog predominates, its maximum frequency being 8 days in August.

Off the coasts of Washington and Oregon, navigation is sometimes seriously obstructed by dense smoke from forest fires, which are most prevalent\* from July to September. At other times light smoke will add to the density of fog.

The maximum frequency of fog along the coast of Washington and Oregon is 16 percent at Tatoosh Island, occurring in August. Between Tatoosh Island and Brookings,

where 14.5 percent of observations in July record fog, smaller frequencies are encountered. From Brookings to north of the Golden Gate the maximum percentage frequency is reached near Blunts Reef. In the vicinity of Eureka, where there are coastal plains, maximum frequency of fog is in the fall months, and is of the radiation type. Humboldt Bay, the harbor of Eureka, however, is an area of dense sea fog, and the shoals near there are dangerous to vessels in thick weather. Between Blunts Reef and San Francisco are two of the most foggy spots on the Pacific coast: Point Arena and Point Reyes. Point Reyes is often spoken of as being the actual center of heaviest and most frequent fogs on the Pacific coast; this is true when an average over a long period of record is considered. Owing to the persistency of the fog cover, through which it is said the sun's rays sometimes fail to penetrate for 3 or even 4 weeks at a time, Point Reyes has close to the lowest midsummer temperature of any observing station in the United States.

Golden Gate, the entrance to San Francisco Bay, is a region of frequent fog, and shipwrecks have been numerous there. Often a sheet of fog forms in early forenoon off the bold headlands on either side of the Golden Gate and becomes more formidable in size as the day wears on. As the temperature rises in the warm inland valleys, a steadily increasing indraft takes place. Then the fog, perhaps 1,500 or more feet in height, approaches the shore and enshrouds a good portion of all of San Francisco Bay. Under favorable temperature conditions, the fog will overspread the shore and rise up the more than half-mile height of Mount Tamalpais.

There are several well-marked types of fog in the vicinity of San Francisco. First and most prominent is the summer afternoon sea fog described above which moves inland at an average rate of 16 miles per hour. The second type, a low-lying dense land or river fog, forms during winter mornings and drains slowly seaward at the rate of perhaps a mile an hour. It is essentially a valley fog and is most marked in the lowlands, but sometimes on clear winter nights, when the cooling due to radiation is high, fog forms early over the city and bay, dissipating before noon. As a rule, the city hills and even the roofs of the tall office buildings are above the fog. The high parts of the city are generally out of the fog several hours before the low portions. The third type is a nondescript fog, formed by a mixture of city smoke and dust with the condensed vapor.

In summer the afternoon sea fog varies in depth from 100 to about 1,500 feet, the depth decreasing as the distance inland increases. On summer afternoons the velocity of the wind at San Francisco with almost clocklike regularity rises to above 22 miles per hour, and a solid wall of fog comes through the Golden Gate, causing a fall in temperature.

Between San Francisco and Monterey, warm-water eddies are interposed between the cold waters and the coast, and a band of less frequent fog results. Estero Bay, just a few miles south of Point Piedras Blancas, is also one of the foggiest spots along the coast.

Surface fogs are not a common phenomenon over the

waters of southern California below Point Arguello, since warm-water eddies lie between the coast and the cool California current. This condition results in a preponderance of low stratus clouds rather than surface fog. The minimum occurrence is at San Diego Bay. Point Arguello is the southernmost point in the band of maximum occurrence of fog. There the cool water lies close inshore and the maximum frequency of 10 percent occurs in July and August. Fogs at Point Arguello are invariably thick, and this point is recognized by mariners as one of the most dangerous on the coast. While the coast of southern California has a minimum frequency of fog, there are two very foggy spots off the coast of Los Angeles. These are San Miguel Island and Buffalo Springs on Catalina Island.

Along a great length of the coast, fog may be found at any time of the day. At North Head, Washington, fog is often formed when northwest winds of forces 2 to 4 occur; at Tatoosh Island it often comes in with south or southwest winds. When northwest winds approach Humboldt Bay and warm air currents come from the land, the two frequently mingle, resulting in fog banks along this dangerous part of the coast. Off southern California night and early morning fogs predominate.

**Precipitation.**—Along the Pacific coast of the United States most of the precipitation falls during the winter season with the summer months being generally dry. While this pattern prevails along the entire coast the amount of rainfall and the length of the season increases gradually from south to north. This trend is clearly indicated in the climatological tables in the Appendix. It shows that the summer rainfall at Tatoosh Island almost equals the winter rainfall at San Diego. At coastal stations, topography and proximity to the ocean exert some slight influence in the average rainfall.

**Thunderstorms** are infrequent along the coast and over the adjacent ocean areas. With the exception of the extreme southern portion of the California coast, thunderstorms occur almost entirely during the winter portion of the year. Along the Washington and Oregon coasts the average is about 7 to 9 thunderstorms a year, while at San Francisco the average drops to 2 per year.

**Temperature.**—The prevailing westerly winds carrying the modifying effect of the ocean onto the coast bring moderate and equable temperatures to the coastal portions of California, Oregon, and Washington which are accompanied by few extremes of heat or cold. The range between the normal winter temperature and that of summer averages about 15° F. to 25° F. at coastal stations and lies between a low range of 10° F. at Eureka, Calif., and a high range of 30° F. at Portland, Oreg. Along the northern coastal areas, cold periods develop slowly and warm spells are usually short lived.

The coldest temperature recorded at the coastal stations listed in the Appendix is 14° F. at Tatoosh Island, Wash., in January. At such low-level locations with marine exposures temperatures seldom drop below freezing. At Tatoosh Island the average is only 8 days a year. At northern locations farther from the coast minimum temperatures below freezing may occur on as

many as 50 days a year. At coastal stations from San Francisco southward freezing temperatures are almost unknown.

Although the highest temperatures of record have exceeded 100° F., at most west coast locations there are actually few days in which the high temperatures exceed 90° F. Portland has an average of 8 such days and Los Angeles averages 15 days per year.

**Pilots** are available at most of the ports along the coast. Vessels requiring pilots should radio ahead and state probable time of arrival off entrance.

**Towboats** are available at the principal ports. Arrangements for towage should be made by radio.

**Supplies.**—Large vessels usually take on fuel and other supplies in San Diego, Long Beach, Los Angeles Harbor, 15

San Francisco Bay, Columbia River, or Puget Sound. Small-craft supplies are also available at many other places.

**Repairs.**—Major repairs can be made to large and small vessels in Los Angeles Harbor, San Francisco Bay, Portland, and Seattle. Motorboats and small yachts also can be hauled out and repaired, hull and engine, at other places.

**Standard time.**—California, Oregon, and Washington use Pacific standard time, which is 8 hours slow of Greenwich mean time.

**Daylight saving time.**—In California the clocks are advanced one hour on the last Sunday in April and are set back to standard time on the last Sunday in September. Oregon and Washington do not use daylight saving time.

## 4. SAN DIEGO TO POINT ARGUELLO, CALIFORNIA

**Chart 5101.**—The coast of southern California from the Mexico border to Point Arguello extends in a general northwesterly direction for 240 miles. The off-lying islands and dangers are discussed in Chapter 5.

In addition to the danger and restricted areas established by Federal regulations as given in Chapter 2, temporary danger and firing areas have been established by the U.S. Navy in the waters off the southern California coast. Firing schedules and regulations are published in the Local Notice to Mariners issued by the Commander, Eleventh Coast Guard District, Long Beach, Calif., and the Daily Memorandum, West Coast Edition, issued by the Navy Branch Hydrographic Office, San Francisco, Calif.

In clear weather, vessels coming from the southward will sight Table Mountain, and its surrounding high land, and Los Coronados before picking up the San Diego landmarks.

**Table Mountain**, 2,244 feet high, conspicuous and flat-topped, is in Mexican territory, about 25 miles south-eastward of Point Loma and about 6 miles inland. It is shown on Charts 5020 and 5002, and on Navy Hydrographic Office Chart 1149, 5195, and 5196.

**Los Coronados (Coronado Islands)** are four bare, rocky islands, extending 4.5 miles in a northwesterly direction, 7 miles offshore in Mexican waters. **North Coronado**, the northwesternmost island, 14 miles southerly of Point Loma, is 467 feet high. **South Coronado**, the southeasternmost and largest, is 672 feet high. **Middle Coronado** and a small islet northward are small barren rocks, 251 and 101 feet high, respectively. These islands are prominent in clear weather, and the passage eastward of them is commonly used by steamers. Depths in the vicinity of the islands are irregular, and in thick weather or at night caution must be observed when near them.

A light, 190 feet above the water and visible 20 miles, is shown from a white cylindrical masonry tower on the south end of South Coronado; it is obscured from certain directions by both Middle Coronado and North Coronado. Another light, 157 feet above the water and visible 11 miles, is shown from a white square masonry tower near the north end of South Coronado; local fog sometimes obscures it.

The boundary between the United States and Mexico is marked near its Pacific end by a white marble obelisk 14 feet high that rests on a pedestal 41 feet above the water. The marker, which is visible from seaward, is about 200 yards from the beach, is near the edge of a low table bluff, and is about 10 miles  $142^\circ$  from Point Loma Light. A stone mound, 365 feet above the water and about

1 mile eastward of the obelisk, marks another point on the boundary line. Directly northward of the obelisk the mesa falls to the low marshy land south of San Diego Bay.

Approaching from seaward in clear weather, San Clemente Island, the southernmost of the off-lying islands, will be sighted before seeing the distinguishing features of the coast. This will check the vessel's position and indicate subsequent shaping of the course for Point Loma. Upon a nearer approach, Cuyamaca Peak and the high land of the interior, Los Coronados, and Point Loma will be distinguished. Several aviation lights in the vicinity of San Diego are visible from seaward.

**Charts 5105, 5107.**—The entrance to **San Diego Bay** is about 10 miles northwestward from the boundary between the United States and Mexico. The bay is the best natural harbor south of San Francisco and affords excellent protection in any weather. A low, narrow sandspit, which expands to a width of 1.6 miles at North Island on its northwestern end, separates the bay from the ocean. An obstruction area encompassing the remains of a concrete barge extends 0.3 mile offshore 2.5 miles southerly of Coronado. Mariners should remain well clear of the area and should not pass inshore of the buoys marking it. **Restricted areas** are southward of Point Loma and between Ballast Point and Zuniga Point; limits and regulations are given in § 207.612 and § 207.612a, Chapter 2.

The city of **San Diego** is on the northeastern shore of the bay. **Coronado** is on the sandspit opposite San Diego. **National City** and **Chula Vista** are on the southeast side of San Diego, and **Roseville** is on the west side of the city. The principal wharves are at San Diego. Coronado, connected to San Diego by passenger and automobile ferry, is of little commercial importance. National City has some waterborne traffic in oil. A **sea-plane restricted area** is in the south part of San Diego Bay; limits and regulations are given in § 207.612, Chapter 2.

**Prominent features.**—**Point Loma**, on the west side of the entrance to San Diego Bay, is a ridged peninsula with heights of about 400 feet. The ridge is bare of trees except in the gullies and where planted around the houses near the summit. Otherwise it is sparsely covered with grass, sagebrush, and cactus. At a distance it usually has the appearance of an island. **Point Loma Light** ( $32^\circ 39.9' N.$ ,  $117^\circ 14.5' W.$ ), 88 feet above the water and visible 15 miles, is shown from a white square pyramidal skeleton tower at the south end of the point. The

radiobeacon and the fog signal at the light are synchronized for distance finding. Heavy kelp extends more than 1.5 miles southward of the point.

On a nearer approach, the abandoned lighthouse and a tower will be seen on the highest part of the hill immediately back of Point Loma Light. The old lighthouse and grounds now comprise the **Cabrillo National Monument**. Other prominent objects along the crest of the ridge are a large elevated tank, a standpipe, and a tall lookout tower 2.6 miles northward from the light.

**North Island**, the filled northwestern end of the sandspit on the eastern side of the bay entrance, is an aviation field. On its southeasterly side is the town of Coronado. Prominent features that show up well from the entrance are the south tower of Hotel del Coronado and the tower of the Naval Administration Building which is surmounted by an aviation light that is operated intermittently with varying characteristics. The high stack of the Marine barracks on the north side of the bay is conspicuous from the western part of the bay. A measured nautical mile on course 018°49' is off the west side of North Island; the markers are on shore.

**Ballast Point**, low and sandy, projects about 0.4 mile northeastward from the eastern side of Point Loma 1.3 miles northward from Point Loma Light. **Ballast Point Light** (32°41.2' N., 117°14.0' W.), 34 feet above the water and visible 11 miles, is shown from a white square tower attached to dwelling on the extremity of the point; a fog signal is at the light. Deep water is close to the outer end of the point.

A jetty extends 1 mile southward on **Zuniga Shoal** from **Zuniga Point**, the southwest extremity of North Island. The outer two-thirds of the jetty has only small sections visible at high water. A lighted buoy marks the outer end of the jetty.

**Boundary lines of Inland Waters.**—The lines established for San Diego Bay are described in § 82.140, Chapter 2.

**Channels.**—A Federal project provides for an entrance channel 40 feet deep; a bay channel 35 feet deep to the Naval Air Station; an anchorage basin 26 to 35 feet deep north of the bay channel; a turning basin 35 feet deep opposite the municipal piers; a channel 30 feet deep and about 3.3 miles long in the southerly part of the bay; a channel 20 feet deep to National City and Chula Vista; and two seaplane basins 10 feet deep, one north of the anchorage basin and the other westward of the 30-foot channel. The channels are maintained at or near project depths. A lighted range and lighted buoys mark the entrance channel. The other channels are marked by buoys and lights.

The dredged channel into **Glorietta Bay**, on the southeast side of Coronado, had a controlling depth of 15 feet in 1956. Lighted ranges, buoys, and daybeacons mark the channel which is used by small pleasure craft proceeding to and from the yacht club.

**Anchorage.**—General anchorages, special anchorages, and anchorages for Government vessels have been established in San Diego Bay; limits and regulations are given in § 202.90 and § 202.210, Chapter 2. Vessels waiting

outside the entrance for a pilot will find good anchorage in depths of 36 or more feet eastward of the entrance buoys, although permission to anchor in the restricted area must be obtained from the local naval authorities; see § 207.612a, Chapter 2.

The anchorage grounds above the municipal piers are usually occupied by Naval craft when the fleet is in home waters. As fore-and-aft mooring is not required, the main channel is often partly obstructed during slack water by vessels trailing in different directions.

The **Embarcadero** boat basin is north of the municipal piers. Another commercial basin is northeast of the mole that extends out from **Fisherman Point**, Roseville, to **Shelter Island**; the municipal yacht harbor is southwest of the mole and behind Shelter Island.

**Caution.**—Degaussing circuits extend across the channel from the vicinity of Ballast Point Light to Zuniga Point. In order to prevent damage to this equipment, tows should be streamed and shortened in to seaward of the light, and towing appendages and catenaries should not be dragged along the bottom while proceeding through the channel. Avoid anchoring in this area.

**Aircraft warnings.**—To avoid danger of collision between patrol planes and small boats operating in and out of San Diego, the Commandant, 11th Naval District, has promulgated the following measures:

When patrol planes are operating involving takeoffs and landings, there will be displayed on a hangar on the northeast end of North Island the International Danger Flag U by day and two vertical red lights by night.

Shipping should keep a sharp lookout for patrol planes at all times whether on the water, taking off, or landing, and give them a wide berth.

When flights are in progress the takeoff or landing area will be patrolled by boats. By day these boats will display a red flag and by night a red lantern. The waving of a red flag or red light at an approaching boat is to be construed as a danger signal. Boats so warned should look for and sight the plane or planes, and alter course as necessary, preferably hauling immediately to the side of the channel and waiting for a clear time to proceed.

**Tides.**—The mean range of tide at San Diego is 4¼ feet. The range between mean lower low water and mean higher high water is 5¾ feet. A range of about 9 feet may occur at the time of maximum tides. Daily tide predictions for San Diego are given in the Tide Tables.

**Currents.**—The currents set generally in the direction of the channels. In the vicinity of the entrance the usual velocity at strength varies from ½ to 3 knots, depending upon the stage of the tide. Westward of Middle Ground north of Ballast Point is an inshore eddy of 0.1 to 0.3 knot on both flood and ebb. On the flood the current sets northwestward over Middle Ground, and on the ebb, in the opposite direction. Southward of the end of the jetty there is a slight set toward Zuniga Shoal on the ebb. The average central surface velocity in the channel east of Ballast Point at the time of strength is about 1½ knots. Great care should be taken while passing this

point as a vessel may take a sudden shear because of a crosscurrent deflected from Ballast Point.

The eddy usually encountered along the ends of the municipal piers makes docking difficult. The velocity and direction of the eddy are irregular and the greatest care must be exercised by even the most experienced. Strangers should not attempt to dock large vessels without a pilot.

For daily predictions of the times of slack water and times and velocities of strength of current, see the Tidal Current Tables, Pacific Coast.

**Weather.**—The prevailing winds are from the northwest and west; the heaviest are from the south and west in winter and early spring. The winds seldom exceed 30 miles per hour, and shipping is considered safe at all times. Fogs occur occasionally, the average being about 20 dense fogs per year. These are mostly night fogs, and seldom occur between the hours of 9 a.m. and 6 p.m. See Appendix for **storm warning displays**.

**Pilotage.**—Pilots are usually employed by strangers. The pilot boat station is at the operation pier located near the southern end of Shelter Island. The pilot's office is in the Harbor Administration Building at the foot of Ash Street. Pilots may be obtained by signaling the harbor control station on Shelter Island, but vessels desiring a pilot should radio ahead stating the expected time of arrival off the entrance.

All vessels sailing under enrollment and licensed, and engaged in the coasting trade, between the port of San Diego and any other port of the United States, are exempt from all pilotage, unless a pilot is actually employed.

All foreign vessels and vessels from a foreign port or bound thereto, and all vessels sailing under a register between the port of San Diego and any other port of the United States, are liable for pilotage.

**Towage.**—Gas and diesel towboats ranging from 50 to 1,250 horsepower are available. Naval tugs and Coast Guard cutters based at San Diego are available in emergencies.

**Quarantine** is enforced in accordance with regulations of the U.S. Public Health Service. Vessels subject to visitation usually are boarded at the piers. Yachts, fishing boats, and small craft are visited at the Embarcadero. The Public Health Service maintains an outpatient clinic.

**Customs.**—San Diego is the headquarters of the customs collection district and a port of entry; marine documents are issued. The boarding dock is on the Embarcadero.

**Immigration** officials are stationed at San Diego for the inspection of passenger and crews of incoming vessels engaged in the foreign trade. Such vessels are boarded by inspectors at the piers.

**Harbor regulations.**—Local rules and regulations for the Port of San Diego are enforced by a Port Director who is employed by the Harbor Department.

**Terminal facilities.**—Depths at the wharves are 18 to 36 feet. The city of San Diego maintains three modern piers with a fourth one under construction in May 1957,

with depths of 35 feet alongside, that handle practically all the general cargo of the port.

**Supplies.**—Fuel oil is available in any quantity at docks with depths of 26 feet alongside. Arrangements can be made to fuel from barges.

Fresh water is supplied at the wharves. The city water is satisfactory for drinking and boiler purposes. Provisions and ship chandlery are available in San Diego.

**Repairs.**—There are six floating drydocks in San Diego, the largest having a capacity of 3,000 tons. Marine railways and machine shops are available for the repair of smaller vessels. The largest marine railway has a capacity of 1,600 tons and can handle vessels up to 212 feet in length.

**Communications.**—San Diego has direct transcontinental railway connection, and has communications with points north and south by rail and coasting steamers. There are complete telegraph, telephone, and radio facilities. It is a port of call for many of the intercoastal steamship lines. Several airlines maintain regular service into the city. The municipal airport is only a mile north of the municipal piers.

**Chart 5101.**—The coast between San Diego and San Pedro Bays is thickly settled. The numerous towns and resorts along the beach have buildings that show up prominently from seaward. Communication is mainly by rail, air, and highway. Water transportation is mostly to Newport Bay which has an improved entrance for vessels drawing up to 20 feet.

Between Point Loma and Point La Jolla the coastline is extremely rocky. Because of the possibility of uncharted rocks, coasting vessels should keep well to seaward of the kelp beds which extend to 2 miles offshore in some places.

**Mission Bay**, 5.5 miles northward of Point Loma, is a recreational area being developed for anchorage of small craft. A Federal project provides for an entrance channel, a main channel, a turning basin and two anchorage basins 20 feet deep. The jetties at the entrance to the bay have been completed. A light 38 feet above the water and visible 11 miles is shown from the outer end of the middle jetty; a light 36 feet above the water and visible 11 miles, and a fog signal are on the outer end of the north jetty. Controlling depths were 14 feet in the entrance channel (October 1957), 20 feet in the east two-thirds of the main channel and east anchorage (December 1957), and 6 feet in the west anchorage basin (September 1956).

**Mission Beach**, just north of the entrance to Mission Bay, is an amusement place with a roller coaster and prominent buildings. From seaward the highest part of the roller coaster looks like a dome.

**Pacific Beach** is on the north shore of Mission Bay and 1 mile northward of Mission Beach. The pleasure pier has a large twin-towered structure arching over the shore end and is conspicuous from seaward.

The first high land northward, about 9 miles from

Point Loma, is a rounding rocky point, 2 miles in length, the seaward termination of a spur from **Soledad Mountain**, 822 feet high. The southern end of this headland is called **False Point** and the northern end is **Point La Jolla**. In the vicinity of Point La Jolla, rock cliffs, in which are many caves, rise abruptly from the water to heights of 70 or 80 feet. The buildings at La Jolla and Pacific Beach are prominent from seaward. The 247-foot radio tower on Soledad Mountain shows red flashing lights at night.

**La Jolla** is a resort with no port facilities or waterborne commerce. It has bus connections to San Diego.

North of Point La Jolla is a **danger area** about 10 miles square; limits and regulations are given in § 204.190, Chapter 2.

**Scripps Institute of Oceanography**, devoted to research work in oceanography and marine biology, is about 1 mile northward of La Jolla. The institute maintains a pier for observation purposes. A **restricted area** extends seaward from this pier; limits and regulations are given in § 207.613, Chapter 2. Just northward of the Scripps Institute the bluffs rise to a height of about 300 feet, then decrease gradually for the next 5 miles to heights of 20 to 80 feet.

A **measured nautical mile**, on course 000°, is about 3 miles northward of Point La Jolla. Each range is marked by two steel towers. A large elevated aluminum-colored tank is just southward of the south rear range tower. A smaller elevated tank is just northward of the north rear range tower.

**Del Mar**, about 7 miles northward from La Jolla, is a resort with a pleasure pier extending out to the surfline; the pier is in poor condition. A hotel with many gables is prominent from the sea.

The coast from Del Mar northward 31 miles to San Mateo Point is a low, flat tableland with abrupt cliffs 60 to 130 feet high and with broad low-water beaches. The tableland is intersected by numerous deep valleys with streams that usually dry in the summer. In the northern part, the high ridges of the interior are much nearer the coast. Paralleling this coast are U.S. Highway 101 and the Santa Fe Railroad.

**Solana Beach**, **Cardiff-by-the-Sea**, and **Encinitas** are small towns 9, 10, and 11.5 miles, respectively, northward from Point La Jolla. The aluminum-colored standpipe on the top of the ridge at **Leucadia**, 13 miles northward of Point La Jolla, is conspicuous.

**Carlsbad**, 19 miles northward of Point La Jolla, is a resort with several hotels. The stacks on the tall concrete buildings of the San Diego Gas & Electric Co. near the south end of town are very prominent. The company maintains a lighted buoy 1 mile offshore in 60 feet of water, and 5 large mooring buoys in a semicircle about 400 yards east of it. Mariners are cautioned to pass west of the lighted buoy. Near the north edge of town the low white square tower on the west end of the San Diego Army and Navy Academy is distinctive.

**Oceanside**, 21 miles northward of Point La Jolla, is a small town with buildings that are prominent from seaward. A pleasure pier extends out to the surfline.

About 1.5 miles northwestward of the pier at Ocean-

side is the **Camp Del Mar Boat Basin**. Vessels in distress may enter the basin, but can be given no docking or mooring facilities except when in a sinking condition or to receive fuel from nearby commercial concerns. The entrance is protected by two breakwaters marked on the outer ends by lights. Lights also mark the outer ends of the two inner groins. The entrance channel, marked by buoys, was dredged to 20 feet in 1958. The controlling depth of the basin is reported to be 17 feet.

An aviation light prominent from seaward and a landing field are near **Fallbrook Junction**, 2 miles northward of Oceanside. The highway bridge and trestlework of the railroad crossing **Santa Margarita River**, 3 miles northward of Oceanside also are prominent. The large white barn about 9 miles northwestward of Oceanside is conspicuous from seaward.

**San Onofre Mountain**, 1,725 feet in elevation and 1.5 miles from the coast, is 12 miles northwestward of Oceanside.

**San Mateo Point**, 16 miles northwestward of Oceanside, ends in cliffs about 60 feet high, and is the northern head at the mouth of **San Mateo Creek**. Both San Mateo Creek and Arroyo San Onofre are crossed by trestlework.

From San Mateo Point to Dana Point, 7.5 miles northwestward, the land is higher and more rugged, and is broken by the **San Juan Capistrano Valley** and **San Juan Creek** about 1.5 miles eastward of Dana Point. The railroad and the highway run along the beach under the bluffs in this stretch of the coast to the San Juan Capistrano Valley.

**San Clemente**, 2 miles northward of San Mateo Point, is a small town with a large land area. Many houses are white with red-tiled roofs, making the place conspicuous from the sea. There is a small pleasure pier at the town.

**Dana Point**, 8 miles northwestward of San Mateo Point, is the seaward end of a high ridge. The spur forming the point ends in a moderately bold sandstone cliff 220 feet high with a precipitous broken face. Outlying rocks and ledges extend offshore for 350 yards. **San Juan Rock**, 10 feet high and about 50 feet in extent, is 340 yards southward of the highest point on the cliff.

**San Juan Capistrano Anchorage**, now seldom used, is 116° from Dana Point in a depth of about 5½ fathoms outside the kelp. Small vessels with local knowledge anchor inside the kelp in depths of 3 fathoms about 0.4 mile from the beach with Dana Point bearing 279°. Along the beach are a pleasure pier and several prominent buildings, the most conspicuous of which is a white tower just east of the pier.

**San Juan Capistrano**, a small town about 2.5 miles inland, is the site of the old mission founded in 1776. Some of the buildings are in fair preservation.

From Dana Point to Newport Bay, a distance of 11.5 miles, the coast is bold, with rocky cliffs 40 to 100 feet high; these are the seaward ends of ridges transverse to the coast, and separated by narrow, deep valleys. **Laguna Beach**, a summer resort, is midway along the stretch of the coast. Three radio towers with flashing red lights are high on the hill back of the beach.

**Santiago Peak**, 5,696 feet high, double-headed and dark

in contrast with the immediate coast range, is the dominant feature of this part of the coast. It is about 17 miles northeastward of Dana Point and is visible about 80 miles.

**Chart 5108.**—Newport Bay, 64 miles northwesterly of Point Loma, is an extensive lagoon bordered on the seaward side by a sandspit 3 miles long. The bay is an important yachting and sport-fishing center, and offers excellent anchorage for large yachts and small craft under all weather conditions.

The city of **Newport Beach** embraces the communities of **Newport** and **Balboa**, on the sandspit, and **Corona Del Mar**, east of the entrance. **Balboa**, **Collins Bay**, **Harbor**, and **Shark Islands** and **Lido Isle** are in the bay.

The numerous houses and buildings of the area are prominent from seaward. A light-colored concrete school building with a high tower is on the high ground 1 mile back from the beach. About 4 miles westward of the jetties and a mile inland is a group of concrete reservoir tanks.

The entrance to Newport Bay is between jetties 900 feet apart with lights at their outer ends. A radiobeacon and a fog signal are also on the outer end of the west jetty. A lighted bell buoy is off the entrance.

A Federal project provides for a channel 20 feet deep from the entrance to and including the turning basin at the west end of the bay; anchorage areas 20 feet deep on the north and south sides of the main channel in the easterly part of the bay; a yacht anchorage area 15 feet deep on the south side of the main channel midway of the bay; the Newport Channel south of Lido Isle 15 feet deep; and for channels 10 feet deep in the remainder of the main bay area. In March 1957 the entrance channel was at project depth and in February 1950 the other channels were at or near project depth, except the anchorage areas north and south of the main channel which had a controlling depth of 12 feet and the Newport Channel which had a controlling depth of 11 feet.

**Anchorage**s in the bay are assigned by the harbor-master; limits and regulations are given in § 202.95 and § 202.212, Chapter 2. There are fixed bridges from the mainland to Balboa, Collins Bay, Harbor and Shark Islands and to Lido Isle; none of these bridges restrict passage to the anchorage areas. A removable-span highway bridge over the bay north of Shark Island has a horizontal clearance of 40 feet and an overhead clearance of 13 feet; the overhead power cable nearby has a permit clearance of 34 feet. When outside the bay, fishing boats often anchor eastward of the east jetty in depths of 18 to 36 feet, sand bottom, to secure protection from northerly and westerly winds.

Severe storms are rare. The Santa Ana is an exceptional wind that blows from the northeast or east with great violence, although of short duration; see Chapter 3. See Appendix for **storm warning** display. A search and rescue craft of the U.S. Coast Guard is stationed at the pier adjacent to the Harbor Department.

The numerous small wharves and landings in the bay are mostly for the use of fishing craft and yachts. Gas-

line, water, provisions, and ship chandlery are obtainable.

The largest marine railway in Newport Bay has a capacity of 325 tons and can haul out craft up to 150 feet in length and 18 feet in draft. Machine shops are available. Several shipyards can haul out small boats for general repairs.

There is communication by rail, bus, and motortruck with Los Angeles and points inland. The city of **Santa Ana** is about 9 miles northward of Newport Bay.

Balboa is the easterly part of the peninsula separating Newport Bay from the sea. A pier extends about 800 feet from the beach about 1 mile westward of the western jetty. Newport is a continuation westward of Balboa. A pleasure pier, with a depth of about 30 feet at its face, is 2.8 miles northwestward from the western jetty. A lighted bell buoy is 1.5 miles southwestward from the pier. The head of a submarine valley extends in a southerly direction off the pleasure pier. The valley bottom is green mud, whereas the surrounding ocean bottom is uniformly fine gray sand.

**Chart 5142.**—From Newport Bay to Point Fermin, a distance of 20 miles, the coast is low and there are several lagoons near the beach. There are no trees near the shore; towns and resorts are almost continuous along the beach.

**Huntington Beach State Park** is a recreational area that extends 2 miles northwestward along the coast from the mouth of **Santa Ana River**, which is 4.5 miles northwest of Newport Bay entrance. The trestle crossing the mouth of this river is conspicuous. A buoy marks the seaward end of a terminal structure of a water conduit extending from shore 1.4 miles northwestward of Santa Ana River. The stack of the Southern California Edison steam plant on shore is conspicuous throughout the area.

A mooring berth with pipeline to shore for unloading oil is 2.2 miles northwesterly of Santa Ana River; a lighted buoy marks its seaward limit. **Huntington Beach**, a resort 5 miles northwestward of Newport Beach, is identified by its many oil derricks. The city has a fishing and pleasure pier. **Sunset Beach** is a small town 5 miles northwestward of Huntington Beach. An elevated wooden tank is near the western extremity of the town.

**Chart 5148.**—**Anaheim Bay**, 14 miles northwestward of Newport Bay entrance, is a naval ammunition and net depot. The **danger zone** in the bay is described in § 204.195, Chapter 2. The channel into the basin is marked by a lighted range, and is protected by jetties with lights on the outer ends. A fog signal is also at the outer end of the westerly jetty.

**Seal Beach**, just northwestward of Anaheim Bay, has several resort structures and a pleasure pier 1,650 feet long.

**Alamitos Bay**, 1.2 miles northwestward of Anaheim Bay, is used by pleasure boats. It is separated from the ocean by a long sandspit, and the entrance is protected by stone jetties extending 1,000 yards seaward with lights on the outer ends. A fog signal is also at the outer end of the westerly jetty. The development project provides for

extensive boat basins, and repair and refueling facilities. The controlling depth in the entrance channel and basins was 14 feet in May 1957.

**Belmont Shore**, 2 miles westward of Seal Beach, has a pleasure pier extending 300 yards seaward. A fog signal is on the outer end of the pier.

**Charts 5147, 5148.**—**San Pedro Bay**, between Seal Beach on the east and Point Fermin on the west, is about 82 miles northwestward of San Diego. On the shores of the bay are the city of **Long Beach** and the port areas of the city of **Los Angeles**. **Terminal Island**, in the northwestern part of San Pedro Bay, separates the outer bay from Los Angeles and Long Beach inner harbors. The bay is protected by breakwaters and is a safe harbor in any weather.

**Los Angeles Harbor**, at the western end of San Pedro Bay, includes the districts of **San Pedro**, **Wilmington**, and a major portion of Terminal Island. The harbor, one of the best along the Pacific coast, has extensive traffic, both foreign and domestic, and ample modern port facilities for the largest vessels.

**Long Beach Harbor**, in the eastern part of San Pedro Bay, is connected north of Terminal Island with Los Angeles Harbor by Cerritos Channel. The distance between the outer entrances to the two harbors is only about 4 miles. Inner Long Beach Harbor is protected by two curving moles.

**Prominent features.**—**San Pedro Hill**, 1,480 feet high, is the distinguishing feature for making San Pedro Bay from eastward or westward. The hill terminates seaward in steep, rocky cliffs about 60 feet high, with several horizontal terraces between them and the summit.

**Point Fermin**, the southeastern extremity of San Pedro Hill, is a bold cliff about 100 feet high. A light, 134 feet above the water and visible 18 miles, is shown from a 30-foot white skeleton tower on the point.

A very conspicuous neon sign 130 feet above the ground at the Union Oil Company plant on the west side of Wilmington has the red numerals **76**, 35 feet high, inside concentric circles of blue. The sign can be seen from south to east for 15 miles.

**Signal Hill** rises to a height of 355 feet about 2 miles from the beach, and is readily recognized because of the many oil derricks around it.

The high concrete stack of a powerhouse at Seal Beach is an excellent landmark. It is flood-lighted at night and in clear weather is visible 15 miles in the daytime and 12 miles at night.

Several prominent objects of use to the navigator are the two tall, rectangular-shaped towers of the Commodore Schuyler F. Helm Bridge over Cerritos Channel; a large stack of the Hammond Lumber Co. in Los Angeles inner harbor; and the four western stacks, 256 feet high, of the Southern California Edison powerplant on the eastern end of Terminal Island.

In the central business district of Long Beach, conspicuous buildings include the Ocean Center Building with a yellow tower near the foot of Pine Avenue, a yellow hotel tower a block eastward of the Ocean Center Build-

ing, and a conspicuous white stone tower 0.4 mile eastward of the hotel.

**Breakwaters.**—**San Pedro Breakwater** extends about 0.9 mile in a southeasterly direction from the eastern side of Point Fermin, then turns northeastward for another 0.9 mile to Los Angeles Light. **Middle Breakwater** extends northeastward for 2.1 miles from the Los Angeles entrance, thence eastward for 1 mile to the Long Beach entrance, and is marked at both ends by lights. **Long Beach Breakwater** extends eastward 2.2 miles from Long Beach entrance and is marked by lights on both ends. Ranges for a measured nautical mile on course **090°** are on the Long Beach Breakwater. They are yellow diamond-shaped daymarks on iron pipes.

**Los Angeles Light (33°42.5' N., 118°15.0' W.)**, 73 feet above the water and visible 14 miles, is shown from a white cylindrical tower, black pilasters on concrete block, on the outer end of the San Pedro Breakwater. The radiobeacon and the fog signal at the light are synchronized for distance finding.

A light, 42 feet above the water and visible 12 miles, is shown from a white skeleton tower on a white concrete house on the west end of Middle Breakwater; a fog signal is at the light. **Long Beach Light (33°43.4' N., 118°11.2' W.)**, 50 feet above the water and visible 12 miles, is shown from a white rectangular tower on a white building on the east end of Middle Breakwater; a fog signal and a radiobeacon are at the light. A light, 41 feet above the water and visible 12 miles, is shown from a white skeleton tower on the west end of Long Beach Breakwater, and a light, 43 feet above the water and visible 12 miles, is shown from a skeleton tower near the east end; fog signals are at the east and west lights.

**Important.**—Outside the breakwaters, the approach to the Los Angeles Channel is marked by a lighted bell buoy and the approach to the Long Beach Channel is marked by a lighted whistle buoy. All inbound and outbound vessels should leave these buoys to port, should shape courses to about north or south before passing the buoys, and should proceed at speeds no greater than is necessary for steerage while making the entrances.

Vessels that approach the entrances close in and attempt to turn at or near the entrance are in danger of collision with outbound vessels, especially with smaller craft at night when their lights are not easily distinguishable at low tide or against the background of lights in the harbor.

Incoming vessels waiting at the entrances to enter should stay eastward of the fairway buoys so as to be clear of outbound traffic.

Due to the hazardous condition that exists when making the turn from Long Beach Channel to the Inner Harbor opposite Pier A Extension, particular attention should be given to the Pilot Rules for navigating narrow channels and bends. In the control area between Pier A Extension and the Naval Base Mole outbound vessels have priority over inbound vessels.

**Fish Harbor**, on the southern side of Terminal Island near its western end, is protected by two sets of breakwaters, the outer ends of which are marked by lights; a fog

signal is at the offshore end of the western outer breakwater. A dredged channel with a controlling depth of 22 feet in April 1951 leads between the outer and inner breakwaters to Fish Harbor, which had a controlling depth of 18 feet in 1951. The seawall is lined with canneries and other fishworks. The outer breakwaters enclose the Yacht Club Anchorage, sometimes called the Fish Harbor Extension. This anchorage has depths of 22 to 25 feet easterly and depths of 11 to 14 feet westerly of the dredged channel.

The entrance to West Basin north of San Pedro is obstructed on the north and south by broken piles which are the remains of a former railroad bridge. These obstructions extend channelward about 85 yards from the north shore and about 90 yards from the south shore. A channel 250 feet wide into the basin is marked by two lighted buoys.

**Boundary lines for Inland Waters.**—The lines established for San Pedro Bay are described in § 82.135, Chapter 2.

**Channels.**—A Federal project provides as follows: **Los Angeles Channel**, an entrance channel 40 feet deep and 1,000 feet wide from the outer breakwaters to the outer harbor, with a turning basin of the same depth southerly of the light off the south end of Pier 1, and an inner harbor channel 35 feet deep, and 1,000 feet wide with a turning basin at its northern extremity of the same depth; **East Basin Channel**, 35 feet deep and 650 feet wide from the turning basin to Cerritos Channel; **Cerritos Channel**, on the north side of Terminal Island, 35 feet deep and 400 feet wide to a turning basin of the same depth in Long Beach Inner Harbor; **Long Beach Channel**, 45 feet deep from the outer breakwaters to the westerly end of Pier A Extension, thence 35 feet deep to the Inner Harbor. The channels are maintained at or near project dimensions.

In addition to the breakwater lights, a lighted range, bearing 309°23', marks the axis of Long Beach Channel. Numerous other aids mark the channels in the two harbors.

**Anchorage.**—General anchorages, special anchorages, and anchorages for Government vessels have been established in San Pedro Bay; limits and regulations are given in § 202.100 and § 202.214, Chapter 2. When inside the breakwaters, vessels are required to anchor in the anchorage area prescribed in the regulations, except in cases of great emergency. The Santa Ana is the only wind dangerous to vessels anchored inside the breakwaters.

**Dangers.**—A rock with a depth of 3 feet over it is about 0.3 mile east-southeastward of Point Fermin Light. A lighted whistle buoy is about 0.2 mile southward of the rock.

**Restricted areas** are westerly and northerly of the Naval Base Mole southerly of Terminal Island, and a **seaplane restricted area** is in the eastern part of San Pedro Bay; limits and regulations are given in § 207.616, § 207.617, and § 207.618, Chapter 2.

**Bridges.**—There are no bridges over Los Angeles Channel. Two bridges cross the Cerritos Channel north of Terminal Island: Schuyler F. Heim Bridge, a highway span that has a lift with a horizontal clearance of 180

feet and an overhead clearance of 42 feet down and 167 feet up; and a railroad and highway bridge 25 yards westward with a double-leaf bascule span that has a horizontal clearance of 180 feet and an overhead clearance of 11 feet.

Several overhead power cables with a permit clearance of 169 feet are near the east end of Cerritos Channel. Vessels are required to have a clearance of at least 6 feet under the cables to avoid the danger of arcing.

Overhead clearances over Cerritos Channel are continually decreasing due to land subsidence.

A retractable pontoon bridge over Back Channel between Long Beach Middle Harbor and Inner Harbor has an open horizontal clearance of 170 feet.

Operating regulations for the bridges in Los Angeles and Long Beach Harbors are given in § 203.1, § 203.710, and § 203.711, Chapter 2.

**Tides.**—The mean range of tide in Los Angeles and Long Beach Harbors is 3¾ feet and the diurnal range between mean lower low water and mean higher high water is about 5½ feet. A range of about 9 feet may occur at times of maximum tides. The time of tide is about the same for both harbors. Daily tide predictions are given in the Tide Tables.

**Currents.**—The tidal currents follow the axes of the channels. They rarely exceed 1 knot and are generally negligible.

**Surge.**—Both Los Angeles and Long Beach Harbors are characterized by short-period oscillations manifested by vertical and horizontal movements which are designated respectively as seiche and surge. The most persistent and conspicuous oscillation has a period of approximately one hour. In the vicinity of Reservation Point and near the eastern end of Terminal Island, the hourly surge is very prominent, causing velocity variations which at times may be as great as a knot, and which often overcome the lesser tidal current so that the current floods and ebbs at half-hour intervals. Because of the more restricted channel, the surge through Back Channel at the east end of Terminal Island usually reaches a greater velocity than through the channel west of Reservation Point. In Back Channel, the hourly variation may sometimes be 1½ knots or more. The hourly surge, together with other oscillations of shorter period and of more irregular occurrence, at times causes a very rapid change both in height of the water and the velocity and direction of the current and may endanger vessels tied up at the piers. A 3-minute surge is reported to be responsible for major ship movements and damage. Pilots advise taut lines to reduce the effect of the surge.

**Weather.**—Fogs occur throughout the year, but most frequently during the early spring and fall months. Ordinarily they are of comparatively short duration, and occur during the night, clearing before 9 a.m. There are times, however, when the fog hangs in Los Angeles Channel for several days without clearing. The outer harbor usually is clear of fog first, then the Los Angeles Channel gradually clears.

The prevailing winds during the summer are from the northwestward and in winter from the southward and

westward; for each season the heaviest winds come from the prevailing direction. Southeasterly gales occur occasionally during the winter.

The only wind likely to be destructive is a local wind known as the **Santa Ana**, or desert wind, which comes from the northeastward. It is a warm, very dry wind, blowing furiously and laden with great clouds of dust. It usually occurs with greatest force during the fall and winter and is most frequent during the night or early morning hours, especially the latter. An excessively low humidity and a very high visibility for some hours before the desert storm reaches the coast are preliminary signs of its approach. A dark brown dust cloud coming from the northeastward gives a few minutes warning of its arrival, but the barometer gives no warning. A Santa Ana can usually be predicted from weather maps made from current weather reports. When an area of very high barometric pressure develops over the plateau region of Nevada and northern Arizona with a relatively low area along the southern California coast, a steep barometric gradient is formed, indicating winds from the northeastern quadrant.

See Appendix for storm warning displays.

**Pilotage** for Los Angeles and Long Beach Harbors is compulsory for foreign vessels and all vessels of 300 gross registered tons and over sailing under United States of America register. Vessels under enrollment, licensed and engaged in the coastwise, intercoastal, and fishing trades between the ports of Los Angeles or Long Beach and any other port of the United States, while under the control and direction of a pilot duly licensed under the laws of the United States for the ports of Los Angeles and Long Beach are exempt from pilotage unless a pilot is employed.

Los Angeles Harbor Department has two pilot boats on station at all times. The pilot station is at the outer end of Pier 1. The pilot boats are equipped with ship-to-shore telephone and cooperate with the radar station at the pilot station. Vessels are met outside of Los Angeles Channel, in the outer harbor, has depths of 40 feet along- usually sets to the eastward at the Los Angeles Harbor entrance and becomes stronger as the afternoon wind increases. The whistle signal for calling a pilot is one long and one short blast.

Pilots usually board the ship on the starboard side in normal weather. In southeasterly weather, when the sea is breaking in the entrance, they will board the vessel inside the breakwaters northeasterly of the westerly light of the Middle Breakwater. Vessels unable to make the entrance in foul weather should anchor eastward of the fairway on a bearing of 300°, or less, on the west end light on the Middle Breakwater.

Long Beach Harbor Department has pilots available at all times. The pilot station is on a short jetty at the southwest end of the east mole. The pilot boats are equipped with ship-to-shore telephone and operate cooperatively with the radar station at the pilot station. Pilots board one mile south of the harbor entrance. The whistle signal for calling a pilot is one short, one long blast.

**Towage.**—Towboats are available. Large vessels usually have one or more towboats in attendance while berthing at or departing from wharves along the inner channels.

**Quarantine.**—Quarantine for the ports is enforced in accordance with regulations of the U.S. Public Health Service. The quarantine station is on **Reservation Point** on the eastern side of Los Angeles Channel. Vessels requiring examination by the quarantine, customs, or immigration authorities usually proceed to their docks where they are boarded by the officials. Fishing boats and other small vessels in quarantine proceed to the immigration dock on Reservation Point for quarantine and other visitation. Vessels from foreign ports entering for bunkers only will be boarded at the quarantine anchorage, northwestward of Los Angeles Light. The Public Health Service maintains outpatient clinics in Los Angeles proper and in San Pedro.

**Customs.**—Los Angeles is the headquarters of the customs collection district and a port of entry; marine documents are issued.

**Immigration.**—The Immigration Station is on Reservation Point.

Other local offices of the following **Federal agencies** are in the area, see Appendix for addresses: Coast and Geodetic Survey, Navy Branch Hydrographic Office, Coast Guard, Federal Communications Commission, Weather Bureau, and Corps of Engineers, U.S. Army.

**Harbor regulations.**—Local rules and regulations for the Port of Los Angeles are enforced by a General Manager of the Harbor Department assigned by a Board of Harbor Commissioners.

Similar regulations for the Port of Long Beach are enforced by a Port Manager of the Harbor Department assigned by a Board of Harbor Commissioners. The **speed limit** for Middle Harbor and Inner Harbor is 6 knots.

Copies of the regulations may be obtained from the local office concerned.

**Terminal facilities.**—The Los Angeles wharves have depths alongside sufficient for the largest vessels. East Channel, in the outer harbor, has depths of 40 feet alongside the bulkhead. There are extensive warehouses in the port.

Most of the wharves in Long Beach inner harbor are privately owned, while those in the outer harbor are owned by the municipality. Depths of 35 feet or more are available at berths in the outer harbor. Limited storage facilities only are available on the waterfront of Long Beach.

**Supplies.**—Fuel oil, water, provisions, and ship chandlery can be had in any quantity at both Los Angeles and Long Beach. The fuel oil can be furnished at the oil docks or by barge. There are no regular facilities in either port for bunkering vessels with coal. This service can be provided by special arrangements made several days in advance of the delivery date.

**Repairs.**—Los Angeles Harbor is well equipped with marine repair plants, and repairs of any size can be undertaken. The largest drydock has a lifting capacity of 15,000 tons and will accommodate vessels 560 feet in

length and has a depth of 25 feet over the blocks at high water. There are no graving docks. The port is well equipped with wrecking and salvage facilities. A trained salvage crew and a corps of expert divers are in readiness at all times to render aid in any disaster to shipping along the coast and at distant localities.

Long Beach has a floating drydock of 3,000-ton capacity which will accommodate vessels 280 feet in length. The plant is well equipped to handle all kinds of repairs. There are also marine railways for small craft.

**Communications.**—Los Angeles Harbor is a port of call for many foreign, intercoastal, and coastwise steamship lines. Rail communications with three transcontinental lines and one standard gage electric line serve the harbor. Twelve commercial air lines operate in Los Angeles and vicinity. The many highways provide for rapid bus and truck service to the surrounding territory. The port has complete radio, telegraphic, and telephone facilities. An auto and passenger ferry operates between San Pedro and Terminal Island.

While the ports of Los Angeles and Long Beach are separate entities, the traffic facilities are closely interrelated.

**Chart 5142.**—From Point Fermin the coast trends in a general westerly direction 6.5 miles to Point Vicente, and forms the northern shore of San Pedro Channel, which is discussed in Chapter 5. From Point Vicente the shoreline curves northward. The coast is free of off-lying dangers and is well marked by kelp.

**Whites Point** is 1.3 miles northwestward from Point Fermin. Several submarine sewers extend from shore northwesterly of this point about 1.3 miles seaward. **Danger zones** for practice firing extend off Whites Point and Point Vicente; limits and regulations are given in §204.197, Chapter 2.

**Portuguese Bend** is a small bight 4.1 miles northwestward from Point Fermin. A private beach community maintains a clubhouse and pier in the northwest corner of the bight. The pier is 430 feet long and has facilities for lifting out small pleasure boats for repair and storage. The buildings of the Marineland Oceanarium, on **Long Point**, 0.7 mile southeast of Point Vicente, are very prominent from seaward. A private pier, 240 feet long, is maintained for sport fishing and small boat launching.

**Point Vicente** is a steep, rocky cliff, 120 feet high, white and red in color, with red predominating. A rock awash is 250 yards southwestward from the point with kelp extending 100 yards farther to seaward. A small black pyramidal rock, 25 feet high, is close inshore 0.3 mile eastward of the point. **Point Vicente Light** ( $33^{\circ}44.5' N.$ ,  $118^{\circ}24.6' W.$ ), 185 feet above the water and visible 20 miles, is shown from a white cylindrical tower on the southwesterly end of the point; a fog signal is at the light. The Coast Guard maintains a radio station near the light.

A **measured nautical mile** on course  $304^{\circ}40'$  is offshore at Point Vicente. The range markers are on shore on both sides of the point.

**Chart 5144.**—**Palos Verdes Point**, 2 miles north-northwestward of Point Vicente, is a bold, bluff point, 120 feet high, rising abruptly to the western extremity of San Pedro Hill. There are no dangers off the point, but heavy kelp extends out about 0.6 mile.

**Lunada Bay** is a small bight on the southern side of Palos Verdes Point. **Resort Point** forms the southern side of this bay.

**Flat Rock Point**, 1.7 miles northeastward of Palos Verdes Point, is on the southern side of Santa Monica Bay. A narrow spur protudes from the otherwise rounded point. **Flat Rock**, 6 feet high, and **Bit Rock**, 5 feet high, are 175 yards and 250 yards, respectively, off the end of the spur. **Bluff Cove** is a shallow bight on the southern side of Flat Rock Point. The beach is covered with boulders.

**Santa Monica Bay** is formed by the curving coast between Point Vicente and Point Dume. From Flat Rock Point to Santa Monica the shore is comparatively low, consisting of sand dunes about 100 feet high backed by the high mountains of the Sierra Madre far in the interior. The shores of Santa Monica Bay are free of outlying dangers, and the depths are comparatively shoal, the 10-fathom curve in general lying about 1 mile from shore, except at Redondo Beach where a deep submarine valley, **Redondo Canyon**, heads close to the shore.

There are several prominent objects in this vicinity. About 1 mile northward of Redondo Beach and about 200 yards inshore is a large powerhouse with six very large smokestacks in a line parallel with the beach. The stacks are floodlighted at night. On Hermosa Beach is a 7-story white concrete beach club, surmounted by an elevator penthouse. Numerous white tanks within the extensive oil refinery area in El Segundo can be seen from seaward. The twin stacks of a powerplant at the south edge of town and the lone striped stack about 1 mile north are quite prominent. An aluminum-colored water tank is on the southern pier at Venice. In the city of Santa Monica are an aluminum-colored gas holder and a terra-cotta office building, surmounted by a tower upon which blazes a huge neon sign.

**Malaga Cove**, just northward of Flat Rock Point, is used occasionally by fishing boats with local knowledge, but it is open to the prevailing westerly winds. Boats enter through a break in the kelp and anchor inside in 6 to 7 fathoms, with the south point of the cove bearing  $207^{\circ}$ .

**Redondo Beach** is about 6 miles northward of Point Vicente. Gasoline and fresh water may be obtained by small craft alongside a wharf which is immediately southward of the municipal fishing pier. A yacht basin with an anchorage protected by jetties is just north of the municipal pier. Its entrance is marked by a lighted gong buoy. Two water intake concrete caps with 14 feet of water over them inside the west jetty are marked by buoys. See Appendix for **storm warning** display.

**Submarine oil seepage.**—About 1.5 miles off Redondo, in the deep water of Redondo Canyon, there is submarine

oil seepage and the water surface is often covered with a film of petroleum. Gas bubbles have been reported in several locations in this vicinity. A second seepage 3.5 to 4 miles to the northwestward is more noticeable and more continuously in action. On calm days, globules and large blobs of oil have been seen projected clear of the water surface. Gas also escapes continuously in large bubbles often 3 to 6 inches in diameter.

**Hermosa Beach** is a resort 1.5 miles northward of Redondo Beach.

**Manhattan Beach** is another resort with a pleasure pier 3 miles northward from Redondo Beach. The development of beach property in this section has been so extensive it is difficult to distinguish the dividing lines between towns.

About 2 miles northward of Manhattan Beach an oil-loading wharf extends out to a depth of 28 feet. About 0.5 mile west-southwestward of this wharf is the outer end of a heavy-oil submarine pipeline. A second line for lighter oils extends about 0.6 mile west-northwestward from the wharf. There are mooring buoys near the wharf and the ends of the pipelines, and a bell buoy farther offshore. The larger tankers are handled offshore and the smaller ones at the wharf. A foghorn is maintained by the oil company at the end of this wharf. At the inshore end of the pipeline is a powerplant with prominent twin stacks. The water intake obstructions northward of the wharf are marked by buoys.

**El Segundo**, 1 mile inshore from the oil wharf, has extensive oil refineries. Nearly 100 large white oil tanks on the high ground are prominent. An aviation light in El Segundo is 2.5 miles from the beach.

The city of Los Angeles outfall sewer extends 0.9 mile seaward from the beach at **Hyperion**, 0.7 mile northward of the oil-loading wharf, and is marked by buoys. An abandoned outfall sewer, 300 yards farther northward, also extends 0.9 mile seaward. Just northward of the outfalls and 300 yards in from the beach the sewage disposal plant, with a large concrete stack 200 feet high, is very conspicuous. The stack is floodlighted.

**Playa del Rey** is a conspicuous real estate development at the southern end of **Ballona Lagoon**, which is about 3 miles northward of El Segundo.

**Playa Del Rey Inlet and Basin** for small vessels and pleasure craft is being constructed just northward of Ballona Creek (1958). A Federal project provides for the construction of two jetties to mark the entrance to the inlet and the dredging of an entrance channel 20 feet deep decreasing to 10 feet in the basins inside the harbor. In December 1958 the entrance jetties were completed.

**Venice**, at the northern end of the lagoon, is a resort, but many oil wells have been drilled along the southern part of its beach. There is a large pleasure pier with buildings, chutes, and domes that are conspicuous from the sea. Gasoline and water for small craft may be obtained here. Venice is a part of the city of Los Angeles.

**Santa Monica** is an important city and seaside resort. The buildings and structures along the beach are prominent from seaward. A large pleasure pier extends out to

a depth of about 22 feet, but there is no water commerce. Fuel oil, distillate, and gasoline are available. A breakwater 0.3 mile long and parallel to the beach is about 200 yards off the outer end of the pier. A light, 45 feet above the water and visible 12 miles, is shown from the top of a building on the outer end of Santa Monica Wharf. A fog signal is at the light.

A lighted bell buoy is southwestward of the breakwater. See Appendix for storm warning display. A special anchorage area for small craft is off the pier; limits and regulations are given in § 202.110, Chapter 2.

**Chart 5101.**—The coast between Santa Monica and Point Dume, a distance of 16 miles, is bold, rocky, and rugged. Steep cliffs rise abruptly from the water's edge, ascending gradually within 3 or 4 miles to the summits of the Santa Monica Mountain Range, about 3,000 feet high. The seaward termination of this range is at Point Mugu, 14 miles westward of Point Dume.

**Kellers Shelter**, 9 miles northwestward of Santa Monica, is an open bight offering protection from northerly and westerly winds in depths of 5 to 7 fathoms, sandy bottom. A reef marked by kelp extends a short distance offshore about 0.5 mile westward of the anchorage.

A well-constructed fishing and pleasure pier, 700 feet long and with 15 feet of water at its outer end, is on the western side of Kellers Shelter. Twin white buildings are prominent marks at the outer end of the pier. Private mooring buoys are maintained east of the pier for the use of sport fishing boats which leave for the nearby fishing grounds daily except during winter months. An aviation light is about 2 miles northward of the beach at Kellers Shelter. An improved highway extends along the beach in this section. Frequently the headlights of autos are directed toward the sea.

**Paradise (Dume) Cove**, about 2 miles northeastward of Point Dume, affords protection similar to Kellers Shelter. The anchorage is abreast the fourth break or arroyo in the cliffs from Point Dume, and is immediately outside the kelp line, in depths of 6 to 7 fathoms, sand bottom, with Point Dume bearing 240°. Kelp should be avoided on account of possible dangers. A 400-foot pleasure pier and several moorings for small boats are in the cove. A fog signal is atop a building about halfway out on the pier.

**Point Dume** is the seaward end of a rather low plateau that terminates in a dome-shaped head, about 200 feet high, rising from a bold rocky bluff. The bluff is reddish, with white cliffs eastward and westward. A small rock visible at all stages of the tide is 150 yards southward of the point, and a reef which bares at low tide is 150 yards farther out. A lighted whistle buoy is 0.5 mile off the point.

**Dume Canyon** is a submarine valley with extremely steep slopes running about 0.3 mile offshore from Point Dume, and extending northwestward roughly parallel to the beach. Moderately strong currents of a confused directional nature have been observed in the vicinity of this submarine valley.

**Chart 5202.**—Between Point Dume and Point Mugu, a distance of 14 miles, the coast is very rugged and there are no outlying dangers. About 2 miles eastward of Point Mugu, on the beach at the foot of a very high bluff, is a sand dune 140 feet high. This is quite prominent and can be made out on clear moonlight nights. About 0.5 mile farther eastward is a pleasure pier extending out to the surf line.

**Point Mugu**, the seaward termination of the Santa Monica Mountains, is prominent on account of the lowland of the Santa Clara Valley to the westward. The cuts and fills of the highway which skirt the shore from Point Mugu eastward are prominent. Aluminum-colored twin tanks, 1.5 miles northwestward of the point and on the western slopes of Laguna Peak, show well from south-eastward through west.

**Caution area.**—The U.S. Navy advises navigation interests and others that extensive guided-missile firing operations will take place in the U.S. Naval Air Missile Test Center, Point Mugu, Calif., Sea Test Range, daily Monday through Friday from 8:30 a.m. to 5:00 p.m. until further notice. The test area, which is about 75 miles wide and 150 miles long, extends in a southwesterly direction from Point Mugu, and is shown on the charts. Commercial and privately owned vessels may obtain further information by communicating on ship-to-shore facilities with Flight Test Control Officer, Naval Air Missile Test Center, Point Mugu, Calif., on 2638 kc. and 2738 kc.

**Mugu Canyon** is a submarine valley with its head near Mugu Lagoon. The 50-fathom curve is about 0.5 mile offshore.

Santa Barbara Channel is discussed in Chapter 5.

**Chart 5007.**—**Mugu Lagoon**, immediately westward of Point Mugu and parallel with the beach, is about 4 miles long at high water. Its mouth shifts from year to year. The lagoon and adjacent lands are restricted to use of the U.S. Navy. The 100-fathom curve of a submarine valley is about 1.2 miles off the lagoon.

**Laguna Point** and **Middle Point** are merely wider portions of the sand beach separating Mugu Lagoon from the sea. They are not prominent from seaward.

**Point Hueneme**, low, rounding, and sandy, is 8 miles northwestward of Point Mugu and is the outermost point of the low land at the mouth of the Santa Clara Valley. **Point Hueneme Light** ( $34^{\circ}08.7' N.$ ,  $119^{\circ}12.5' W.$ ), 52 feet above the water and visible 13 miles, is shown from a white square tower on the fog signal building on the point; a fog signal is at the light. Other landmarks include a large yellow building 500 yards east of the channel, a large oil tank the same distance west of the channel, the elevated water tank in the town, and two similar tanks along the shore northwestward of the jetties. The aviation light at Oxnard is a good night mark.

**Port Hueneme** is an inland basin protected by two jetties at the entrance on the point. Cargo vessels, and commercial and sport fishing craft use the port. The western jetty has a light at its outer end. A lighted bell buoy is off the end of the eastern jetty. A lighted range on bearing  $037^{\circ}$  marks the centerline of the channel.

In July 1955, the controlling depth in the entrance channel was 35 feet. The central basin, about 900 by 1,200 feet, has a general depth of 30 feet. A boat basin at the north end of the harbor has depths of 10 to 15 feet.

The harbor at Port Hueneme is under the jurisdiction of the U.S. Navy. All vessels over 300 gross tons are required to have a pilot holding a Federal pilot's license for Port Hueneme to enter. Harbor pilots are employed by the U.S. Navy. A request for a pilot should be made to the Marine Department, U.S. Naval Station, Port Hueneme, Calif. Vessels will lay-to 1 to 2 miles off the entrance to be boarded by a pilot.

The bulkhead wharf on the southern side of the central basin, which is used by merchant vessels, has a transit shed and railroad tracks. It is under the control of the Oxnard Harbor District. Fresh water is available on the wharf; diesel oil, gasoline and marine supplies can be obtained locally. See Appendix for storm warning display.

A **danger zone** for a Navy small-arms firing range is about 2 miles north of Port Hueneme; limits and regulations are given in § 204.201, Chapter 2.

**Oxnard**, inland 3.5 miles northward of Port Hueneme, has communication by rail, air, and bus.

A row of cottages extends northwestward along the beach for 2 miles from Point Hueneme. From the point, low sand beaches and dunes trend northwestward for 9 miles to the mouth of the **Ventura River**.

A stack 0.6 mile northward of **Mandalay Beach** is conspicuous throughout the area. It is 209 feet high and is painted in white and orange horizontal bands with lights near the top. A private lighted buoy is 1.1 miles to the westward of the stack.

**Ventura**, eastward of the Ventura River, has a wharf 1,960 feet long with depths of 19 feet at the outer end and 18 feet at the inner end of the 250-foot loading face. The outer end of the wharf is marked by a light. Fresh water is piped to the wharf and gasoline is available in the town. The prevailing winds are westerly, and gales are rare.

Small pleasure and fishing boats anchor eastward of the wharf during the summer months, but the anchorage is not safe in winter and spring because of southwesterly swells and comparatively shallow water. Vessels anchor anywhere in the bight with good holding ground, but there is no protection.

The buildings in the town, the oil tanks at the inner end of the wharf, and the railroad trestle crossing Ventura River immediately west of the town are prominent features in approaching. **Padre Serra's Cross**, on a 350-foot hill immediately northwestward of the center of the town, may be seen from the anchorage. There are several aluminum-colored tanks and many oil derricks high up the slopes of the hills northwestward of the town. A radio tower with fixed red lights in the southeast part of town is conspicuous. An aviation light 4.5 miles northwestward of Ventura, is useful to marine navigation. A lone oil derrick is close eastward of the light.

A submarine pipeline to floats about 1.5 miles southward of the wharf is used for loading fuel oil. A group

of storage tanks mark the inshore end of the line. Another submarine pipeline to floats westward of the wharf is used for loading gasoline and fuel oil. Several large mooring buoys are maintained for the tankers loading from the floats. A lighted whistle buoy is 1 mile south-  
westward of the wharf.

Communication is by the main line of the Southern Pacific Railroad, by bus, and by telegraph and telephone. **Pierpont Bay** is a beach resort 1 mile southeastward of the wharf.

**Chart 5202.**—From the Ventura River, the **Santa Ynez Mountains** extend to Point Conception and Point Arguello. For 10 miles westward from the river to Rincon Point the coast is very rugged, elevations of over 2,000 feet being found within 1 mile of the beach. The dangers do not extend over 0.5 mile from the beach which is well fringed with kelp. From Ventura to Santa Barbara, both the highway and railroad skirt the shore; retaining walls are a common feature.

**Point Las Pitas** is the first bold point westward of the river. A very steep arroyo or gulch is on its western side. Eastward of Point Las Pitas is a mile of beach cottages. High on the steep slopes above the cottages are the derricks and tanks of an oil field. Aluminum-colored tanks and oil-processing plants are prominent a mile east of the point; and the aviation light on the hilltop above the tanks is a good mark at night.

**Point Gorda**, 3.5 miles northwestward of Point Las Pitas, is low at its outer extremity but rises rapidly to prominent **Rincon Mountain**, about 2,165 feet high. Eastward of Point Gorda is a long pier supporting many oil pumps. Two derricks are conspicuous on the outer end of the pier. Tanks and numerous derricks are along the highway just east of the pier. West of this pier a causeway extends southerly from Point Gorda for 0.5 mile to an artificial island used for oil operations. A light and fog signal are on the island.

**Rincon Point**, low and sandy, is about 10 miles northwestward of Ventura River and the same distance eastward of Santa Barbara.

**Sand Point**, 3.5 miles westward of Rincon Point, is low and rounding, with the narrow opening to **Carpinteria Lagoon**, shoal and of no importance, lying close under and eastward of it. A rock awash at low tide is 550 yards offshore from Sand Point. An oil-drilling platform is located in 17 fathoms of water 1.7 miles offshore southwestward of Sand Point.

**Carpinteria** is a small town 8 miles eastward of Santa Barbara. A light-colored clubhouse and short pier on the beach at the eastern side of Carpinteria are prominent. An aluminum-colored water tank may be seen among the buildings of the town. A submerged pipeline leads to mooring buoys 0.6 mile offshore where tankers are loaded. Storage tanks mark the inshore end of the pipeline.

**Serena** is a small settlement in the bight just eastward of Loon Point, 2 miles westward of Sand Point. **Summerland** is a small town 4.5 miles eastward of Santa Barbara.

**Ortega Hill**, 0.5 mile westward of Summerland and about 250 feet high, is conspicuous because of the extensive cuts for the highway, and from offshore it has the appearance of a large slide.

**Chart 5261.**—**Santa Barbara**, 29 miles northwestward of Point Hueneme and 39 miles east of Point Conception, is the yachting center for this section of the coast. **Lavigia Hill**, 459 feet high, is the distinguishing feature in approaching Santa Barbara from eastward or westward.

**Point Castillo**, the eastern extremity of the hill, terminates in an almost perpendicular cliff about 50 feet high. **Santa Barbara Point**, the southeastern extremity, is a high cliff and is the eastern limit of the narrow tableland. **Santa Barbara Light** ( $34^{\circ}23.8' N.$ ,  $119^{\circ}43.3' W.$ ), 142 feet above water and visible 18 miles, is shown from a white square pyramidal tower 1 mile westerly of the point. A lighted whistle buoy is 1.2 miles southeastward of the entrance.

Conspicuous landmarks are St. Anthony's Seminary Spire, the neon-lighted theater spire in the center of the town, the neon-lighted hotel tower on the beach 1 mile eastward of the town, and the many residences on the hillsides back of the town. At night the electric lights of Santa Barbara are prominent from the channel, but they are obscured from the westward by Lavigia Hill.

An angular breakwater 750 yards in length extends from Point Castillo. The outer end is marked by a light and fog signal. Electric lights 32 yards apart mark the length of the breakwater, but at times these lights are difficult to pick up against the background of lights in the city.

The shoaling in the harbor is rapid and in April 1958 it was reported to have extended into the channel to a point 335 yards east-northeast of the light on the south breakwater. A lighted buoy marks the limit of the shoal at the entrance. Vessels entering the basin behind the breakwater must pass Stearns Wharf close-to. A Federal project provides for maintenance dredging in the harbor.

The prevailing winds are westerly. Southeasterly gales occur occasionally during the winter months. Anchorage may be had inside the kelp, but large vessels anchor outside the kelp in better holding ground. The approach to Stearns Wharf is through a break in a heavy bed of kelp, usually kept clear by passing vessels.

The spire of St. Anthony's Seminary and the white square tower of a building 140 yards northeastward of the shore end of Stearns Wharf form a good range for approaching the wharf from the southeastward. The bearing of this range is  $319^{\circ}$ .

Small boats anchor in the basin behind the breakwater in a **special anchorage area**; limits and regulations are given in § 202.115, Chapter 2. The holding ground is good. Boats usually are moored fore and aft because of the limited area. Mooring space is assigned by the harbor-master, who has an office on the breakwater. Boat landings, launching ramps, and small-boat hoists are on the western side of the harbor at the breakwater where water, gasoline and oil are available at float landings. Marine

and general supplies are also available on the breakwater.

The U.S. Naval Reserve training station is on Point Castillo at the breakwater. Wharfage can be obtained at their pier, charges to be paid to the city of Santa Barbara. A Coast Guard rescue vessel is stationed here.

**Stearns Wharf**, which extends 680 yards in a southeasterly direction, has two lights on the outer end. Depths alongside the wharf are 18 to 24 feet. Diesel oil, gasoline, and fresh water are available on the wharf. A 30-ton hoist on the wharf can handle boats up to 60 feet in length. Engine and hull repairs can be made. Traffic in the harbor is confined mostly to fishing and pleasure boats. See Appendix for **storm warning** display.

Communication is by rail, motor vehicle, and plane. The Santa Barbara Municipal Airport is at Goleta, 7 miles west of the harbor.

**Chart 5202.**—From Santa Barbara westward to Goleta Point, the coast consists of bluffs 30 to 100 feet high with short stretches of sand beach and is fringed with kelp 0.2 mile offshore. There are no dangers.

**Goleta Point**, 6.2 miles westward of Santa Barbara Light, is low and terminates in a cliff about 30 feet high. The aviation light 1 mile northeastward and the two lighted radio towers 1.5 miles northeast of the point are good marks at night. A short pleasure wharf is in the bight east of the point.

From Goleta Point to Point Conception, a distance of 32 miles, the coast is more rugged than that eastward. **Gaviota Canyon**, 12 miles eastward of Point Conception, is a conspicuous break in the mountains back of this coast. A railroad skirts the shore over trestles and embankments which cross the mouths of numerous gulches and arroyos. The kelp grows quite heavily, and in some places extends over a mile offshore. The Pacific Highway parallels the coast from Santa Barbara to Gaviota, where it turns inland.

**Coal Oil Point**, 1.8 miles westward of Goleta Point, is low and may be distinguished by the strong odor of petroleum discharged by a spring. This odor is noticeable over 2 miles offshore.

**Ellwood** oil field, about 2 miles northwestward of Coal Oil Point, extends more than 1 mile along the shore and is marked by numerous wharves and many tall derricks. One wharf has a length of more than 2,000 feet. Several large tanks may be seen on the bluffs above the beach. Large tankers call frequently for oil at the submarine pipeline off the wharves. The moorings are in a depth of about 10 fathoms, sandy bottom.

A rock with a depth of 15 feet over it is about 3.7 miles westward of Coal Oil Point and 0.9 mile offshore; it is surrounded by kelp. This rock is the outermost danger along the north side of the Santa Barbara Channel.

**Capitan**, 7.5 miles westward of Coal Oil Point, is in a small bight which offers little protection to small craft. About 1 mile northwestward of Capitan a submerged pipeline extends seaward 1 mile, where there are large mooring buoys for tankers receiving oil. There are a few tanks on the bluff above the pipeline, and a lone tank stands on a bare hill 500 feet high and 0.3 mile inland.

**Refugio Beach at Orella**, 2.5 miles westward of Capitan, is a small auto camp at the mouth of the canyon. A small bight here offers some little protection for small boats in northwesterly winds in a depth of about 15 feet.

A submarine oil-loading terminal is at **Gaviota**, 13.5 miles eastward of Point Conception. A number of large white storage tanks mark the inshore end of the pipeline. About 1 mile west of Gaviota is a state beach park where a pleasure-fishing pier, 545 feet long, is located. An electric hoist for launching skiffs is available. The railway trestle along the beach is quite prominent. An aviation light, 2,904 feet above the water, is about 3 miles north-eastward of Gaviota. This light has been reported seen by ships at distances of more than 60 miles; it should not be confused with the marine aids to navigation, particularly those on the Channel Islands.

**Coxo Anchorage**, 1.5 miles eastward of Point Conception, affords protection off the mouth of the Coxo Valley from moderate westerly and northwesterly winds. The suggested anchorage is opposite a culvert, under the railroad tracks, about 1.5 miles east of Point Conception Light, in depths of 5 to 10 fathoms, hard sandy bottom. The cove 1.7 miles eastward of this anchorage known as **Little (Old) Coxo**, is foul and affords little protection.

**Point Conception**, 118 miles northwestward of Point Fermin and at the western end of Santa Barbara Channel, is a bold headland 220 feet high that marks an abrupt change in the trend of the coast. There is comparatively low land immediately behind it. At a distance from northward or eastward, it usually looks like an island. **Point Conception Light (34°26.9' N., 120°23.2' W.)**, 133 feet above the water and visible 18 miles, is shown from a white tower behind a dwelling near the western part of the point; a fog signal is at the light. A low black rock, nearly awash at high tide, is 220 yards offshore, southward and westward of the light.

Point Conception has been called the **Cape Horn of the Pacific** because of the heavy northwesterly gales encountered off it during the passage through Santa Barbara Channel. A marked change of climatic and meteorological conditions is experienced off the point, the transition often being remarkably sudden and well defined. When the northwesterly winds are strong they blow down the canyons between Point Conception and Capitan, and cause heavy offshore gusts.

From Point Conception, the coast trends in a gentle curve northwestward for 12 miles to Point Arguello, and consists of bold rocky cliffs, 100 to 400 feet high. The coast railroad runs along these cliffs and through several tunnels.

The 100-fathom depth curve off Point Arguello, and to a lesser extent off Point Conception, is characterized by a succession of indenting deeps or gorges. In following the curve during thick weather with an echo sounder, these submarine features should be found extremely useful.

**Espada Bluff** is a prominent cliff 370 feet high, 5.5 miles northward of Point Conception. The cliffs on each side drop sharply to less than 100 feet in height.

**Point Arguello** is a narrow, jagged, rocky projection,

extending about 800 yards westward of the general trend of the coast. An outlying rock is about 200 yards seaward. The extremity of the point overhangs the water's edge, and about 200 yards inshore the point is nearly divided by gullies on the northern and southern sides. These form a saddle which, from northward and southward, looks like two small heads. **Point Arguello Light** ( $34^{\circ}34.6'$  N.,  $120^{\circ}39.0'$  W.), 124 feet above the water and visible 17 miles, is shown from a white skeleton tower on the western extremity of the point. The radiobeam

and the fog signal at the light are synchronized for distance finding. **Point Arguello Loran Station** (slave) is about 0.6 mile northeasterly of the light.

**Tranquillon Mountain**, 2,170 feet high, near the seaward end of the Santa Ynez Mountains, is prominent in clear weather. It terminates in Rocky Point, Point Arguello, and Point Pedernales.

**Rocky Point**, 1.2 miles south of Point Arguello, has numerous detached rocks extending in some cases 300 yards offshore.

## 5. CHANNEL ISLANDS, CALIFORNIA

**Chart 5020.**—The eight islands extending for 130 miles in a northwesterly direction off the coast of southern California from San Diego to Point Conception are known as the **Channel Islands**. They include the four islands of the southern group—San Clemente, Santa Catalina, San Nicolas, and Santa Barbara; and the four islands of the northern group also referred to as the **Santa Barbara Islands**—Anacapa, Santa Cruz, Santa Rosa, and San Miguel.

In approaching from the southward, there are several banks encountered before reaching the Channel Islands. **Sixty-mile Bank**, 62 miles southwestward of Point Loma, has a least depth of 53 fathoms over it. Differences of 3° or more from the normal magnetic variation have been observed within a radius of 8 miles of this bank.

**Chart 5101.**—**Bishop Rock**, on which the clipper ship BISHOP struck in 1855, has a depth of only 2½ fathoms over it and is the shallowest point on **Cortes Bank**. The rock, marked by a lighted whistle buoy, is in latitude 32°27' N., longitude 119°08' W., about 40 miles southwestward of San Clemente Island, and is the farthest outlying danger along the coast. The currents are largely nontidal in character; velocities between 1 and 2 knots have been measured. These currents cause considerable swell and even in moderate weather the sea usually breaks at this rock.

The locality for about 2.5 miles southeastward of Bishop Rock should be avoided because of the broken bottom. Deep-draft vessels should also avoid a 9-fathom spot 5 miles west-northwestward of the rock where the bottom is extremely broken, although no breakers have been reported.

**Tanner Bank** covers an area about 15 miles long in a west-northwesterly direction and about 5 miles wide. The least survey depth over it is 12 fathoms, but in December 1945 a depth of 9 fathoms was reported in latitude 32°42' N., longitude 119°08' W. The northwestern end of the bank is about 28 miles southeastward of San Nicolas Island.

A bank with depths of from 52 to 70 fathoms over it is 18 miles northwesterly of Tanner Bank. The bank extends 9 miles in a northwesterly direction and has an average width of 2 miles. The bottom is hard with fine gray sand and shells. The bank is fished extensively during the winter season.

**Chart 5111.**—**San Clemente Island**, 43 miles south-southwestward of Point Fermin and 57 miles west-northwestward of Point Loma, is about 18 miles long in a northwesterly direction, has a greatest width of about 4

miles, and has a greatest elevation of about 1,965 feet. The island is a U.S. Naval Reservation and is closed to the public. Vessels are warned that the vicinity of the island may be dangerous at any time on account of naval activities, including gunfire, bombing, and rocket firing. This warning applies to yachts and fishing vessels as well as to other vessels.

**Local magnetic disturbance.**—Differences of as much as 5° from normal variation have been observed up to 3 miles offshore along the north, east, and south coasts of the island.

The top of the island looks like a tableland as seen from a distance, and presents no definite natural features of value to navigation. Such structures as are shown on the charts may be identified by their positions and the descriptive notes.

The northeastern side of the island is bold, with rocky cliffs. The water is deep close inshore, in general, and kelp grows close to the beach. On this side of the island a prominent white rock is close inshore, about 6 miles northwestward of Pyramid Head. On the beach behind this rock is a fresh-water spring, the only one available during the dry season.

The southwestern side of the island is more irregular, but it is lower and has more gentle slopes. Here the kelp extends several hundred yards offshore, and generally to or beyond the 10-fathom curve. Rocks are numerous close inshore and inside the kelp, but outside the kelp line the bottom slope is more gradual than on the other side of the island, and there are many places where vessels might anchor safely in the lee of the island during the northeastern storms, known as the Santa Anas.

**Seal Cove**, on the southwestern side of the island midway between the two ends, affords a boat landing and indifferent anchorage for small craft in northwesterly weather.

**Outer Santa Barbara Passage** is between San Clemente and Santa Catalina Islands.

**Chart 5117.**—**China Point** is the southwestern extremity of San Clemente Island and on the western side of Pyramid Cove. A light, 112 feet above the water and visible 11 miles, is shown from a white pyramidal structure on the point.

**Pyramid Cove** is the deep bight in the southern end of San Clemente Island. This cove offers protected anchorage in depths of 10 fathoms or more during northwesterly weather. The cove is included in a **danger zone**; limits and regulations are given in § 204.200, Chapter 2. Vessels should not enter the kelp as there are indications of other dangers besides those already shown on the charts.

Some swell makes into the cove most of the time, but landing on the beach is usually not difficult.

**Pyramid Head**, the southeastern point of San Clemente Island and the eastern side of Pyramid Cove, is about 900 feet high, sharp, jagged, and prominent. A light, 226 feet above the water and visible 11 miles, is shown from a white pyramidal structure on the head.

**Chart 5118.**—**Wilson Cove**, on the northeastern shore of San Clemente Island, 15.5 miles northwestward of Pyramid Head, is a fair anchorage in the prevailing westerly weather, but is uncomfortable at times as the swells make around the point from the northwestward. A strong wind usually blows down off the hills in the afternoon. A **restricted anchorage area** and a **naval restricted area** are in the vicinity of the cove; limits and regulations are given in § 202.218 and § 207.614, Chapter 2.

Three lights shown from white pyramidal structures and a lighted range are in the vicinity of Wilson Cove. On the hill on the southwestern side of the cove is a light 125 feet above the water and visible 15 miles; on a point 2 miles south of the cove is a light 140 feet above the water and visible 9 miles; on a point about 1 mile north of the cove is a light 60 feet above the water and visible 10 miles. The range lights are in line with the Navy pier on bearing 198°. A fog signal is on the end of the pier.

The buildings on the hill overlooking Wilson Cove are prominent from the southeastward. The best anchorage for small craft is in the lee of the kelp making off from a point nearly a mile northwestward of the wharf.

In the middle of Wilson Cove the U.S. Navy has a steel pier that extends 550 feet from shore. A landing section at its outboard end is 38 feet wide by 210 feet long, with its deck 18 feet above low water. Depths along the landing section vary from 14 feet inboard to 24 feet outboard. Two fixed breast moorings are in place on each side opposite the landing section and should be used to avoid danger of damage from surge. Time of the tide is about the same as that of Los Angeles. The mean range is 3½ feet.

**Northwest Harbor**, on the northwestern end of the island, affords shelter in southerly weather and is a comfortable anchorage in the prevailing westerly weather, as the large beds of kelp and the low islet to the northward of the anchorage afford protection. It is open northward, and is unsafe in heavy northwesterly weather.

A light, 202 feet above the water and visible 11 miles, is shown from a white pyramidal structure on the headland at the north end of San Clemente Island.

A line of rocks extends westward from the northwestern extremity of San Clemente Island, terminating about 0.4 mile off the point in Castle Rock, a bold rocky islet. This islet is 72 feet high and is prominent in approaching from the northeastward or southwestward.

Shelter from Santa Ana winds may be had off the southwestern side of San Clemente Island, just southward of **West Cove**, 1.5 miles southeastward of Castle Rock.

**Chart 5112.**—**Santa Catalina Island**, 18 miles southward of Point Fermin, is about 18.5 miles long in a south-

easterly direction and has a greatest width of 7 miles. About 6 miles from the western end, a deep northerly cut almost divides the island. The cut forms coves less than 0.5 mile apart at their heads, and because the isthmus separating these coves is low, the island appears as two from a few miles away. Rugged and mountainous, the island has steep, precipitous shores intersected occasionally by deep gulches and valleys, and is covered with a thick growth and some scrub oak. The highest peak, 2,125 feet, is about in the middle of the eastern part of the island. Sheep and cattle are raised to some extent.

Much of the northern shore is free from kelp, but the southern side in general has a narrow fringe of kelp close to the beach. The island rises abruptly from deep water, the 30-fathom curve being close inshore. Most of the dangers in the approaches to the island are inside the kelp.

Navigational lights are shown from white pyramidal structures on the island. A light, 212 feet above the water and visible 12 miles, is on the southeast point of the island. A light, 71 feet above the water and visible 9 miles, is shown from **Long Point**, on the northeasterly side of the island, 4 miles northwestward from Avalon. A light, 76 feet above the water and visible 12 miles, is on West End, the northwest extremity of the island.

**Ribbon Rock**, on the southwestern side of Santa Catalina Island, 3 miles from the western end, shows as a dark vertical rock wall with a gigantic ribbon of quartz veining which is visible many miles.

**Farnsworth Bank**, 5 miles southward of Catalina Harbor and 1.5 miles offshore has a least known depth of 8 fathoms over it.

Shelter from Santa Ana winds can be had by anchoring in the bight near the **Palisades** on the southern side of the island, 2 to 3 miles northwestward of the southern extremity.

There are two prominent rock quarries on the eastern side of the island; one is about 1.5 miles southward of Avalon Bay, and the other is about 1 mile southeastward of Isthmus Cove.

**White Cove**, 3.5 miles northwestward of Avalon, affords anchorage in depths of 8 fathoms; the protection is similar to that at Avalon.

**Chart 5128.**—**Avalon Bay** is on the northern shore of Santa Catalina Island, 2.5 miles from its southeastern extremity. The small bay affords indifferent anchorage in a depth of 8 fathoms, sandy bottom. A depth of 20 fathoms is immediately outside the points of the cove. The shelter is good in southwesterly weather, and fair in northwesterly weather if the wind is not too strong. The anchorage is not safe during the Santa Ana winds that occasionally blow from the eastward during the fall and winter months. A **special anchorage area** is in the bay; limits and regulations are given in § 202.105, Chapter 2.

A large white circular building on **Casino Point**, on the north side of the bay, is brilliantly illuminated for about half the night. **The Carillon**, a white concrete tower, 0.2 mile southwesterly of the point, is illuminated and is easily identified.

A fog signal is on the pump house near **Bathhouse Point**, on the southeastern side of the bay, but it is sounded only upon the approach of regularly scheduled passenger vessels. Manually operated fog horns at Steamer Pier and at Casino Point are also sounded to aid the scheduled vessels in thick weather.

The village of **Avalon**, an extensive resort and the principal settlement on the island, has several wharves. Daily ship and airplane service is maintained with San Pedro. A road along the beach extends some distance on each side of the cove, and at night the lights along this road are conspicuous from San Pedro Channel. The cove is important as a yacht anchorage and as a vacation resort. The customary yachting and fishing-boat supplies are available.

A large hotel with a pleasure pier is on **Descanso Bay**, just northwestward of Casino Point. There is an **anchorage area** in the bay; limits and regulations are given in § 202.216, Chapter 2.

A **seaplane restricted area** is at **Hamilton Beach**, about 0.4 mile northward of Casino Point; limits and regulations are given in § 207.620, Chapter 2.

**Isthmus Cove**, on the north shore 6 miles from the western end of the island, affords shelter for small vessels in southerly weather, but is dangerous in northwesterly weather. A wharf extends out to a depth of 17 feet. Several prominent buildings are on shore. Isthmus Cove and Avalon are connected by a road, and during the tourist season launch service is maintained between the two points. An **anchorage area** is in the cove; limits and regulations are given in § 202.216, Chapter 2.

The approach to Isthmus Cove alongshore from the eastward is clear, but westward of the cove entrance is **Eagle Reef**, which has a least depth of 3 feet over it. The reef is marked by growing kelp and by a buoy about 100 yards to the eastward. In approaching from northward, **Ship Rock**, about 1 mile northward of the cove, is the guide. A light, 75 feet above the water and visible 9 miles, is shown from a white pyramidal structure on top of the rock. From the channel the rock looks like a black haystack; the top is mostly white due to bird droppings. A reef extends about 120 yards southward of Ship Rock, ending in a rock that bares 3 feet at low water.

**Bird Rock**, 37 feet high and about 150 yards in length, is about 500 yards off the beach northward from the eastern part of the cove entrance. The rock is covered with sand and grass. In places reefs extend off the rock more than 100 yards, but it may be approached close to on the eastern side.

**Harbor Reefs**, 400 yards southwestward of Bird Rock, are 350 yards long in a northwesterly direction, and less than 100 yards wide. They usually are well marked by kelp. A rock near the eastern end bares about 2 feet at low water. There is a lighted buoy just southward of the eastern end of the reef and a buoy westward of the western end.

**Fisherman Cove**, in the eastern part of Isthmus Cove, is small, and little used.

**Catalina Harbor**, on the southern side of the isthmus

separating it from Isthmus Cove, affords shelter for small vessels in all but southerly weather. This harbor is funnel-shaped, open to the southward, free from hidden dangers, and easy of access. **Pin Rock**, a small rock above water close inside the eastern head, is about 150 yards offshore and has deep water around it. The anchorage is in depths of 4 to 5 fathoms, soft bottom, abreast **Ballast Point**, the long low point on the eastern shore. The head of the harbor is shoal. The 3-fathom curve is marked by kelp, and vessels entering should give the shores a berth of 150 yards.

**Chart 5101.—San Pedro Channel**, about 17 miles wide, is between the mainland, Point Fermin to Point Vicente, and Santa Catalina Island. Current observations have been made 7 miles south of San Pedro Breakwater. Two periodic currents occur at this location; a tidal current, and a daily current apparently due to a land and sea breeze. Both are rotary, turning clockwise, and each is weak, having a velocity at strength of about  $\frac{1}{4}$  knot. The tidal current is very complicated, but the daily current is simple maintaining on the average an approximately constant velocity and shifting direction to the right about 15° each hour. It sets north about 9 a.m., east at 3 p.m., south at 9 p.m., and west at 3 a.m.

Currents due to winds and oceanic drifts vary in velocity and direction. The average current for the period of observations set 112° with a velocity of about 0.1 knot. Currents greater than 1 knot occur infrequently. The greatest velocity measured during 5 months of observations was 1½ knots.

**Chart 5113.—San Nicolas Island**, the outermost of the group off southern California, is 53 miles off the nearest point of the mainland, 43 miles west-northwestward of San Clemente Island, and 24 miles southwestward of Santa Barbara Island. The island is 8 miles long in an easterly direction, about 3 miles wide, and about 905 feet high at its highest point. It is visible about 38 miles. From a distance, the island has a gently rounding profile, with no features that can be identified for taking bearings. The western part is covered with sand, some of which has drifted to the middle northern shore. The remainder of the island is cut by deep arroyos and the top of the mesa is spotted with patches of burr clover and bunch grass. With the exception of the rocky points, the beaches are all sand. The island is practically surrounded by kelp. At the western end the kelp extends westward about 3 miles, over very irregular bottom. Two reefs in the kelp extend about 1.6 miles westward from the western extremity of the island. In thick weather great caution must be exercised in approaching from westward, and vessels should in no case pass inside the kelp. No dangers are known to exist outside the kelp.

A **naval restricted area** extends 3 miles from the shoreline around the island; limits and regulations are given in § 207.615, Chapter 2.

**Begg Rock**, 15 feet high, is 8 miles northwestward of the western point of San Nicolas Island. A reef extends

northward and southward of the rock a little over 100 yards in each direction. The rock rises abruptly from depths of 50 fathoms. A lighted whistle buoy is about 500 yards northward of the rock.

A bank with 30 to 40 fathoms over it extends 7 miles eastward from the eastern point of San Nicolas. From the 40-fathom curve the depths increase rapidly to the eastward and southward.

Two **restricted anchorage areas** are off San Nicolas Island; limits and regulations are given in § 202.220, Chapter 2. Indifferent anchorage may be had on the southern side of the sandspit, 0.6 mile long, on the eastern end of the island. Small craft anchor in a depth of 8 fathoms, hard sand bottom, near the inshore edge of the kelp. Larger vessels anchor farther offshore in depths of 10 to 17 fathoms, hard sand bottom. The anchorage is often uncomfortable as the island tends to split the westerly seas and they break with equal force on both sides and meet off the end of the spit in a maelstrom of breakers. This condition tends to move the sand from the western end of the island and builds up the sandspit. After sunset there is frequently a strong wind blowing off the mesa, making holding difficult. In a blow, local fishermen usually leave this anchorage, preferring the one at Santa Barbara Island. A landing can usually be made at the eastern end on the southern side of the island during the summer months without difficulty.

An aviation light near the center of San Nicholas Island is 981 feet above the water, and three surface navigation lights are shown from white pyramidal structures around the island. A light, 55 feet above the water and visible 7 miles is on the east side of the island. On the north side of the island, 2.3 miles from the easternmost light, is a light 33 feet above the water and visible 11 miles. Another light on the south side, about 2 miles from the easternmost light, is 50 feet above the water and visible 7 miles. The south light has been reported visible at greater distances due to atmospheric conditions in this area. A lighted buoy is about 2 miles east of the easternmost light.

**Chart 5110.—Santa Barbara Island**, 33 miles south-southwestward of Point Dume and about 21 miles westward from the western end of Santa Catalina Island, is about 1.5 miles long in a northerly direction, and has a greatest width of 1 mile. The profile of the island is saddle-shaped, and at a considerable distance it appears to be two islands. The greatest elevation is 635 feet on the southern side of the saddle, and the island is visible for over 25 miles in clear weather. The shores are bold and precipitous and well marked by kelp extending to about 10 fathoms at irregular distances from the shore. Westward of the island the kelp makes out more than a mile over very irregular bottom; a sunken rock is near the outer and southern edge of the kelp. The water around the island is deep except where the kelp indicates foul or rocky bottom.

**Sutil Island**, a rocky islet 300 feet high and surrounded by kelp, is about 0.4 mile westward from the southern point of Santa Barbara Island; its northern face is steep.

A smaller rock islet, 145 feet high, is 200 yards offshore about 0.2 mile westward from the northern point of Santa Barbara Island.

A fair anchorage for small craft in the prevailing westerly weather may be had off the eastern side of the island about 700 yards southeastward of the northeastern point. Large vessels can anchor off the eastern side of the island within the 30-fathom curve with hard gray sand bottom. A **general anchorage area** is off the east coast of the island; limits and regulations are given in § 202.222, Chapter 2.

A light, 195 feet above the water and visible 9 miles, is shown from a white pyramidal structure on the northeasterly point of Santa Barbara Island. Another light, 486 feet above the water and visible 12 miles, is shown from a white pyramidal structure on the westerly side of the south end of the island.

**Chart 5101.—Osborn Bank**, about 6.5 miles southward of Santa Barbara Island, is 5 miles long in a northwesterly direction and has an average width of about a mile. The least depth found over it is 19 fathoms.

About 16 miles north-northwestward of Santa Barbara Island is a submerged pinnacle rock of very small area with a least depth of 17 fathoms over it.

**Channel Islands National Monument**.—Santa Barbara Island, Anacapa Island, and areas within one nautical mile of the shoreline of these islands, except for certain described parcels of land, have been reserved as Channel Islands National Monument, and are subject to rules and regulations prescribed by the Secretary of the Interior.

**Chart 5114.—Anacapa Island**, the easternmost of the northern group of Channel Islands, actually consists of three islands separated by two very narrow openings which cannot be used as passages. The easterly opening is filled with rocks, is bare at all stages of the tide, and is crossed by a trestle walkway. The westerly opening is only 50 feet wide and is blocked by sand that is awash at high tide. The eastern point of the island is about 11 miles southwestward of Point Hueneme. **Anacapa Island Light** (34°00.9' N., 119°21.5' W.), 277 feet above the water and visible 24 miles, is shown from a white cylindrical tower on the east end of the island. The radio-beacon near the light and the fog signal on the lower white square tower close eastward of the light are synchronized for distance finding.

From the eastern point the island extends about 4.5 miles in a general westerly direction. The eastern and lowest island of the Anacapa group is about 1 mile long, 0.2 mile wide, 250 feet high, and rather level on top. The middle one is about 1.5 miles long, 0.2 mile wide, and 325 feet high. The western and largest island is about 2 miles long, 0.6 mile wide, and rises to a peak 930 feet high. The westernmost island is visible at a distance of 35 miles in clear weather, and the other two at 15 to 20 miles. The shores of Anacapa Island are perpendicular and filled with numerous caves. The eastern extremity terminates in **Arch Rock**, 80 feet high, with a 50-foot arch and a pyramidal rock just southward of its eastern

end. The island is surrounded by kelp except in a few small places.

The light station attendants and one or two fishermen are the only persons on Anacapa Island. Seals and pelicans are present in large numbers. The eight or nine cream-colored houses with tile roofs of the light station personnel are 300 to 400 yards westward of the light. A single large white building is 100 yards farther to the westward. There is a group of four or five weather-beaten shacks on the easternmost island about 100 yards from the pass which separates it from the middle island. They are visible only from the northward.

The best anchorage in southeasterly storms is on the northern side about 0.2 mile northward of the center of the middle island in depths of 9 to 12 fathoms. In northwesterly weather the best anchorage is 0.3 mile southward of the eastern opening in depths of 8 to 12 fathoms. However, it is best for larger vessels to lie at Smugglers Cove, on the eastern side of Santa Cruz Island, where the bottom is not so steep-to. Small boats anchor in depths of 5 to 7 fathoms in **East Fish Camp**, a bight about 0.4 mile southwestward of the eastern opening. About the only protection from northeasters is to anchor as close as possible in the bight immediately westward of **Cat Rock**, on the southern side of the western island. The Coast Guard maintains a boat landing and hoist on the northern side near the eastern extremity. Landings can also be made on either side of the island near the western opening and at East Fish Camp. In thick weather, vessels in the area should stay in depths of not less than 50 fathoms because the island rises abruptly from deep water.

**Anacapa Passage**, between Anacapa and Santa Cruz Islands, is about 4 miles wide and is free from dangers. It is steep-to on the Anacapa Island side and has a gradual slope to the shore of Santa Cruz Island. The passage is seldom used and should not be attempted in thick weather as soundings give no warning of a close approach to the islands. Tide rips are strong under certain conditions of wind and current, especially during southeast storms and during northeasters.

**Charts 5114, 5115.**—**Santa Cruz Island**, the largest of the Channel Islands, is about 21 miles long in a westerly direction and has an average width of about 5 miles. The highest peak, in the western part of the island, rises to 2,434 feet, and in the eastern part the land attains an elevation of about 1,800 feet. The eastern part is very irregular, barren, and destitute of water; the western part has a few trees, is well covered with grass, and has several springs. Sheep and cattle are raised to a considerable extent. The shores are high, steep, and rugged, with deep water close inshore, and there is considerably less kelp than around the other islands. There are no outlying dangers except Gull Island.

**Chart 5114.**—**Smugglers Cove**, immediately southward of the eastern point of Santa Cruz Island, affords shelter in northwesterly weather in depths of 5 fathoms, sandy bottom. Water may be obtained from wells on shore.

**San Pedro Point** is the eastern extremity of the island. **Scorpion Anchorage**, a shallow bight, is 1.8 miles north-westward of San Pedro Point. There is a small-boat landing which consists of a cribbed area with a float and gangway at the end of the roadway. Several large buildings, one of which is white, are along the roadway. Large clumps of trees are near the houses.

**Chinese Harbor**, in the eastern part of the broad bight on the northern shore, about 4.5 miles from the eastern point of the island, affords anchorage in the kelp in depths of 5 to 6 fathoms. The northeastern part of the harbor is an excellent anchorage in southeasterly to southwesterly weather in depths of 9 to 10 fathoms. Fresh water may be obtained about 0.8 mile eastward of the anchorage. This harbor affords the best shelter on the island from northeasterly winds.

**Prisoners Harbor**, in the western part of the bight on the northern shore about 8 miles from the eastern point, affords shelter from all winds except from northeastward to westward. Some protection from northwesterly weather is afforded by the kelp but a heavy swell rolls in. In northeasterly weather the anchorage is unprotected and dangerous. A wharf with a depth of 16 feet at its face is in the harbor. A large white house, with tile roof, and other buildings stand back of this wharf. The best anchorage is in depths of 12 to 15 fathoms, sandy bottom, abreast a white rock on the western shore of the bight, and the outer end of the wharf in range with the buildings at the inner end. Fresh water can be obtained.

**Chart 5115.**—**Pelican Bay**, a small indentation in the northern shore of Santa Cruz Island about 1 mile west-northwestward of Prisoners Harbor, is used as a yacht anchorage during the summer season. In northwesterly weather small boats anchor close to the cliff which forms the western shore of the bay.

**Painted Cave**, about 3 miles east of **West Point**, the northwestern extremity of the island, is a large cave into which small boats may be rowed for a considerable distance. The entrance is over 150 feet high. The inner end of the first chamber, 600 feet from the entrance, has depths of more than 2 fathoms.

**Forney Cove**, about 1 mile eastward of **Fraser Point** at the western end of the island, affords shelter in northerly weather in depths of 7 to 8 fathoms. The surf is heavy on the beach, but the rocky islet westward and the reef connecting it with the shore lessen the swell at the anchorage.

**Gull Island**, 65 feet high and about 0.2 mile in extent, is the largest and outermost of a group of small rocky islets, 0.7 mile southward of **Punta Arena**, on the southern side of Santa Cruz Island. Kelp surrounds Gull Island, and the bottom in the vicinity of the group is foul. A light, 73 feet above the water and visible 8 miles, is shown from a white pyramidal structure on the island.

**Willows Anchorage**, on the southern shore about 3.6 miles eastward of Gull Island, can be used by small craft in northwesterly weather and affords a good boat landing.

**Santa Cruz Channel**, between Santa Cruz and Santa Rosa Islands, is about 5 miles wide, with good water close

to both islands. The rocks off the western and southwestern points of Santa Cruz Island and the eastern and northeastern points of Santa Rosa Island are so close inshore that they cannot be considered as dangers in the channel.

**Charts 5115, 5116.**—**Santa Rosa Island** is about 15 miles long in a westerly direction and has a greatest width of nearly 10 miles. The highest point, near the middle of the island, is 1,589 feet and is visible over 40 miles. The island has some water, and is partially covered with vegetation, but there are no large trees. The shores are bold, high, and rocky; kelp surrounds the greater part of the island. Depths in the approaches to the island shoal more abruptly from southward than from northward, where the 100-fathom curve is over 5 miles and the 20-fathom curve about 2 miles from the beach.

There are no harbors, but anchorage may be made in Bechers Bay and Johnsons Lee. There are several good boat landings.

**Chart 5115.**—**South Point**, the southern point of Santa Rosa Island, terminates in a rocky bluff 100 feet high, and rises rapidly to a height of 460 feet, then to 603 feet. Cliffs, several hundred feet high and about 0.5 mile in extent, comprise the southwestern face of the point. A light, 530 feet above the water and visible 18 miles, is shown from a small white house on the point.

**Johnsons Lee**, an open roadstead immediately eastward of South Point, affords fair shelter from westerly and northwesterly winds but is dangerous in southerly weather. The Coast Guard makes landings on the west shore of Johnsons Lee with supplies for South Point Light.

**East Point**, the eastern extremity of the island, is moderately high, sharp, and bold. A rock with a depth of  $2\frac{3}{4}$  fathoms over it is in the kelp 0.7 mile northward from the point, and a shoal with a depth of  $3\frac{1}{2}$  fathoms over it is about 2 miles northward of the point.

**Skunk Point**, 2.5 miles northward of East Point, is formed by drifting sand. It is difficult to see on dark nights. There are sand beaches westward and southward, and the sand dunes behind the point are 250 feet high. Care should be taken to avoid the sandspit off the point where the sea breaks heavily in bad weather. The current is sometimes strong in the vicinity of the point.

**Bechers Bay**, a broad semicircular bight on the northeastern side of Santa Rosa Island, is about 4.5 miles wide between Skunk and Carrington Points and 1.5 miles in depth. **Southeast Anchorage**, about 1.3 miles westward of Skunk Point, affords protection in southeasterly weather in a depth of about 6 fathoms, sandy bottom. **Northwest Anchorage**, in the western part of the bight and about 1.5 miles southward from Carrington Point, affords fair shelter in northwesterly weather. A wharf at the anchorage has a depth of 16 feet at its outer end. The best anchorage is in depths of 6 to 7 fathoms off the end of the wharf.

**Carrington Point**, the northern point of the island, has a seaward face 0.8 mile in length. It is bold and rocky, and rises rapidly to an elevation of 440 feet.

Foul ground extends about 0.3 mile northward from Carrington Point and terminates in **Beacon Reef**, which has a least depth of  $2\frac{1}{4}$  fathoms over it. The reef rarely breaks, and there is no safe passage behind it.

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**Chart 5116.**—**Brockway Point**, high, bold, and rounding, is about midway along the northern shore of Santa Rosa Island.

**Rodes Reef**, marked by kelp, is a patch of three sunken rocks 1.2 miles east-northeastward from Brockway Point and about 0.8 mile offshore. It breaks in nearly all weather.

**Sandy Point**, the western extremity of the island, is moderately bold and rocky, with a detached rock lying close inshore and sand dunes 400 feet high extending inland. These white dunes are prominent when approaching from southward or westward. Shallow water extends off the point. During the general northwesterly weather, swells form at a considerable distance from the shore. The swell also reaches the point from a southwesterly direction.

An anchorage on the southern side of Sandy Point affords shelter from northerly and northwesterly winds to small vessels, but local knowledge is necessary to avoid outlying rocks.

**Talcott Shoal**, with a least depth of  $1\frac{1}{4}$  fathoms over it, is on the edge of the kelp, about 1.5 miles north-northeastward from Sandy Point. Depths in the vicinity of the shoal range from 4 to 12 fathoms. The shoal breaks only in heavy weather. In calm weather there is little indication of the shoal as the kelp is light and there is very little lumping of the water. A detached kelp patch is 1 mile northward of the shoal.

**Bee Rock**, 0.8 mile off the shore of the island, 3.6 miles southeastward of Sandy Point, is 5 feet high, but is not easily seen. It is surrounded by the kelp that stretches from South Point to Sandy Point. A smaller rock, 10 feet high, is about 100 yards southeastward of the rock. A rock with a depth of 2 fathoms over it is northwestward from Bee Rock. In average weather there is a lumping of the water with an occasional break at this point. Another rock with a depth of  $1\frac{1}{4}$  fathoms over it is close southward of Bee Rock. Several other rocks and shoals exist inside the kelp. Vessels should not go inside the kelp in this area.

**San Miguel Passage**, between Santa Rosa and San Miguel Islands, is about 2.5 miles wide between the ledges which project from Sandy Point and Cardwell Point, the opposite points of the two islands. There is much broken water, with many current rips near these ledges. To avoid Talcott Shoal, vessels making the passage from the southwestward should not allow the outer rock off the western point of Santa Rosa Island to bear westward of south until clear of the shoal. Sailing vessels should avoid this passage as the light airs and calms under the lee of San Miguel Island and the currents frequently combine to set a vessel toward Talcott Shoal.

**San Miguel Island**, the westernmost of the Channel Islands, is the most dangerous to approach. Its western point is about 25 miles southward of Point Conception

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Light. The island is irregular in shape and about 7.6 miles long in a westerly direction, with an average width of about 2 miles; the highest points, 831 and 822 feet, are near the middle of the island and are visible about 35 miles. The island is covered with grass, but there are no trees. The western part has more sand dunes on it than any of the other islands in the group. The shores are bold, broken, and rocky, with a few short stretches of beach, the southern shore being more precipitous than the northern. Several anchorages and boat landings are available along the northern and southern shores.

**Warning.**—All vessels are warned that San Miguel Island and vicinity are dangerous on account of aircraft bombing.

**Cardwell Point**, the eastern extremity of the island, terminates in a low sandy point extending about 0.5 mile eastward of a cliff about 40 feet high. A dangerous reef extends 0.4 mile eastward of the point, and foul ground extends 0.8 mile north-northwestward. A sunken rock and a rock awash are about 400 yards southward of the middle of the sandy point. During prevailing weather breakers off this point are caused by the meeting of the seas.

**Prince Island**, 288 feet high, is 2.6 miles northwestward of Cardwell Point and 0.4 mile off the eastern head of Cuyler Harbor. The island is dark in color and rocky, with a precipitous seaward face.

**Cuyler Harbor** is a bight about 1.2 miles long and 0.6 mile wide on the northern shore southwestward of Prince Island. The anchorage is in the western part of the harbor; the eastern part is foul. Good shelter may be had in southerly weather, but the holding ground is poor. In strong northwesterly weather the heavy swells that sweep around the northern shore and into the harbor make the anchorage dangerous. The harbor is not safe in northerly or easterly winds, which, however, are rare. Water may be obtained at a small spring abreast the anchorage. Prince Island and Harris Point are prominent in the approaches.

**Middle Rock**, awash at  $\frac{3}{4}$  tide, is about 0.5 mile west-southwestward of Prince Island; foul ground surrounds the rock for a distance of about 100 yards. **Can Rock**, 4 feet high, is 0.3 mile southwestward of Prince Island; there is foul ground between the rock and the southern shore of the harbor. Kelp grows profusely all over the bight.

To enter Cuyler Harbor, bring Harris Point to bear  $261^\circ$ , distant 1.7 miles, and the western point of Prince Island to bear  $186^\circ$ , distant 1.3 miles; thence steer  $209^\circ$ , heading midway between Middle Rock and the western point at the entrance, and when the southern point of Prince Island bears midway between Middle and Can Rocks, anchor in depths of 5 to 8 fathoms. The course heads for **Judge Rock**, small and black, near the western end of the sand beach. The western point at the entrance off **Bat Rock**, should be given a berth of about 0.3 mile to avoid the shoal extending eastward for over 300 yards. If desired, anchorage may be made about 0.1 mile farther westward, where better protection is afforded in northwesterly

weather. The passage between Prince Island and the eastern head should be attempted only by small craft.

**Harris Point**, the northern point of the island, is bold and precipitous, rising to a hill, 485 feet high, 1 mile southward of the point. There are no outlying dangers, and the water is deep close-to.

**Wilson Rock**, 19 feet high and black, is 2.2 miles northwest of Harris Point. A reef, showing in two places at lower water, extends about 1 mile west-northwestward from the rock, and foul ground is a short distance northward of the reef. It breaks in any light swell from the northwestward. There is foul ground southward and southwestward of the rock. The sunken rock 0.3 mile southward of Wilson Rock breaks. These are unmarked by kelp, and this locality should not be approached in thick weather, as the dangers rise abruptly from deep water and soundings give no positive warning of their proximity.

**Simonton Cove**, on the northwestern side of San Miguel Island, is a very shallow bight about 2.4 miles wide and 0.6 mile in depth. This cove has considerable kelp and a few sunken rocks. There are several fresh-water springs in the bluffs just above high water. From the southwestern head of Simonton Cove, foul ground extends northwestward for nearly 1 mile.

**Castle Rock**, 180 feet high, is a three-headed islet 1.6 miles north-northeastward from Point Bennett, in the middle of the kelp field, and 0.5 mile offshore. A shoal spot 0.5 mile westward of the rock is near the edge of the kelp.

**Westcott Shoal**, with a depth of  $4\frac{3}{4}$  fathoms over it, is about 0.8 mile northward from Castle Rock. A  $2\frac{3}{4}$ -fathom spot near an oil spring is about 0.6 mile northward from the shoal.

**Point Bennett**, the western point of the island, is a long, narrow, jagged bluff, 74 feet high, rising rapidly to 337 feet. High sand dunes extend inland from the point for 2 miles. There are two rocky islets south of and close under the point, and foul ground extends about 0.5 mile westward and 1 mile northward of the point but inside the limit of the kelp. A lighted whistle buoy is about 0.8 mile southwestward of the point.

**Caution.**—Navigation in this area should not be attempted without local information.

**Richardson Rock**, 53 feet high, white-topped, and of small extent, is 5.5 miles northwestward from Point Bennett. Two smaller and lower rocks are close-to on the eastern side. Richardson Rock rises abruptly from deep water, 30 to 40 fathoms being found within 0.3 mile. The rock is prominent in clear weather, but in thick weather the locality should be avoided, as soundings give no warning of a near approach. A lighted whistle buoy is about 0.5 mile northwestward of the rock.

Anchorage for small craft may be had at **Adams Cove**, immediately eastward of Point Bennett, and at several places along the southern shore of San Miguel Island, but local knowledge is necessary.

**Tyler Bight**, on the southern shore about 1.8 miles eastward of Point Bennett, affords shelter for small craft in

northwesterly weather. Anchor in a depth of 7 fathoms, sand bottom, at the northwestern part of the bight under the high bluff, with **Judith Rock**, at the western entrance of the bight, bearing 265°, 500 yards distant. A large field of kelp is southward and eastward. In moderate northwesterly weather, the winds may attain velocities up to 50 miles an hour 0.5 mile offshore; the sea in the bight, however, is quite smooth.

**Wyckoff Ledge**, with a depth of 9 feet over it, is about 1.4 miles westward from Crook Point and 0.5 mile offshore.

A boat landing may be made on the southern shore of the island in a small cove immediately westward of Crook Point, but there is no anchorage.

**Crook Point**, the southern point of the island, is low and irregular.

**Chart 5202.**—**Santa Barbara Channel** is about 63 miles long and increases gradually in width from 11 miles at the eastern end to 23 miles at the western end. The channel is free of dangers and has depths of 40 to more than 300 fathoms along the recommended steamer track from San Diego and Los Angeles to northern ports.

On the northern side of Santa Barbara Channel is the mainland between Point Hueneme and Point Conception. On the southern side is the northern group of the Channel Islands—Anacapa, Santa Cruz, Santa Rosa, and San Miguel—which break the force of the heavy westerly Pacific swell and afford a lee in winter from the full force of the southeasterly gales.

The eastern entrance to Santa Barbara Channel has a clear width of 2 miles between the 100-fathom curves, and lies between Anacapa Island and Point Hueneme. On the northern side of this entrance is a deep submarine valley, **Hueneme Canyon**, which extends from Point Hueneme in a south-southwesterly direction across the channel. The western entrance to the channel has a clear width of 10 miles between the 100-fathom curves, and lies between Richardson Rock and Point Conception.

**Weather.**—The prevailing winds are westerly and blow nearly every day, especially in the afternoon. Southeastern storms occur in the winter months, and at times the sea is too rough for several days to permit the passage of small vessels.

In the summer months the winds in the channel are wholly different from those outside the islands and off the coast to the northwestward. Under the northern shore, which is protected by the bold range of the Santa Ynez Mountains, the westerly winds do not reach far eastward of Point Conception with much strength but are felt toward the islands, a strong northwesterly wind and heavy swell coming in from the open ocean. The climate in the Santa Barbara Channel, because of this blocking of the winds, is much milder than to the northward along the coast. However, during northwesterly weather boats crossing the channel from the mainland usually encounter

heavier seas as the islands are approached. The belt of rough seas, locally known as **Windy Lane**, lies along the north shores of the islands and is about 6 miles wide. This sea condition is the opposite to that experienced in the crossing from Los Angeles Breakwater to Santa Catalina Island. Strangers are cautioned that good seamanship sometimes calls for returning to the mainland rather than attempting Windy Lane when rough seas are encountered. These westerly winds usually begin about 10 a.m. and grow progressively stronger until sundown.

During heavy northwesterly weather strong squally winds draw down the canyons between Point Conception and Capitan and pass directly offshore, causing a severe choppy sea. Heavy northwesterly gales are often encountered off Point Conception on coming through Santa Barbara Channel, and great changes of climatic and meteorological conditions are experienced, the transition often being remarkably sudden and well defined.

In the fall and winter months, stiff northeasters are occasionally experienced at and near the eastern end of the channel. They come up without warning, usually at night in clear dry weather, and when the barometer is either high or rising rapidly. At such times small boats should be prepared to seek shelter at a moment's notice.

During the summer season, heavy fogs are a common occurrence in the Santa Barbara Channel and envelop the main shore, channel, and islands. Not infrequently the mainland and channel are clear or moderately clear, while the islands alone are hidden. Sometimes all are clear during the day, but wrapped in dense wet fog at night. This condition, the fog lying offshore during the day and enveloping the land at night, is characteristic of the whole southern California coast. The fogs occur mostly during calm weather and light winds, and are generally dissipated by the strong northwesterly winds.

**Currents** in Santa Barbara Channel are variable, depending to a great extent upon the wind. It appears that a weak nontidal flow sets eastward in the spring and summer and westward in autumn and winter.

It has been observed that a strong inshore set prevails on a rising tide in the deep waters of submarine Hueneme Canyon. In general, there are conflicting currents, at times quite strong, around the slopes of the submarine valleys both here and off Point Mugu.

A tidal current sets along the northern shore of Santa Barbara Channel with velocities at strength of  $\frac{1}{2}$  to 1 knot. In heavy northwesterly weather, the current and heavy swells make into the southern side of the western entrance to the channel and along the northern shore of San Miguel Island.

The currents in the vicinity of the Channel Islands frequently follow the directions of the wind, with eddies under the lee of the islands and projecting points. Tidal currents of about 1 knot at strength set through the passages between the islands.

## 6. POINT ARGUELLO TO SAN FRANCISCO BAY, CALIFORNIA

**Chart 5302.**—From Point Arguello to Point Sal, the coast trends northward for 19.5 miles in two shallow bights, separated by Purisima Point. From Point Sal the coast continues northward for 14 miles, then bends sharply westward for 6 miles to Point San Luis, forming San Luis Obispo Bay. Soundings are useful along this stretch of the coast, and between Point Arguello and San Luis the 20-fathom curve can be followed with safety in thick weather. In clear weather the headlands and other natural features can be easily recognized.

**Point Pedernales**, 1.5 miles north of Point Arguello, and the largest of the numerous rocks as much as 300 yards offshore, are very dark and conspicuous alongside the sand dunes immediately northward of the point.

The **Canada Honda**, about 2 miles northward of Point Arguello, is a deep gulch crossed by a railroad trestle easily distinguished when abreast the mouth. From here the coast to Purisima Point consists of a low tableland and sand dunes that contrast strongly with the dark cliffs southward.

**Surf**, 7 miles northward of Point Arguello, is a station along the railroad. The yellow station house is conspicuous.

**Purisima Point**, 10.6 miles northward of Point Arguello, is low and rocky, with reefs extending southeastward for 0.3 mile. The northern side of the point is bare sand. It has been reported that an inshore set is experienced off the coast in the vicinity of the point. From Purisima Point to Point Sal, the coast is sandy and lower than that southward.

**Point Sal**, 9 miles north of Purisima Point, is a bold dark headland marked by stretches of yellow sandstone. From northwestward the headland looks like a low conical hill with two higher conical hills immediately behind it. It rises gradually to a ridge 1,640 feet high, 3 miles to the eastward. From southward the hills are not so well defined. **Seal Rock**, 54 feet high, is a large rocky islet 200 yards off the south face of Point Sal. A small rock is close to the point. Breakers and reefs extend nearly 600 yards southward and westward from Point Sal and 200 yards southwestward of Seal Rock.

Anchorage under Point Sal affords some protection from northwesterly winds in depths of 7 to 9 fathoms, sandy bottom, but is subject to swell. Shoal water extends nearly 0.5 mile westward from the southeastern point of the anchorage. The best anchorage is in a depth of 7 fathoms, 500 yards 303° from Seal Rock and with the northern end of the rock just open of the extremity of Point Sal.

From Point Sal northward the coast is a sand beach backed by low dunes for 14 miles, and then changes to

bold rocky cliffs that curve sharply westward to Point San Luis and form the northern shore of San Luis Obispo Bay.

**Oceano** is a small resort 12 miles northward of Point Sal. The county airport is located here.

**Pismo Beach** is a resort 6 miles eastward of Point San Luis. The pleasure wharf is 1,200 feet long and has a depth of 12 feet at the outer end. There are no facilities for landing at the wharf. The beach is noted for its clams. **Shell Beach** is a small residential settlement 1.5 miles northwestward of Pismo Beach. Two aviation lights, one 4 miles northeast and the other 2.5 miles southeast of the city of San Luis Obispo, are visible from seaward.

**Chart 5386.**—**San Luis Obispo Bay**, a broad bight immediately eastward of Point San Luis, is about 3.6 miles wide in an easterly direction and about a mile in depth. The western shore is high, with rocky bluffs extending 1.5 miles to the mouth of **San Luis Obispo Creek**, where a sand beach extends 0.5 mile to Avila Beach. Eastward of Avila Beach for 1 mile are irregular cliffs 40 to 100 feet high; thence, for about 1.5 miles to the eastern point of the bay is a narrow tableland that ends in cliffs about 40 feet high.

Mount Buchon and **San Luis Hill**, the latter 701 feet high, are prominent at a considerable distance when approaching from southward. From northward, Lion and Pecho Rocks and Point Buchon are prominent.

**Point San Luis**, on the western side of the entrance to San Luis Obispo Bay, is bold and rocky. **San Luis Obispo Light** (35°09.6' N., 120°45.6' W.), 130 feet above the water and visible 17 miles, is shown from a white square tower on a dwelling on the point. The radiobeacon and the fog signal at the light are synchronized for distance finding.

The best anchorage for small vessels is in depths of 21 to 24 feet, muddy bottom, 300 to 400 yards northeastward from Smith Island. Large vessels can anchor between Port San Luis Wharf and Pier 2 according to draft, avoiding the several shoal spots in the area. This anchorage affords good shelter in northerly or westerly weather, but is exposed in southerly or southeasterly weather when heavy swells make anchorage poor. Southeasterly gales occur two or three times during the winter season. A **special anchorage** for small craft is easterly of County Wharf; limits and regulations are given in § 202.120, Chapter 2.

The eastern part of the bay is foul. **Howell Rock**, 13 feet deep and 1.6 miles east of the light, is the outermost danger; a buoy is 0.2 mile southwest of the rock. **Lansing**

**Rock**, 18 feet deep, and **Atlas Rock**, 13 feet deep, are eastward of Smith Island and are marked by buoys. **Souza Rock**, 16 feet deep, is 2.1 miles southeastward of the light. It rises abruptly from depths of 19 fathoms. A lighted gong buoy is 200 yards southwestward of the rock.

**Whaler Island**, 72 feet high, is 125 yards eastward of Point San Luis. The breakwater that extends from the point to the island and thence 650 yards southeastward to a ledge partly bare at low water provides some protection from heavy westerly or southwesterly swells to vessels at anchor or at the wharves. A lighted whistle buoy is about 0.3 mile southeastward from the end of the breakwater.

**Smith Island**, 44 feet high, is 0.2 mile northward of Whaler Island and 150 yards offshore. There are several small houses of fishermen on the island.

**Directions.**—From southward, when Point Arguello Light is 2.8 miles 050°, steer 356° for about 35 miles. This course should lead to the lighted gong buoy southwestward of Souza Rock. Pass 100 yards westward of the buoy and steer 000° for 2 miles for Middle Dock until the warehouse on the end of Port San Luis Wharf bears 300°. Then change course to 321°, heading about midway between the ends of the two wharves, and select anchorage according to draft.

From northward, when San Luis Obispo Light is 3.5 miles 052°, which position may be reached in thick weather by following the 30-fathom curve to the fog signal abeam, steer 065° for about 4 miles, passing 175 yards southeastward of Point San Luis lighted whistle buoy 3, to a position with Middle Dock bearing 000°. Then proceed as directed in the preceding paragraph.

**Port San Luis** is the principal seaport for **San Luis Obispo**, which is 10 miles inland. The port is about 0.7 mile northward of Point San Luis in the most sheltered part of the bay. **Port San Luis Wharf** is privately owned and has a warehouse on the outer end. It is used by commercial and sport fishermen, and small cargo vessels. The berthing space opposite the warehouse has a depth of 23 feet alongside. To reach the wharf, vessels pass 300 yards southeastward of the lighted whistle buoy; then steer 029° for the east stack at Avila Beach, which may be difficult to see, until the end of the wharf bears 305°; then steer 305° for the end of the wharf.

Port San Luis is a suburb of the Los Angeles customs district and a port of entry. The deputy collector of customs and Immigration offices are at San Luis Obispo. The port is used solely for the shipment of oil and a few commodities produced locally, and for the receipt of supplies required for local consumption. Shipments of petroleum products are about 99 percent of the total traffic.

Pier 2, known as Middle Dock and maintained by the Union Oil Company of California, extends 0.5 mile out near the west side of the entrance to San Luis Obispo Creek. The pier has depths of 31 feet along both sides. Care should be exercised in the vicinity of a rocky patch 17 feet deep and about 200 yards inshore from the outer end of the wharf. A light and a fog signal are privately operated on the outer end of the wharf when ships are expected. The wharf is lighted throughout its length

when ships are being loaded. It is not safe for ships to moor alongside in strong northerly weather; vessels usually leave the pier on the approach of such weather and anchor until it moderates. Oil tankers are the only deep-draft vessels that enter the bay and use the wharf. Mooring buoys are used to keep vessels clear of the wharf, and a tug is available for handling lines to the buoys. A tide station is maintained at the outer end of the pier by the Coast and Geodetic Survey.

**Avila Beach**, 1.5 miles northeastward of Point San Luis, is a small settlement of little commercial importance. A number of large oil storage tanks are located inshore from **Fossil Point**. **County Wharf**, built out to a depth of 25 feet and used to some extent by fishing and pleasure boats, is lighted all night. See Appendix for **storm warning** display. Avila Beach and Port San Luis are connected by a narrow road over the old rail bed.

Fuel oil, water, and some provisions can be obtained. Small boats can be hoisted onto Port San Luis Wharf. There are no marine railways in the bay.

Communication is by automobile to San Luis Obispo where rail, bus, and air connections can be made. There are telephone and telegraph facilities.

**Chart 5302.**—From Point San Luis to Point Buchon, the coast trends northwestward for 9 miles and consists of cliffs 40 to 60 feet high. The land rises rapidly from the cliffs to Mount Buchon. There are numerous outlying rocks and sunken ledges that extend more than a mile from the shore in some places.

**Mount Buchon**, a rugged mountain mass between San Luis Obispo Bay, Estero Bay, and the valley of San Luis Obispo, is prominent from either northward or southward. **Saddle Peak**, 1,836 feet high, is visible for a distance of over 40 miles.

A rock 7½ fathoms deep is 1.3 miles southward from San Luis Obispo Light. **Westdahl Rock**, 3 fathoms deep, is a dangerous pinnacle 1.3 miles southwestward from the light. The rock rises abruptly from depths of 10 fathoms. A lighted bell buoy is southwestward of it.

**Chart 5387.**—**Santa Rosa Reef**, 2¾ fathoms deep and 1.4 miles westward from San Luis Obispo Light, rises abruptly from depths of 13 fathoms. **Lone Black Rock**, 2 feet high and of small extent, is about 0.5 mile westward from the light and 0.2 mile offshore.

**Pecho Rock**, 40 feet high, is 3 miles west-northwest from the light and 0.5 mile offshore. A smaller rock, 2 feet high, is 0.3 mile eastward from it. Foul ground, marked by kelp, is between the rocks and the shore.

A sharp prominent dark-gray rock, 111 feet high, is 2.9 miles northwestward of Pecho Rock and 0.1 mile offshore.

**Lion Rock**, 2.6 miles southeastward of Point Buchon and about 0.2 mile offshore, is 240 yards long in a northwesterly direction and 136 feet high. A high rock lies between it and the shore, and a small low rock is 200 yards westward.

**Point Buchon** ends in an overhanging cliff 40 feet high, with a low tableland behind that rises rapidly to a bare hill, 1,280 feet high, about 1 mile to the eastward. There

are a few detached rocks close under the cliffs. A lighted whistle buoy is 1 mile southwestward of the point and about 400 yards westward of a rock  $3\frac{3}{4}$  fathoms deep.

**Estero Bay** is formed by a curve in the coast between Point Buchon and **Point Estero**, 13.5 miles northwestward. The shore of the bay follows a general northerly direction from Point Buchon for about 11 miles, and then turns sharply westward for about 5 miles to Point Estero. The northern part of Estero Bay is fringed with sunken rocks and scattered kelp. The seaward faces of Cayucos Point and Point Estero are cliffs 50 to 90 feet high.

The coast drops abruptly from bold Mount Buchon to a sandy spit bordering Morro Bay and then rises to a bluff-bordered treeless country of rolling hills.

**Morro Rock**, 581 feet high, is a prominent cone off the entrance to Morro Bay. A light, 36 feet above the water and visible 11 miles, is on the south side of it; a fog signal is at the light. **Pillar Rock**, 100 feet high, is about 50 feet from the northern side of Morro Rock.

A sandspit, dry at all stages of the tide, extends northeastward from Morro Rock to the mainland. A  $5\frac{1}{2}$ -fathom spot, 1.2 miles northwestward from Morro Rock, is marked by a gong buoy. From the northwestward, the aviation light 13 miles inland, near San Luis Obispo, is usually the first light seen.

The powerplant stack, 450 feet above water and about 0.5 mile inshore from Morro Rock, is a conspicuous landmark. The top 75 feet of the stack is floodlighted at night and has been reported seen by ships at a distance of 30 miles. A row of peaks extends inland in a south-southeasterly direction from Morro Rock. **Hollister Peak**, 1,409 feet high, is most prominent because of its jagged outline.

**Morro Bay**, a shoal lagoon several miles in extent, is separated from Estero Bay by a narrow strip of sand beach. A Federal project provides for an entrance channel 16 feet deep protected by breakwaters, a main channel 16 feet deep from the entrance channel to opposite the town of Morro Bay, and a channel 12 feet deep from the town to the lower bay. The opening between the outer extremities of the breakwaters is about 300 yards wide. The entrance and main channels are marked by lighted and unlighted buoys. The channels were dredged to project depths in August 1956. The outer half of the west breakwater is reported to be submerged at high water.

**Special anchorage areas** are in the bay; limits and regulations are given in § 202.125, Chapter 2.

Currents in the entrance channel and around the breakwaters are strong at times. Because of the currents and the sea conditions, it is advisable to approach the entrance from the southwestward. Sharp turns should be avoided in the vicinity of the breakwaters, especially in heavy weather.

The town of **Morro Bay** is on the eastern shore near the entrance. The County Wharf, on the north side of the harbor, has a depth of 20 feet alongside. A Coast Guard rescue vessel is stationed at the wharf. Fresh water, gasoline, and oil are available; marine supplies can be obtained locally. A fish pier, with a depth of 16 feet

alongside, and several small landings are abreast the town. A boat works has facilities for hoisting craft up to 15 tons. A submerged pipeline has its inshore end at the powerplant located in the northwestern edge of town. There is a good highway to San Luis Obispo and to the northward along the coast.

A submarine oil-loading terminal is at **Morro Beach**, 1.5 miles northward of Morro Rock. Two other pipes V out from shore to depths of 50 feet off **Toro Creek**, 2.5 miles northward of Morro Rock; a small-boat wharf at the shore end of the V is marked by a light. Buoys are near the outer ends of the pipes. Loading ships lie with their bows in the direction of the prevailing northwesterly wind. Each vessel should have at least five 700-foot lines of good 10- or 12-inch manila line for use as breast and stern moorings. Adequate lines for offshore breast moorings are absolutely essential to prevent damage to the vessel and terminal equipment in case of a southerly wind. Each terminal is connected with the shore station by telephone. Printed instructions are issued, and a mooring master supervises the mooring of vessels.

**Cayucos** is 11.5 miles northward of Point Buchon and in the northeastern part of Estero Bay. The County Wharf, built out to a depth of 12 feet, is used by small fishing boats. The general store has a limited amount of provisions. Travel is by bus over a good highway to San Luis Obispo.

Anchorage with fair shelter from the northward and northwestward may be had in depths of 11 fathoms, sandy bottom, with the prominent white concrete tank on a hill westward of Cayucos bearing  $017^\circ$ .

**Mouse Rock**,  $\frac{1}{2}$  fathom deep, is 0.7 mile westerly of Cayucos, and breaks heavily in all but smooth weather. The rock is marked by a bell buoy.

**Cayucos Point**, 2 miles westerly of Cayucos, is a low rocky promontory. **Constantine Rock**,  $1\frac{1}{4}$  fathoms deep, is 0.5 mile south of the point. The rock breaks heavily in a moderate swell and is marked on its southward side by a buoy.

**Chart 5302.**—From Point Estero northward to the village of Cambria, the bluffs increase in height, and the range of grassy hills is close to shore. The shore is well fringed with kelp; several rocks are close inshore. **White Rock**, 6 miles northwestward of Point Estero, is the most prominent. A pinnacle rock,  $5\frac{1}{2}$  fathoms deep, is 0.7 mile southwest of White Rock.

**Von Helm Rock**,  $2\frac{1}{2}$  fathoms deep, is 7.2 miles northwestward of Point Estero, and nearly a mile offshore. The rock is very sharp and breaks only in the roughest weather. A lighted whistle buoy marks the rock.

**Cambria** is about 1 mile inland, in a grove of pine trees. Some of the streets and buildings are visible from seaward. No landing or anchorage is recommended.

From Cambria to San Simeon, rocks continue close inshore but the bluffs decrease in height and the hills recede from the shoreline. Thick groves of pine trees scatter the hillsides. Of the several rocks offshore, **Cambria Rock**, 10 feet high, and **Pico Rock**, 12 feet high, are the

largest, but they are not prominent from seaward. Shoal patches up to 360 yards surround Cambria Rock and there is foul ground northwestward and southward of Pico Rock. A shoal  $3\frac{3}{4}$  fathoms deep is 580 yards southwesterly from Pico Rock.

**San Simeon Bay**, 14 miles northwestward of Point Estero, is formed by the shoreline curving sharply to the westward, and on the western side by **San Simeon Point**, a low wooded projection extending southeastward. The trees show well from westward, but from southward the warehouses and buildings in the village are more prominent. From westward the point itself is not easily recognized by those not familiar with it.

A lighted bell buoy 0.4 mile southeast of the point marks the entrance to San Simeon Bay. The bay offers good shelter in northerly weather but is exposed to southerly gales in winter. The best anchorage is in the middle of the bight in depths of 5 to 8 fathoms, hard sand.

**San Simeon** is a small village with a group of conspicuous white buildings. The village has a general store where a few provisions may be obtained. The post office is in the warehouse near the shore. In June 1957, the county had begun construction on a 495-foot pleasure pier in the bay. The village has no regular bus service. A prominent castlelike structure with turrets is 2.7 miles northeastward of the village. The structure is lighted at night.

Approaching San Simeon Bay from southward, when 0.5 mile southwestward of Von Helm Rock lighted whistle buoy 12VH, steer  $334^\circ$  for 7 miles with the warehouse at San Simeon ahead. This leads just eastward of San Simeon lighted bell buoy and to the anchorage.

Approaching from northward, when 1.5 miles  $232^\circ$  from Piedras Blancas Light, steer  $105^\circ$  for 6 miles with Pico Creek bridge ahead. When abeam San Simeon lighted bell buoy, round the buoy, steer  $337^\circ$  for the warehouse, and anchor in the middle of the bay. At the anchorage, San Simeon Point should be given a berth of over 0.2 mile and the eastern shore of the bay a berth of 0.5 mile.

The coast from San Simeon Point to Point Piedras Blancas, a distance of 5 miles, is low, with numerous detached rocks lying in some cases over 0.5 mile offshore and usually well marked by kelp.

**Point Piedras Blancas** is a low rocky point projecting about 0.5 mile from the general trend of the coast. **Piedras Blancas Light** ( $35^\circ 39.9' N.$ ,  $121^\circ 17.1' W.$ ), 142 feet above the water and visible 18 miles, is shown from a white conical tower with flat top on the point; a fog signal is at the light.

**Piedras Blancas** are two large white rocks, 74 and 31 feet high, 500 yards offshore and about 0.8 mile eastward of the point. From the southward they look like one rock.

**Outer Islet**, a large and prominent white rock 110 feet high, is close westward of the point. In hazy weather this rock is sometimes visible from the northwestward and southward when the light cannot be seen.

Anchorage for a small vessel, with protection from northwesterly winds, may be had under Point Piedras Blancas in depths of 4 to 5 fathoms, sandy bottom, with the light about 0.2 mile bearing  $280^\circ$ .

A bank, 11 fathoms deep and 3 miles west-northwestward from Piedras Blancas Light, has been reported breaking in a heavy westerly swell.

From Point Piedras Blancas to the mouth of the San Carpoforo Valley, about 8.6 miles, the coast is low, with small bluffs and rolling treeless hills. Numerous rocks, fringed with kelp, extend well offshore. **Harlech Castle Rock**, 0.7 mile offshore 1.5 miles northwestward from Piedras Blancas Light, is the outermost and bares 1-foot at low water. It is not usually marked by kelp. A shoal,  $2\frac{3}{4}$  fathoms deep and 0.5 mile northwestward of this rock, is surrounded by depths of 10 to 12 fathoms.

**La Cruz Rock**, 48 feet high and fairly prominent, is 3 miles north-northwestward of Piedras Blancas Light and just southward of Point Sierra Nevada. A sandy beach inshore from the rock is a fair landing place in heavy northwesterly weather. This stretch of beach is free from breakers. There is a suitable anchorage for small boats east of the northerly limits of the rock in heavy northwesterly or light southerly weather.

**Point Sierra Nevada**, a low inconspicuous bluff, is named for the steamship SIERRA NEVADA which stranded on the rocks 400 yards northwestward of the point.

About 1.8 miles northward of Point Sierra Nevada is a group of isolated buildings inland from **Breaker Point**, which is not prominent nor easily identified.

The off-lying rocks and kelp end at **Ragged Point**, a low projection made conspicuous by the visible rocks and ledges extending about 0.3 mile westward and readily identified since it is the first point southward of the prominent valley, **Arroyo San Carpoforo**.

From Arroyo San Carpoforo northward to the Sur River, about 41 miles, the coast is very bold and rugged. The cliffs are 200 to 500 feet high and the land rises rapidly to elevations of 2,500 to 5,000 feet within 2 to 3 miles from the coast. There are few beaches and few outlying rocks. The highway along the coast is 100 to 500 feet above water and is plainly visible from seaward.

Northbound coasting steamers keep close inshore from Ragged Point to within 6 miles of Point Sur during northwesterly weather, and thus obtain considerable lee.

Two conspicuous landmarks lie between Ragged Point and Cape San Martin. **White Rock No. 1**, 39 feet high and rather sharp, is 0.5 mile offshore and 3.8 miles northwestward of Ragged Point; about 200 yards west of White Rock No. 1 is a rock awash. **White Rock No. 2**, 64 feet high and with a rounded top, is 0.2 mile offshore and 4.5 miles southeastward of Cape San Martin.

**Salmon Cone**, 500 feet high, is a rocky butte close to the shore and 0.5 mile northward of White Rock No. 1. The cone is not conspicuous as it blends into the background.

Several deep narrow gulches indent the coast between Salmon Cone and Cape San Martin. Two of the most prominent, **Villa Canyon** and **Alder Creek**, are crossed by conspicuous white bridges.

A pinnacle rock,  $1\frac{3}{4}$  fathoms deep, is 1.7 miles southeastward of Cape San Martin and 0.5 mile offshore.

**Whaleboat Rock**, baring 5 feet at low water, and **Bird Rock**, 5 feet high, are about a mile southeastward of Cape

San Martin; they are conspicuous only when close inshore. A white barn is prominent in a group of buildings on the bluff just northward of these rocks.

**Cape San Martin**, 16 miles northwestward of Point Piedras Blancas, has a ragged precipitous seaward face and is readily identified by the **San Martin Rocks**. From southward, the inner rock, which is 100 yards offshore, is the most prominent, being 144 feet high and white in appearance. The middle rock is 34 feet high and triangular. The outer rock is cone-shaped, 44 feet high, and 0.5 mile offshore. A light, 200 feet above the water and visible 14 miles, is shown from a white structure near the western extremity of Cape San Martin. The structure is not conspicuous.

**Willow Creek bridge**, 0.3 mile northward of the light, is prominent from westward.

From Cape San Martin to Lopez Point, the coast forms an open bight 10 miles wide and 2 miles in depth, with rugged shores intersected occasionally by deep narrow valleys. There are a few detached rocks but, with two exceptions, they do not extend far from the shoreline.

**Plaskett Rock** is a large prominent white rock, 110 feet high, 2 miles northward of Cape San Martin and 0.3 mile offshore.

**Tide Rock** is a small black rock, awash, 4 miles northward of Cape San Martin and 0.7 mile offshore. The rock is quite sharp and is a menace in smooth weather as there is no breaker to indicate its position.

**Lopez Point** is a narrow tableland, 100 feet high, projecting a short distance from the highland. **Lopez Rock**, 51 feet high, is 0.3 mile offshore and 0.8 mile northwestward of Lopez Point. A shoal 6 fathoms deep is 0.3 mile southwestward of Lopez Rock.

An open anchorage affording some protection from northwesterly weather may be had about 1 mile southeastward of Lopez Point in a depth of 10 fathoms, sandy bottom. Smaller vessels may obtain better shelter by anchoring inside the kelp bed in a depth of about 5 fathoms, sandy bottom, with Lopez Point bearing about 287°. A rock, 1¼ fathoms deep, is in the kelp beds 0.5 mile southeastward of Lopez Point.

**Harlan Rock**, 10 feet high, is 0.3 mile offshore 1.7 miles east-southeastward of Lopez Point. The rock is conspicuous only when approaching the anchorage. A shoal, ¼ fathom deep, is 680 yards southeastward from Harlan Rock.

In clear weather Junipero Serra, Twin, and Cone Peaks are prominent in this vicinity. **Junipero Serra Peak**, 5,844 feet high, is about 10 miles northeastward of Lopez Point; there are pines on and near the summit. The peak is more prominent when well offshore than close in.

**Twin Peak**, 4,700 feet high, and **Cone Peak**, 5,155 feet high, known to coasting mariners as **Twin Peaks**, are about 3 miles back from the coast and 4 miles northeastward of Lopez Point. The peaks are in line on the bearing of 104°. They have scattered trees on their summits and are good landmarks even at night. An observation tower on the summit of Cone Peak is lighted when occupied.

From Lopez Point to Pfeiffer Point, the coast is rugged and high mountains rise precipitously from the shore.

The coastline makes in slightly, forming a shallow bight. Northbound coasting schooners keep about 1 or 2 miles offshore, and thus avoid the fresh northwesterly weather prevalent during the summer months. Several hundred feet above the beach, the slopes are marked by numerous highway cuts.

**Square Black Rock**, 4 miles northward of Lopez Point, is 62 feet high and has a conspicuous cleft in its center. It is the most prominent landmark visible from offshore between Lopez Point and Pfeiffer Point.

**Dolan Cone**, 4.5 miles northward of Lopez Point, is white in appearance and 77 feet above the water.

**Little Slate Rock**, about 7.5 miles northward of Lopez Point, is 4 feet high; **Slate Rock** is 18 feet high. Both rocks are discernible only when close inshore.

A prominent dwelling visible from westward and northward is on a bluff about 5 miles southeastward of Pfeiffer Point. Several conspicuous highway bridges cross the canyons. Some of these, notably an arch bridge over **Dolan Canyon** and a girder bridge over **Andersen Canyon**, are visible well to seaward. The highway leaves the coast about 3.5 miles southward of Pfeiffer Point and does not emerge again until northward of Point Sur.

A deep submarine valley makes in from the southward in the bight 13.5 miles northward of Lopez Point and 4.5 miles southeastward of Pfeiffer Point. The head of the canyon parallels the shore for about a mile and the 100-fathom curve lies only 500 yards from shore; a depth of 47 fathoms is found only 255 yards southward of Grimes Point.

**Chart 5476.—Pfeiffer Point**, 17.5 miles northward of Lopez Point and 6 miles southward of Point Sur, is 400 to 500 feet high, and is the seaward end of a long ridge 2,000 feet high, 1.5 miles northeastward of the point. The point presents a bold, precipitous, light-colored face to seaward. It is distinguished from the southward by its color, and from the northward the pointed summit stands out. The point is more prominent from northward than from southward. **Sycamore Canyon** is immediately northward of the point.

Anchorage, affording fair protection in northerly and northwesterly weather, may be had for small steamers about 0.9 mile east-southeastward of Pfeiffer Point and 0.5 mile offshore in depths of 10 fathoms, sandy bottom, with cable sufficient to clear the kelp line. Small boats may anchor in a bight in the kelp about 0.2 mile offshore, just northward of the anchorage, and obtain better protection. This anchorage is used extensively by local fishermen. Access by land is difficult as the road is poor.

**Cooper Point**, 1.5 miles northwestward of Pfeiffer Point, is marked by a prominent pinnacle 172 feet high and an off-lying rock 18 feet high.

From the mouth of the **Sur River**, 3.5 miles northward of Pfeiffer Point, to Point Sur, the shore is low, with sand beaches and dunes extending eastward. Sunken rocks and ledges extend a mile offshore in some places, between Cooper Point and Point Sur.

**False Sur**, 206 feet high, is a rounded hillock of somewhat similar appearance to Point Sur, and during fog

and low visibility may be mistaken for it. The hillock is close to the beach about a mile southeastward of Point Sur.

**Point Sur** is a black rocky butte 362 feet high, with low sand dunes extending eastward from it for over 0.5 mile. From northward or southward, it looks like an island and in clear weather it is visible about 25 miles. The buildings on the summit of Point Sur may confuse the stranger. **Point Sur Light** ( $36^{\circ}18.4' N.$ ,  $121^{\circ}54.0' W.$ ), 270 feet above the water and visible 23 miles, is shown from a gray stone tower on the seaward face of the point. The radiobeacon and the fog signal at the light are synchronized for distance finding. In June 1957, construction was started on a number of buildings for oceanographic studies about 0.5 mile eastward from the light.

**Pico Blanco**, 3,710 feet high and about 4.5 miles eastward of Point Sur, rises from the long ridge bordering the south side of Little Sur River. The pointed and white-topped peak is prominent from both northward and southward of Point Sur in clear weather.

**Sur Rock**, 1.8 miles south-southeastward from Point Sur Light, is awash nearly 0.8 mile offshore. A shoal, 2 fathoms deep and 0.3 mile westward of Point Sur, breaks heavily in all but very smooth weather. About 0.5 mile southwestward from Sur Rock is a shoal  $4\frac{1}{2}$  fathoms deep that breaks in heavy weather. Extending 0.9 mile from Sur Rock toward Point Sur are many covered rocks that show breakers in moderately smooth weather. Foul ground lies between the rocks and the beach. These dangers are usually well marked by kelp, but it is a dangerous locality in thick or foggy weather, and vessels in this vicinity should stay in depths greater than 30 fathoms.

The bank, 23 to 27 fathoms deep over sand and broken shells, and about 4 miles southwestward of Point Sur, was examined with the wire drag and found to be free of dangers to surface navigation. There is slightly deeper water between it and the point. The 100-fathom curve extends about 8.5 miles to the westward of the point, and at a distance of 12.5 miles there is a depth of 400 fathoms.

**Chart 5402.**—The coast trends north-northwestward from Point Sur for 17 miles to Point Cypress, then northeastward for 4 miles to Point Pinos. Monterey Bay is a broad open bight 20 miles wide between Point Pinos and Point Santa Cruz. The shores decrease in height and boldness as Point Pinos is approached, while those of Monterey Bay are, as a rule, low and sandy. The valleys of Salinas and Pajaro Rivers, which empty into the eastern part of Monterey Bay, are marked depressions in the coastal mountain range and are prominent from a considerable distance seaward. From Point Santa Cruz the coast curves westward and northward for about 23 miles to Pigeon Point, and then extends for about 25 miles in a general north-northwesterly direction to Point San Pedro, the southern headland of the Gulf of the Farallones.

Between Point Cypress and Point Pinos the coast is bold and the 30-fathom curve is less than a mile from

shore in many places; a deep submarine valley extends into Carmel Bay and another heads in Monterey Bay. Northward of Monterey Bay, depths are more regular, and the few dangers extend less than a mile from shore.

**Chart 5476.**—Just north of Point Sur are a sandy beach and bluff that continue for about 1.8 miles to the **Little Sur River**, where the coast becomes bold, the 30-fathom curve lying in many cases less than a mile from shore. The highway returns to the coast just north of Point Sur and is visible from seaward until it reaches Carmel Point. It is marked by a number of bridges.

**Ventura Rocks**, about 2.2 miles northward of Point Sur, are two rocks close together, about 0.6 mile offshore. The northern rock is conical-shaped and 12 feet high. It is fairly conspicuous when seen from the northward with the sand bluff north of Point Sur as a background, but when seen from the southward it is confused with the rocks near the beach and to the northward. The southern rock is awash at high water.

From the noticeable valley of the Little Sur River to Soberanes Point, a little over 7 miles, the coast, although moderately straight, is bold, rugged, and broken, with numerous detached rocks and sunken ledges close inshore.

**Bixby Landing** is identified by a prominent concrete arch bridge showing well to the westward but obscured to the northward. Less prominent is another concrete arch bridge on the north side of the 620-foot hill in this locality.

**Soberanes Point** projects slightly from the general trend of the coast. An isolated, grassy hillock, 200 feet high, lies immediately back of the point, and a grassy ridge extends inland to heights of 1,600 feet.

The coastline from Soberanes Point to Carmel Point, about 4.6 miles, is rugged and broken, but becomes less precipitous and the mountain ridges lessen in height as Carmel Point is approached. Innumerable rocks and ledges extend in some cases over 0.3 mile offshore.

**Lobos Rocks**, a group of small rocky islets, are nearly 0.5 mile westward of Soberanes Point. The two larger islets are white-topped, and each is about 40 feet high. From seaward they rise abruptly from 20 fathoms, but there is foul ground between them.

**Mount Carmel**, 4,417 feet high, is about 7.3 miles northeastward of Point Sur and is round and bare on the summit. Mount Carmel and **Pico Blanco** sometimes can be seen when the lower land is covered by fog or haze.

**Yankee Point**, about 2.5 miles northward of Soberanes Point, projects 0.3 mile from the general trend of the coast. The seaward face is irregular and broken, with numerous detached rocks. **Yankee Point Rock**, 6 feet high, is 125 yards westward of the point. A sunken rock that generally breaks is 0.4 mile southward of the point and the same distance offshore.

**Carmel Point**, the extremity of **Point Lobos** and the southern point at the entrance to Carmel Bay, is an irregular, jagged, rocky point 100 feet high. **Whalers Knoll**, 200 feet high, rocky and prominent, lies on the northern side 0.5 mile from the western extremity of the point. There are rocks off the point. **Whalers Rock**,

12 feet high and 0.5 mile southwestward, is the most conspicuous and is the farthest offshore. This rock is more prominent from northward than from southward.

**Carmel Bay**, an open bight between Carmel Point and Point Cypress, is about 2.8 miles wide and 1.5 miles in depth. The beach before the town of Carmel is low. The land on the south side of the bay is bare and mountainous, and on the north side it is hilly and heavily wooded. Carmel Bay affords shelter in northerly and southerly weather to small craft having local knowledge. In northerly weather anchorage may be had in two coves on the northern shore, **Pebble Beach** on the west and **Stillwater Cove** on the east. These are shallow kelp-filled bights, with rock and gravel bottom. Anchorage is in depths of 1 to 3 fathoms, but local knowledge is necessary to avoid the dangers. Stillwater Cove has a landing at its head with a depth of 5 feet alongside. In southerly weather, anchorage may be had in **Carmel Cove**, a small indentation on the southern shore about a mile eastward of Carmel Point, in depths of 3 to 4 fathoms, rock or gravel bottom, but there is a rock with 1¾ fathoms of water over it near the middle of the cove.

**Carmel Canyon**, a deep submarine valley heads in the southeastern part of Carmel Bay and has depths of 50 fathoms less than 0.3 mile from the beach. The bay is not recommended for strangers, and no directions can be given that would be of any value.

On the northeastern shore of Carmel Bay, and northward of **Carmel River**, is the city of **Carmel**. The lights of Carmel are prominent on a clear night. The Carmel Mission at the southern end of the town is a conspicuous isolated structure. Communication may be had by bus over good highways. Carmel has no rail transportation.

**Point Cypress**, on the northern side of the entrance to Carmel Bay, is comparatively low and extends about 2 miles beyond the general trend of the coast. The cliffs are steep, and numerous detached rocks are close under them. The point is heavily wooded to within 400 yards of its extremity. **Point Cypress Rock**, 12 feet high, is 450 yards northwestward of Point Cypress and is prominent from either northward or southward. A lighted gong buoy is northwestward of the point.

**Chart 5403**.—From Point Cypress to Point Pinos, the coast trends northeastward for about 4 miles. Numerous small rocks and ledges closely border the shoreline. The land is low, with the height of the cliffs decreasing toward **Point Joe**, a rocky extension of the shoreline where the surf breaks heavily. From this point to Point Pinos white sand dunes are conspicuous, even in moonlight, against the dark trees behind them.

**Point Pinos**, on the southern side of Monterey Bay, is low, rocky, and rounding, with visible rocks extending offshore for less than 0.3 mile. The point is bare for about 0.2 mile back from the beach, and beyond that is covered with pines. **Point Pinos Light** (36°38.0' N., 121°56.0' W.), 89 feet above the water and visible 15 miles, is shown from a white tower on a dwelling near the northern end of the point. A radiobeacon is at the

light and a fog signal is 450 yards northwestward. A lighted whistle buoy is off the point.

**Monterey Bay**, between Point Pinos and Point Santa Cruz, is a broad, open roadstead 20 miles in width and 9 miles in depth. The shores are low, with sand beaches backed by dunes or low, sandy bluffs. The lowland extending eastward from about the middle of the bay is prominent from seaward as it forms the break between the Santa Lucia mountain range southward and the high land of the Santa Cruz Mountains northward. The bay is free of dangers, the 10-fathom curve lying at an average distance of 0.7 mile offshore. Submarine **Monterey Canyon** heads near the middle of the bay with a depth of over 50 fathoms about 0.5 mile from the beach near Moss Landing. Shelter from northwesterly winds is afforded at Santa Cruz Harbor and Soquel Cove, off the northern shore of the bay, and from southeasterly winds at Monterey Harbor, off the southern shore. The tidal currents are weak.

A **danger zone** for a firing range is in the southeast part of the bay, and a **naval operating area** is in the northeast part of the bay; limits and regulations are given in § 204.205, Chapter 2.

**Pacific Grove**, an important summer resort, is just southeastward of Point Pinos. The town has no wharves, all shipping being done from Monterey.

**Monterey Harbor**, 3 miles southeastward of Point Pinos, affords good shelter in southerly weather. It is an oil shipping port and has a small amount of domestic commerce, mostly lumber, by water. It is the home port for a large fishing fleet, and has several sardine and tuna canneries.

**Monterey** was the capital of California under the Mexican rule, and for some time after it became a state. The old adobe customhouse is still standing. The radio mast near the inner end of the municipal wharf is a good leading mark when approaching this wharf. The granite **Presidio Monument** is prominent on the brow of a barren hill. A group of large tanks is between the beach and highway at Seaside. A large red-roofed building is conspicuous on the bluff above the shore 4 miles northeastward from the breakwater. Two radio towers, 450 feet high and lighted at night, just inshore from the sand dunes at **Marina**, 6 miles northeastward from the breakwater, are conspicuous in the southern part of Monterey Bay.

A breakwater extends from the foot of Spence Street in an easterly direction for about 1,700 feet. This affords excellent protection in northwesterly weather to the large fishing fleet that bases at Monterey, and is a protection to the municipal wharf. The outer end of the breakwater is marked by a light. Since the construction of the breakwater, the harbor shoals with sand, and is periodically dredged in the vicinity of the fish wharves.

A **special anchorage area** for small vessels is south of the breakwater; limits and regulations are given in § 202.126, Chapter 2.

**Directions**, from southward.—From a position 2.5 miles 240° from Point Sur Light, steer 350° for 17.8 miles when

Point Cypress lighted gong buoy 14CPT should be abeam, distant 1.5 miles. Then steer  $042^\circ$  for 6.0 miles, passing close aboard the lighted whistle buoy. Round Point Pinos at a distance of 1.5 miles from the light and steer  $138^\circ$  so as to leave the lighted bell buoy to southward close-to. When about 0.9 mile past the lighted bell buoy, steer various courses and anchor as desired.

From northward.—From a position 1.3 miles  $222^\circ$  from Ano Nuevo Island lighted whistle buoy 2AN, steer  $141^\circ$  for 32.5 miles, which should lead to a position 1.5 miles  $000^\circ$  from Point Pinos Light. Then steer  $138^\circ$  so as to leave the lighted bell buoy to southward close-to. When about 0.9 mile past the lighted bell buoy, steer various courses and anchor as desired.

See Appendix for storm warning display.

A submerged fuel-oil pipeline with floating connections is at Seaside, about 1 mile eastward of the municipal wharf at Monterey, and tankers moor alongside this float to receive their cargo. Moorings are planted for holding the vessels in position.

San Francisco is the port of entry for Monterey. No customs, quarantine, or immigration officials are stationed at Monterey, but a deputy customs office is there.

A Coast Guard station is near the inner end of the breakwater. A Naval Reserve training center is located at Monterey.

The municipal wharf is about 1,600 feet long and 86 feet wide at the outer end. In 1957 there were depths of 25 feet along the eastern face at the transit shed and 24 feet along the western face. An electric hoist of 3 ton capacity and another of 1,500 pounds are available. Freight and supplies are handled by trucks over the wharf. A fog signal is on the northern end of the wharf. There is considerable surge which at times seriously interferes with loading operations.

Provisions may be had; diesel oil, gasoline, and fresh water are piped to the wharves.

A boat hoist on the large fish wharf can lift boats up to 30 feet long for repairs. A boatyard in Pacific Grove has a marine railway capable of hauling out boats up to 55 feet long. Monterey has several machine shops.

Monterey has good rail, air, and bus connections with San Francisco and points south, and complete telegraph and telephone facilities.

**Moss Landing**, on the eastern shore of Monterey Bay, is 12 miles northward of Point Pinos. The wharf, in poor condition, is used commercially and has a depth of 50 feet at the end. Vessels make fast to mooring buoys and the wharf for handling oil. The large aluminum-colored oil tanks near the wharf are prominent. Back of the dredged harbor, the huge powerplant, with eight tall stacks, two of which are lighted at night, and the nearby mineral processing plant with twin stacks lighted at night, are the most conspicuous objects along this stretch of the coast. Fuel oil for the powerplant is discharged through a submerged pipeline marked by a buoy about 0.8 mile northward from the harbor entrance jetties.

The anchorage off Moss Landing is unprotected, but the holding ground is good. The prevailing winds are north-

westerly, but there are a few southeasterly and northerly gales during the winter.

**Moss Landing Harbor**, 13 miles northeasterly of Monterey, is used by a substantial fleet of fishing boats. There are several fish canneries inside the harbor.

A Federal project provides for a channel 15 feet deep from the entrance in Monterey Bay to the inner turning basin. In May 1958, the controlling depth was 14 feet in the entrance channel, 12 feet in the upper turning basin and 10 feet in the inner channel. A light, 22 feet above the water and visible 10 miles, is shown from a white tower at the entrance to the harbor; a fog signal is at the light. The channels are marked by lighted ranges and buoys.

There are landings in the harbor where fuel and water can be obtained. A marine railway, capable of handling craft up to 100 tons, is available.

**Elkhorn Slough** is a shallow stream that empties into Monterey Bay about 1.3 miles northward of Moss Landing. There is a salt works in the slough. A low fixed concrete highway bridge crosses the slough about at its junction with the lagoon at Moss Landing.

**Palm Beach** is a small resort and camping ground back of the sand dunes 4 miles northward of Moss Landing. Two lighted radio towers show well from seaward.

**Monterey Wind Gap**.—The great mountain barriers northward and southward of Monterey Bay and the receding shoreline to the eastward offer a broad entrance to the cold foggy northwesterly winds of the summer, and they drive over the bay and well into Salinas Valley to the southward.

**Soquel Cove** is in the northeastern part of Monterey Bay, eastward of Santa Cruz Harbor. Fair shelter is afforded in northwesterly weather, but the cove is open in southerly weather. The best anchorage is southeastward of the mouth of **Soquel Creek** in depths of 5 to 6 fathoms, sandy bottom.

At **Seacliff Beach**, about 0.5 mile westward of **Aptos Creek**, a concrete ship with two masts has been beached and filled with sand. A pleasure pier for sport fishing extends from the ship to the shore.

**Capitola** is a summer resort with a post office. The small fishing and pleasure wharf has a depth of 11 feet alongside the landing at the outer end. There are facilities to hoist out pulling boats. Communication is by rail and bus, and there are telegraph and telephone facilities. Houses on the bluffs about 1.5 miles eastward of Capitola are prominent. Two radio towers and an elevated water tank about 0.6 mile northwestward of **Soquel Point** are conspicuous from the east and south.

**Point Santa Cruz**, about 20 miles northward from Point Pinos, is flat, rising in terraces to higher land and terminating in cliffs about 40 feet high; two flat rocks are close under the point, the outer one being the higher.

A light, 55 feet above the water and visible 13 miles, is shown from a white tower near the southern extremity of the point. A whistle buoy is 1.1 miles southeast of the light.

**Santa Cruz Harbor** is on the northern shore of Mon-

terey Bay between Point Santa Cruz and Soquel Point. The Casino building and the roller coaster immediately to the eastward are prominent.

The city of **Santa Cruz** is on the northwestern shore of the bay. **Seabright, Del Mar, and Twin Lakes**, suburbs of Santa Cruz, are along the beach to the eastward.

Good shelter is available in Santa Cruz Harbor in northerly weather, but in northwesterly weather a heavy swell is likely to sweep into the anchorage. There is good anchorage anywhere off the wharf in depths of 5 to 6 fathoms, sandy bottom. During southerly weather there is no protection, and vessels run to Monterey for shelter.

**Directions, from southward.**—From a position 2.5 miles 240° from Point Sur Light, steer 350° for 17.8 miles, when Point Cypress lighted gong buoy 14CPT should be abeam, distant 1.5 miles; then steer 000° for 22 miles for the whistle buoy and thence to the anchorage off the wharf, as desired.

From northward.—From a position 1.3 miles 222° from the Ano Nuevo lighted whistle buoy 2AN, steer 132° and give the coast a berth of over 1.5 miles. Continue this course 13.8 miles, and when Santa Cruz Light bears 076° steer 084° for the whistle buoy and pass nearly 1 mile southward of the light. When the light is abeam, round it to the anchorage off the wharf.

Santa Cruz is not a port of entry and there are no customs, quarantine, or immigration officials stationed here.

A substantial municipal wharf with a cargo shed at its outer end extends out to depths of 28 feet; a fog signal is on the wharf. Landings can be made here in all but heavy southerly weather. Few vessels, other than fishing boats, land at this pier. Due to the ocean swell sweeping around the point, there is usually considerable surge, and heavy lines are required. Provisions and launch fuels may be obtained, and city water is piped to the wharf. Just eastward of this wharf is a small pleasure pier which is the westward end of the boardwalk.

There are no repair facilities except for machine work on launches. Launches up to lengths of 30 feet can be hoisted onto the wharf for hull repairs.

Santa Cruz has rail connection with San Francisco and bus service with the interior.

**Chart 5402.**—From Point Santa Cruz the coast trends westward about 4 miles to Needle Rock Point and then northwestward to Point Ano Nuevo. The shoreline rises from high bluffs, with a few intervening beaches, to a low flat tree-covered mountain range.

About 3.5 miles westward of Point Santa Cruz is an oil derrick that is prominent by day in clear weather.

**Needle Rock Point** is 4 miles westward of Santa Cruz Light; a slender pillar of rock stands a short distance seaward from the face of the cliffs; another lower pinnacle is about 200 yards eastward. Neither is distinguishable when abreast it.

**Sandhill Bluff**, about 6.5 miles westward of Santa Cruz Light, is composed of sandstone cliffs about 50 feet high,

with a rounding irregular hillock of white sand near the edge of the cliffs; this hillock is white on the northwestern side, and is covered with brush and grass on the southeastern side. Neither this bluff nor Needle Rock Point is a good landmark.

About 3.5 miles northwestward of Sandhill Bluff and 8.5 miles southeastward of Point Ano Nuevo are the large cement works at **Davenport**. The buildings are conspicuous from seaward; smoke from the plant can be seen a long distance off by day, and many lights are visible at night. A large aluminum-colored oil tank and a tall stack are prominent marks. A steel wharf, 2,300 feet long and with a depth of 50 feet at its end, enables vessels to load bulk cement; there are pipelines for both cement and oil. Because of the current and ground swell, vessels must lay off the dock; mooring buoys are provided.

A submarine pipeline for unloading fuel oil is off **Scott Creek** about 2 miles northward of Davenport. The end of the pipeline and the ship moorings are marked by buoys. The oil is pumped to the cement works storage tanks at Davenport.

**Loma Prieta** is a prominent flat-topped peak surmounting the high mountainous ridge about 13 miles north-northeastward of Santa Cruz Light. It is 3,806 feet high and is the predominating mountain feature of this section. A fire observation tower is on the top of the peak.

**Waddell Creek**, eastward of Point Ano Nuevo, is in a narrow steep-sided valley. The high whitish bluffs, immediately northward, are quite prominent.

**Point Ano Nuevo** is formed by sand dunes, 20 to 100 feet high. Two radio masts are on the point. A low black rocky islet is 0.3 mile off the point. Foul ground extends northwestward and southeastward from the islet. A white square pyramidal skeleton 49-foot tower is on the islet. Near the tower is a group of red-roofed white houses. A lighted whistle buoy is about 0.8 mile southward of the tower.

Anchorage, with protection from northerly and northwesterly winds, can be had in the bight southward of the point in depths of 8 fathoms, with the tower bearing 276°, distant 0.8 mile. The kelp bed and reef, extending a little over 0.5 mile southeastward from the islet, break the force of the swell.

**Pigeon Point** is about 5 miles northwestward of Point Ano Nuevo, the coast between them low and rocky. This point is about 50 feet high and rises in a gentle slope to the coastal hills. Several moderately large detached rocks extend 350 yards southwestward. Pigeon Point was named from the wreck at this place of the clipper ship **CARRIER PIGEON**.

**Pigeon Point Light** (37°10.9' N., 122°23.6' W.), 148 feet above the water and visible 18 miles, is shown from a white conical tower on the end of the point. The radiobeacon and fog signal at the light are synchronized for distance finding. The light cannot be seen in the bight eastward of a line joining Pigeon Point and Pillar Point, about 20 miles to the northward. The light station buildings on Pigeon Point are white with red roofs. A group of farm buildings is about 0.5 mile eastward. A

row of trees, conspicuous against a background of barren hills, is about 500 yards northeastward of the light.

From Pigeon Point to **Pescadero Point**, about 4 miles, the coast is nearly straight and is composed of reddish cliffs, with numerous outlying sunken and visible rocks. A rocky patch with a depth of  $1\frac{1}{4}$  fathoms over it is about 0.8 mile south by west of Pescadero Point; a  $6\frac{1}{2}$ -fathom rocky patch is about 0.7 mile west-southwestward of the point. A long-range aviation radiobeacon is about a mile eastward of Pescadero Point.

From **Pescadero Creek**, about 1.5 miles northward of Pescadero Point, the coast for 8 miles northward becomes more broken and rugged, with yellow or white vertical cliffs. A prominent whitish cliff over 100 feet high is about 7.5 miles northward of Pescadero Point. About 9 miles northward of the point is the prominent white building of the Marine Coastal Receiving Station (KBS), surrounded by numerous antenna poles.

The coast is broken by several small streams in deep steep-sided valleys. Northward of the high cliff, a low flat tableland extends northward for about 9 miles and then bends sharply westward to Pillar Point, forming Halfmoon Bay. The land consists generally of grass-covered rolling hills with ranch houses and cultivated ground in the foreground.

**Chart 5520.**—**Halfmoon Bay** is northward of **Miramontes Point** and eastward of Pillar Point. The bay affords a good shelter in northerly and northwesterly weather, but is exposed and dangerous in southerly weather. There is no waterborne traffic, all shipments being handled by truck to San Francisco.

**Pillar Point**, the southeastern extremity of a low ridge about 2.5 miles long, is about 20 miles northward of Pigeon Point. It is 181 feet high, with several black rocks extending over 300 yards southward. From northward these show as three or four rocks, but from southward appear as one. **Sail Rock** is the largest and southernmost rock, a pillar being situated at its southwestern extremity. Foul ground, well marked by kelp, extends southeastward for over a mile.

A bell buoy, 0.65 mile southwestward of Pillar Point, and a lighted whistle buoy, about 1 mile southeastward, mark the dangers extending from Pillar Point.

**Southeast Reef** is 650 yards long in a general northwesterly direction and has an average width of 100 yards. It has depths of 4 to 18 feet over it, and a pinnacle rock at the southeastern end is awash at extreme low tides. The northern extremity is 1.6 miles southeastward of Sail Rock. Depths of 30 feet and less extend northwestward from the reef for over 0.4 mile. A buoy is about 0.2 mile northwestward from the northern end of the reef. Another buoy is about 0.2 mile southeastward of the southern end of the reef.

Masters of coasting steamers bound for San Francisco do not use the South Channel over the bar if they see breakers on this reef.

**Directions, from southward.**—From a position 2.1 miles  $250^\circ$  from Pigeon Point Light, steer  $355^\circ$  to a position

0.25 mile eastward of the buoy marking the southeastern extremity of Southeast Reef. Then steer  $334^\circ$  heading for the wharf at the mouth of Denniston Creek, and select anchorage as desired.

From northward.—Round Point Montara at a distance of 2 miles. Steer  $151^\circ$  for 5.2 miles, passing 1.4 miles southwestward of Pillar Point. When the large hotel building at Miramar bears  $055^\circ$ , steer for it on that bearing and pass 200 yards southward of the lighted whistle buoy; then haul northward and anchor in the northern part of Halfmoon Bay as desired.

A few pilings of an old wharf and the frame hotel building are on the eastern shore of the bight at **Miramar**. There are three wharves, with depths of 7 to 10 feet at the outer ends, built out from the north shore of the bay at the village of **Princeton**. The middle wharf is unsafe and is not used. The western wharf has an inactive cannery at its outer end, and hoists are available for lifting small boats. Oil and gasoline are available, but there is no space for storage and no facilities for repairs. The wharves are used by commercial and sport fishing boats. Liquid fertilizer is manufactured in the village.

An approved project provides for two protective breakwaters at Halfmoon Bay, but construction had not started in 1958.

The town of **Halfmoon Bay** is about 2 miles southward of Miramar and nearly 1 mile inland. The buildings in the town are prominent. A limited amount of provisions can be obtained but coal and water are not available. The best anchorage is under Pillar Point, but vessels must be prepared to leave on the approach of southerly weather.

**Chart 5402.**—**Montara Mountain**, 1,952 feet high, is about 4.5 miles northward of Pillar Point and 2.5 miles inland; it is covered with grass and bare of trees. From the southward it shows as a long ridge with several small elevations upon it, but from the northwestward, it appears as a flat-topped mountain with four knobs on the summit. It is a prominent feature in approaching the entrance to San Francisco Bay.

**Point Montara**, about 2.8 miles northward of Pillar Point, is the seaward end of a spur from Montara Mountain and the northwestern extremity of the ridge forming Pillar Point. It terminates in cliffs about 60 feet high with numerous outlying rocks. Sunken rocks and ledges lie 0.8 mile westward of the point and extend in a northwesterly direction for about 1.5 miles. This is a dangerous locality in thick weather, and extreme caution should be used when inside the 30-fathom curve.

**Point Montara Light** ( $37^\circ 32.2' N.$ ,  $122^\circ 31.1' W.$ ), 70 feet above the water and visible 14 miles, is shown from a white conical tower on the point; a fog signal is at the light. A conspicuous white tank is near the station and in the daytime is more prominent than the light.

From Point Montara to Point San Pedro the coast is bold and rugged, rising sharply from the sea to the spurs extending from Montara Mountain. **Devils Slide** is light-colored and is the highest bluff in this locality. The highway cuts are distinctive features in the bluffs. There

are no outlying rocks or dangers other than those off Point Montara.

**Point San Pedro** is a dark, bold, rocky promontory, 640 feet high. It is the seaward termination of Montara Mountain and is an excellent mark in clear weather from 5

either northward or southward. A large triple-headed rock, about 100 feet high and white on its southern face, projects 0.3 mile westward from the point. A rocky area, which breaks in a heavy swell, is reported to exist about a mile northward of the point.

## 7. SAN FRANCISCO BAY, CALIFORNIA

**Chart 5502.**—The approaches to San Francisco Bay are in the area bounded on the south by Point San Pedro, on the west by the Farallon Islands, and on the north by Point Reyes. The **Gulf of the Farallones** is about 35 miles long in a northwesterly direction, has a greatest width of 23 miles, and connects eastward with San Francisco Bay through the narrow entrance of the Golden Gate. The prominent landfalls and the numerous aids make navigation of the approaches comparatively simple in clear weather. In thick weather the currents, variable in direction and velocity, render the approaches difficult and dangerous, and strangers should either lie off and wait for clear weather or take a pilot. Point Reyes, Mount Tamalpais, the Farallon Islands, Point San Pedro, and Montara Mountain are all prominent in clear weather and frequently can be used to establish a vessel's position when the lower land near the beach is shut in by fog or haze.

The long-range radiobeacons, synchronized for distance finding at Farallon Light Station and on San Francisco Lightship, are valuable aids in any weather.

An aviation light on **Mount Diablo** is 30 miles 083° from the Golden Gate and should be visible in clear weather to vessels approaching San Francisco. Drakes Bay, eastward of Point Reyes, and Bolinas Bay, eastward of Duxbury Point, are open bights affording shelter in northwesterly weather, but are exposed in southerly weather.

**Mount Tamalpais**, about 7 miles northward of Point Bonita, is a prominent mountain 2,604 feet high. In clear weather it is visible for over 60 miles. From southward and westward it shows three summits of which the westernmost is the highest and the easternmost is the sharpest. It is covered with bushes and scrub trees, giving it a dark appearance which contrasts strongly with the surrounding hills, especially in summer when the hills assume a light reddish color. The lookout tower on the eastern side of Mount Tamalpais is prominent from the central portion of San Francisco Bay.

From Point San Pedro to Point Lobos, the coast extends about 11.5 miles in a northerly direction. The first 8 miles consist of whitish bluffs which at a point 5 miles northward of Point San Pedro reach a height of 600 feet. A sand beach extends from these bluffs to Point Lobos. Back of the beach and shore boulevard the higher ground is built up solidly with white houses.

**Shelter Cove** is on the north side of Point San Pedro. It has been reported that boats can find shelter with good holding ground in this small cove from easterly storms. Shelter is also obtained from southerly storms because of the protection of **San Pedro Rock**, a small islet 150 feet high, close off the point. The bottom of the cove is gray sand to within 0.2 mile of the shore.

**Chart 5532.**—**Point Lobos**, on the south side of the entrance to the Golden Gate, is high, rocky, and rounding, with black rugged cliffs at its base. A marine lookout and reporting station is on the ridge back of the point; several houses and a large water tank on a high scaffolding are on the summit. **Seal Rocks**, a group of high rocky islets, are close under its western face. The **Cliff House** and several other prominent buildings are on and near the southern point of its western face. A small pier carrying a salt water intake pipeline is about 500 yards southward of the Cliff House.

**Chart 5598.**—The **Farallon Islands** are rocky islets extending about 7 miles in a northwesterly direction. **Southeast Farallon**, the largest of the group, is about 18 miles south of Point Reyes Light and 23 miles west-southwest of Point Bonita. Actually it consists of two islands separated by a narrow gorge impassable even for small boats. The eastern island is the larger, is pyramidal in shape, and is 350 feet high. It is surmounted by **Farallon Light (37°42.0' N., 123°00.1' W.)**, 358 feet above the water, visible 26 miles, and shown from a white conical tower. A radiobeacon 290 yards southwestward and a fog signal 360 yards southerly of the light are synchronized for distance finding. The fog signal and dwellings of the attendants are on the lowland on the southern side. The fog signal can seldom be heard northwestward of the island.

**Caution.**—Do not rely on radiobeacon bearings when within 0.5 mile of Golden Gate Bridge.

The western and smaller island is known as **Maintop**, 220 feet high. **Sugarloaf**, 200 feet high, the largest of several rocky islets lying close-to, is northward of the light and forms a small cove where anchorage can be had in depths of 8 fathoms on the line between the points. This islet has a small sand beach where boats can be landed. Another landing is on the southern side of the island. Both landings are marked by derricks and landing stages.

**Hurst Shoal**, 0.6 mile southeastward of the light, is of small extent, is 4 fathoms deep, and breaks only in heavy weather.

**Middle Farallon**, about 2.3 miles northwestward of the light, is a single black rock 50 yards in diameter and 20 feet high. A rock 5 fathoms deep is 0.5 mile southwestward from it.

**North Farallon**, about 6.5 miles northwestward of the light and 14 miles south by west of Point Reyes, consists of two clusters of bare precipitous islets and rocks extending in a west-northwesterly direction for 0.9 mile, with an average width of 0.3 mile. The highest rock, 155 feet, is in the southeastern group.

**Noonday Rock**,  $2\frac{1}{4}$  fathoms deep, is 3 miles north-westward of the northernmost rock of the North Farallon group and 14 miles southwestward of Point Reyes. It rises abruptly from depths of 20 fathoms and is the principal danger in the approach from northward. A lighted whistle buoy is 400 yards southwestward of the rock, which is the shallowest point of **Fanny Shoal**. The shoal is about 2 miles in extent, and has general depths of 10 to 30 fathoms. Noonday Rock derives its name from the clipper ship of that name which struck the rock in 1862 and sank within an hour in 40 fathoms.

**Chart 5532.—San Francisco Lightship ( $37^{\circ}45.0' N.$ ,  $122^{\circ}41.5' W.$ )**, is in 108 feet about 3 miles outside the bar and west-southwestward of the entrance to the Main Ship Channel. The vessel has a red hull, with the words SAN FRANCISCO on each side, and two masts with a gallery at each masthead. The light is 65 feet above the water and is visible 14 miles; the radiobeacon and the fog signal are synchronized for distance finding. The code flag signal and radio call is NNCS. Storm warnings are displayed daytime only.

The San Francisco Bar is semicircular; the area with depths of 36 feet or less extends from 0.5 mile westward of Point Bonita to nearly 1 mile offshore 3 miles southward of Point Lobos. The extreme outer point is about 5 miles west-southwestward of Point Bonita. The northern part, the shoalest, is known as **Potatopatch Shoal**, within the limits of which is a small area covered less than 24 feet. The name is said to have originated from the fact that schooners from Bodega Bay frequently lost their deck loads of potatoes while crossing it. Over the remainder of the bar, except the dredged portion of the Main Ship Channel, depths range from 31 to 36 feet, the deepest water being near the southern end, which is nearly a mile wide. Depths in the approach decrease gradually to about 48 feet and then abruptly to the crest of the bar.

The **Golden Gate** is the passage between the ocean and San Francisco Bay. The western end is 2 miles wide between Point Bonita and Point Lobos, but the channel width is reduced to 1.5 miles by Mile Rocks, off Point Lobos, and thence it contracts to less than 0.9 mile between Lime Point on the northern shore and Fort Point on the southern. The depths increase from about 118 feet at the western end to over 360 feet near the eastern end. These depths, combined with the currents, render sounding of little value in thick weather. The northern shore is bold and rugged, with reddish cliffs rising abruptly from the water's edge to heights of over 600 feet.

**Mile Rocks** are two small black rocks 0.35 mile north-westward of the sharp projecting point off Landsend on the northern face of Point Lobos. The rocks are 20 feet high and about 100 feet apart, with deep water reported between them.

**Mile Rocks Light ( $37^{\circ}47.6' N.$ ,  $122^{\circ}30.6' W.$ )**, 78 feet above the water and visible 14 miles, is shown from a white cylindrical tower on dwelling on the outer and larger rock; a fog signal is at the light. When vessels

are in distress, the fog signal will sound 5 or 6 short blasts and one longer blast to call the Coast Guard.

A rock, 6 feet deep, is 130 yards eastward of Mile Rocks Light. The passage between Mile Rocks and Point Lobos should not be attempted, as a rock, 14 feet deep, 300 yards southward from Mile Rocks Light, is nearly in the middle of the passage, and covered and visible rocks extend over 300 yards from the shore.

The southern shore of the Golden Gate extends in a gentle curve eastward to Fort Point, forming a shallow bight known as **South Bay**. The cliffs rise abruptly from narrow beaches, except near the middle of the bight where a valley terminates in a sand beach about 0.3 mile long. Sailing vessels are sometimes obliged to anchor here when becalmed, or when meeting an ebb current, to avoid drifting onto Mile Rocks, but the anchorage is uncomfortable and it is difficult to get under way from it.

**Fort Point** projects slightly from the high cliffs, and is marked by a square red brick fort with a stone seawall in front. The fort is obscured by the southern end of the Golden Gate Bridge. A Coast Guard station is a short distance eastward of Fort Point.

The **Golden Gate Bridge** crosses the Golden Gate from Fort Point to Lime Point. The horizontal clearance between towers is 4,028 feet; the towers are 740 feet above the water. The overhead clearance at the center is about 232 feet. The center span is marked by two navigational lights, one on the seaward side, the other on the bay side of the bridge; there is also a fog signal at the center. A light and fog signal are on the channel side of the south pier. The south pier and the midchannel fog signals are synchronized, the characteristic signal of one occurring successively after the characteristic signal of the other. Aviation obstruction lights mark the tops of the bridge towers.

**Chart 5502.—Cordell Bank**, about 27 miles northwestward of Farallon Light, has a least depth of 22 fathoms over it. Between the bank and Point Reyes the depths increase to 66 fathoms; outside the bank the depths increase rapidly to 500 fathoms about 3 miles from the bank.

**Chart 5599.—Point Reyes**, 18 miles north of Farallon Light, is a bold dark rocky headland 612 feet high at the western and higher extremity of a ridge running in an easterly direction for 3 miles. There is lowland northward of it, so that from northward and southward, and from seaward in hazy weather, it usually appears as an island. It is visible for over 25 miles and can be seen off Point Bonita, the northern headland at the entrance to the Golden Gate.

**Point Reyes Light ( $37^{\circ}59.7' N.$ ,  $123^{\circ}01.3' W.$ )**, 294 feet above the water and visible 24 miles, is shown from a white pyramidal tower on the western extremity of the point. A radiobeacon is at the light and a fog signal is on the western pitch of the point about 30 feet below the light.

A Coast Guard station is on the western side of Drakes Bay, about 2.4 miles eastward of Point Reyes Light.

Two sunken rocks with about 3 feet of water over them lie about 275 yards westward of Point Reyes Light. These rocks break in a moderate swell.

**Drakes Bay**, named after Sir Francis Drake who anchored here in 1579, affords shelter in northwesterly weather in 5 to 6 fathoms, sandy bottom. From the western headland, which is the eastern termination of the ridge forming Point Reyes, high white cliffs extend northward and eastward in a gentle curve for 6 miles and terminate in high white sand dunes. Several lagoons on the northern shore empty through a common channel which is navigable by light-draft vessels having local knowledge. The western point is 230 feet high, with **Chimney Rock**, a detached rock, lying close under the eastern extremity. A reef which breaks in moderate weather extends more than 0.5 mile eastward of the point. The bay is used extensively by vessels in heavy northwesterly weather and many fishing boats operate from here during the season. Fuel oil and water, but no stores, are available at the fish wharf in the harbor 0.5 mile westward of Chimney Rock. Shelter has been obtained in southeasterly weather, close under the western point, in 4 fathoms, sticky bottom, the force of the swell being broken by the reef off the point. This anchorage, however, is not recommended. No directions for entering are necessary, other than to give the point a berth of not less than 0.8 mile to avoid the reef previously mentioned.

From the sand dunes near the eastern part of Drakes Bay, the rocky cliffs, 100 to 200 feet high, extend eastward and southward for about 6 miles to Double Point.

**Double Point** has two high spurs about 0.4 mile apart extending 200 and 300 yards from the coastline. A small island 47 feet high is 250 yards off the northern spur. The southerly spur, longer and lower than the other, has a rock close under the point and nearly connected with it at low water.

From Double Point to Bolinas Point, about 3.5 miles, the coast is bold with high rocky cliffs bordered by narrow sand beaches and no outlying dangers outside the 10-fathom curve.

**Bolinas Point**, 160 feet high, is the western point of the comparatively level tableland extending eastward to Bolinas Lagoon. Owing to its proximity to Duxbury Point, it is not particularly prominent. The radio towers of a large commercial transmitting station about 0.6 mile northward of the point are prominent. There are about 20 steel towers and nearly 100 wooden towers covering an area about 0.5 mile square, with no apparent design when viewed from seaward and no particularly prominent tower. The power house, brown with red roof, is about the most conspicuous part of this station.

From Bolinas Point, the coast extends southeastward for about 1.3 miles to Duxbury Point.

**Duxbury Point**, 160 feet high and yellowish, is 16.5 miles southeastward of Point Reyes. The point is the southern extremity of the tableland westward of Bolinas Lagoon.

**Duxbury Reef**, upon which many vessels have been lost, is long, narrow, and partly bare at low water. It

extends 1.2 miles southeastward from Duxbury Point. A ledge 30 to 36 feet deep extends southward from the reef, its outer end being 1.4 miles south of the point. A lighted whistle buoy is about 2 miles south of Duxbury Point. Great care should be exercised in passing this area.

**Chart 5532.—Bolinas Bay**, immediately eastward of Duxbury Point, is an open bight about 3.5 miles in width between Duxbury and Rocky Points, and about a mile in depth. It affords shelter in northwesterly weather in depths of 24 to 36 feet, sandy bottom, with Duxbury Point about 1.5 miles 277°. This anchorage is seldom used. The only directions necessary are to keep clear of Duxbury Reef and the dangers off the edge of the reef.

**Bolinas Lagoon** is separated from the bay by a narrow strip of sandy beach that is cut by a narrow shifting channel near the bluffs about the middle of the bight. The lagoon is shoal and is of little commercial importance. It is entered by small light-draft vessels with local knowledge. In June 1957, the controlling depth at the entrance was reported to be 3 feet. **Stinson Beach**, a small village, is at the southeast end of the lagoon, and **Bolinas** is on the western shore a short distance inside the entrance.

**Rocky Point**, about 3.5 miles southeastward of Duxbury Point, is 100 feet high and shelving. Numerous detached rocks are within 200 yards of the cliffs, which are high and precipitous on the southern side of the point.

From Rocky Point to Point Bonita, the coast is very rugged and broken. The cliffs, which are the seaward ends of spurs from Mount Tamalpais, rise to heights of over 500 feet and are cut by deep narrow valleys stretching inland.

**Point Bonita**, on the north side of the entrance to Golden Gate, is a black sharp precipitous cliff 100 feet high, increasing to 300 feet on its seaward face, 0.3 mile northward. From northwestward it shows as three heads, the southern one being cut down to form a foundation for the light. **Point Bonita Light** (37°48.9' N., 122°31.7' W.), 124 feet above the water and visible 17 miles, is shown from a white tower. A radiobeacon and a fog signal are at the light. A single radio mast 134 feet high is near the light. In the summer the cliffs are white with bird droppings, but the first heavy rain restores them to their natural black color. There are a few detached rocks surrounding the point, but these do not extend over 200 yards offshore.

**Bonita Cove**, immediately eastward of Point Bonita, is occasionally used as an anchorage by small vessels. The anchorage is close under Point Bonita in depths of about 36 feet and is used considerably by the pilot boats. There are two wharves, in poor condition and rapidly deteriorating, in the western part of the cove.

**Point Diablo**, about midway between Lime Point and Point Bonita, projects sharply into the strait for about 0.1 mile. The point rises abruptly to a height of over 200 feet, with deep water on all sides. A light, 85 feet above the water and visible 15 miles, is shown from a

white house on the end of the point; a fog signal is at the light.

From Point Diablo to Lime Point, the shore is a shallow bight with steep cliffs. Near the middle of the bight the cliffs are cut by a narrow valley which ends in a low beach at the shore.

**Lime Point** is high and precipitous, and rises abruptly to a height of nearly 500 feet in less than 0.3 mile. **Lime Point Light** ( $37^{\circ}49.5' \text{ N.}, 122^{\circ}28.6' \text{ W.}$ ), 19 feet above the water and visible 9 miles, is shown from a white brick building at the end of the point; a fog signal is at the light.

**Boundary lines for Inland Waters.**—The line established for San Francisco Harbor is described in § 82.130, Chapter 2.

**Channels.**—In smooth weather the bar can be crossed anywhere southward of the western end of Potatopatch Shoal, but in heavy weather use is made of the improved channels.

The **Main Ship Channel** is in most general use. In thick weather it is easily entered owing to the short run from the lightship to the bar. A Federal project provides for a channel 50 feet deep and 2,000 feet wide on the bearing  $070^{\circ}$  toward Alcatraz Light. In November 1957 the controlling depth was 43 feet.

**South Channel** is an approach to San Francisco Bay from southward of Point Lobos. It is about a mile offshore and extends parallel with the shore. Vessels entering this approach and heading for Point Bonita Light on a bearing of about  $357^{\circ}$  should find depths of 34 feet or more. Buoys mark the critical points. Deep-draft vessels may be taken through this channel with a southwesterly swell and, although vessels may roll considerably, they pitch very little and hence lessen the possibility of touching the bottom from that cause. The South Channel, however, should not be used when the bar is rough and inclined to break, as heavy breakers on the bar sometime sweep across the channel.

The **Bonita Channel** is between the eastern end of Potatopatch Shoal and the shore northward of Point Bonita. It is about 2 miles in length and varies in width from 0.3 mile at its southern end, abreast Point Bonita, to 0.6 mile at the northern end. The navigable width is reduced to less than 0.2 mile by several rocky patches, the outer one being **Centissima Reef**, 33 feet deep. **Sears Rock**, 19 feet deep, is 200 yards north-northwestward of Centissima Reef. Near Centissima Reef, a rock 33 feet deep has been reported which is marked by a lighted bell buoy.

The southern portion of the channel is marked by a lighted range bearing  $137^{\circ}$ ; Mile Rocks Light is the front range, and a light shown from a white wooden building on the bluff is the rear range. The rear light, 326 feet above the water, is visible only on the range line.

Although Bonita Channel has deeper water, 39 feet was about the most that could be carried through safely between the aids in 1957. The channel has been used by some of the largest vessels on the Pacific.

**Approaching San Francisco Bay.**—Vessels approaching San Francisco Bay in clear weather will experience no

difficulty in making a landfall. **From southward**, vessels should make the lightship or, if desiring to cross the bar southward of the Main Ship Channel, make Point Bonita Light and use South Channel, or cross westward of the channel. **From seaward**, vessels should make the Southeast Farallon Island and shape a course for the lightship. **From northward**, vessels will make Point Reyes, and when abreast of the point can lay a course for the lightship, observing proper care to avoid Noonday Rock northwestward of the North Farallon; or they may use Bonita Channel.

In the approaches to San Francisco Bay, ships equipped with radio-direction finders may obtain checks on their positions by cross bearings on the radiobeacons at Farallon Light and San Francisco Lightship.

In thick weather, which prevails during a considerable portion of the year, vessels approaching San Francisco from any direction must exercise great caution. The currents are variable and uncertain, at times attaining considerable velocity. A detailed description of the conditions which may be encountered and the precautions which should be observed are given later.

**From southward**, vessels make the fog signal at Pigeon Point and lay a course to pass about 4 miles off Point Montara, when the fog signal at that point should be made; the depths should not be shoaled to less than 25 fathoms. When abreast Point Montara a course can be shaped for the lightship. South Channel should be used only in clear weather and with a smooth or only moderately rough bar.

**From seaward**, vessels should exercise the greatest caution when inside 100 fathoms, and if inside 50 fathoms should head offshore and wait for clear weather or a pilot, unless the fog signal on the Southeast Farallon can be made. This signal cannot be heard well from northward, especially during northerly or northwesterly winds.

**From northward**, vessels endeavor to make Point Reyes fog signal. This signal may not be heard in the bight northward of the point, but soundings will indicate the ship's position. If inside the 30-fathom curve and the signal is not heard, the vessel should be put broad offshore. Under certain conditions, it has sometimes been found difficult to locate the fog signal owing to deflection in the direction of the sound, but by following the 30-fathom curve closely a vessel can round the point safely. Vessels from northward are sometimes guided by soundings on Cordell Bank.

Strangers are advised not to use Bonita Channel in thick weather. The approaches lead past Duxbury Reef on which many vessels have been lost under similar conditions. After passing the reef, unless the buoys are plainly seen and distinguished, the channel, on account of its comparatively narrow width, is dangerous to those not thoroughly familiar with it. It may be used at any time when the aids can readily be seen, and at such times, if the bar is breaking, it should be used in preference to the Main Ship Channel.

Strangers crossing the bar are advised to anchor in about 10 fathoms and wait for a pilot or for clearing

weather. Unless one is thoroughly familiar with the characteristics of the fog signals in the entrance and the peculiarities of the current, entering in thick weather is hazardous as soundings are of little value in the Golden Gate.

**Currents.**—Immediately outside the bar there is a slight current to the northward and westward, known as the **Coast Eddy Current**. The currents at the San Francisco Lightship are described in some detail in the Tidal Current Tables, Pacific Coast. The currents most affecting navigation in this vicinity are the tidal currents. Across the bar the flood current converges toward the entrance and is felt sooner around Point Lobos and Point Bonita than across the Main Ship Channel. The ebb current spreads from the entrance over the bar, but the main strength is west-southwestward, parallel with the southern edge of the Potatopatch Shoal, and through the Main Ship Channel. In the Bonita Channel the ebb current is weak and of short duration, the flood current beginning so early that during the last half of the ebb in the Golden Gate the current in Bonita Channel forms an eddy flowing southeastward around Point Bonita into Bonita Cove.

In the vicinity of Mile Rocks the currents attain a considerable velocity within a few minutes after slack on both flood and ebb.

In the Golden Gate the flood current sets straight in, with a slight tendency toward the north shore, with heavy overfalls both at Lime Point and Fort Point when strong. It causes an eddy in the bight between Point Lobos and Fort Point. The ebb current has been observed to have a velocity of more than  $6\frac{1}{2}$  knots between Lime Point and Fort Point, and it sets from inside the bay on the north side toward the latter point. Like the flood current, it causes an eddy in the bight between Fort Point and Point Lobos, and a heavy rip and overfall reaching about 0.25 mile southward from Point Bonita. At the Golden Gate Bridge there are large current eddies near the foundation piers which cause ships to sheer off course.

Daily predictions of the times of slack water and the times and velocities of maximum flood and ebb in the Golden Gate, together with factors and differences for obtaining the times and velocities of the current for other points in San Francisco Bay, are given in the Tidal Current Tables, Pacific Coast. Additional notes on currents in the Golden Gate are given in a later section. Hourly directions and velocities of the tidal current throughout the bay are shown on the Tidal Current Charts, San Francisco Bay.

**Directions, San Francisco Entrance.**—By the South Channel.—From a position 2.1 miles  $250^\circ$  from Pigeon Point Light, steer  $344^\circ$  for 22.5 miles until Point Montara Light bears  $074^\circ$ , distant 2 miles. Then steer  $007^\circ$  for 13 miles to a position 400 yards  $277^\circ$  from buoy 2. Then steer  $357^\circ$ , heading for Point Bonita Light, for 2.4 miles, passing 100 yards westward of bell buoy 4, and when Seal Rocks are abeam, distant 0.45 mile, and Mile Rock Light bears  $046^\circ$ , change to  $033^\circ$  for 1.1 miles to Mile Rocks

Light abeam, distant 0.25 mile. Then steer  $049^\circ$  for 2.5 miles to the center of the Golden Gate Bridge.

By the Main Ship Channel.—Having made the lightship, pass southward of it and steer  $070^\circ$  until Point Bonita Light bears  $344^\circ$ . Four pairs of lighted buoys mark the bar section of the main channel. Then make good a  $057^\circ$  course for 2.5 miles to the center of Golden Gate Bridge. An automatic fog signal is on the bridge directly over this point.

By the Bonita Channel.—From a position 1.6 miles  $225^\circ$  from Point Reyes, steer  $114^\circ$  for 18 miles to a position 0.3 mile  $204^\circ$  from Duxbury Reef lighted whistle buoy. From the position off the buoy, steer  $101^\circ$  for 6.3 miles to 250 yards  $000^\circ$  from Bonita Channel lighted whistle buoy with Point Bonita Light bearing  $122\frac{1}{2}^\circ$ . Then steer  $129^\circ$  for 1.5 miles, where Point Bonita Light will bear  $102^\circ$ , passing 175 yards southwestward of Bonita Channel lighted bell buoy off Centissima Reef. Then on Bonita Channel lighted range, of which Mile Rocks Light is the front range and a light on the bluff is the rear range, steer  $137^\circ$  for 0.75 mile passing southwestward of Point Bonita Light, and to a position with the light bearing  $356^\circ$ , distant 0.45 mile. The California Palace of the Legion of Honor at Landsend, Point Lobos, is on the range and prominent. Then steer  $073^\circ$  for 2.5 miles to the center of the Golden Gate Bridge.

From the Golden Gate Bridge, vessels bound for San Pablo Bay and Carquinez Strait may set a course to pass 0.5 mile off Point Blunt at the southeast end of Angel Island, thence through the buoyed channels to a point 0.6 mile west of East Brother Island Light off Point San Pablo, thence a course to pass close aboard the fairway buoy in San Pablo Bay, and thence through the buoyed channel to Carquinez Strait.

**Important.**—Steamers leaving San Francisco Bay through Bonita Channel on the ebb current must use extreme caution when crossing the tide rip off Point Bonita. When the bow passes the rip the stern is thrown to port and, unless promptly met, the vessel will head straight for the rocks off the point.

Vessels favoring Potatopatch Shoal too closely have reported a set toward it.

**San Francisco Bay** is the largest harbor on the Pacific coast of the United States. It is landlocked and affords good shelter and anchorage in all weather, except occasional northerly or southerly storms during the winter months. It is the terminus of several transpacific lines of steamers, airlines, and transcontinental railroads, and its commerce, both foreign and domestic, is extensive. Much of the local navigation is carried on by light-draft river steamers and barges that ascend the Sacramento and San Joaquin Rivers.

From its junction with San Pablo Bay between Point San Pedro and Point San Pablo about 10 miles above the entrance, the bay extends southeastward nearly 40 miles. The eastern shore is low and, in the southern part, is composed of extensive marshes intersected by numerous winding sloughs. For about 4.5 miles southeastward

of Point San Pablo, the shore is formed by a ridge of rolling grassy hills. The western shore, northward of the entrance, is much bolder than the eastern shore, with only a few stretches of low marsh. From Fort Point the shore trends eastward for nearly 4 miles and then rounds sharply southward for 10 miles, from which point marshes and flats, intersected by numerous sloughs, extend to the head of the bay. The San Francisco waterfront extends from 1 mile eastward of Fort Point around to Point Avisadero, a distance of about 8 miles. The first two points within the bay are Point Cavallo on the northern side and Black Point on the southern side. Beyond these points the islands within the bay are the most prominent features.

**Weather.**—In common with the more northerly section of the Pacific coast of the United States, the Golden Gate area experiences fogs more frequently during the summer months than during the other periods of the year. These fogs are generally brought in from seaward by westerly winds about sundown, and ordinarily continue until about noon of the following day. In winter, morning or tule fogs frequently occur, these forming over the lowlands of the central valley and over the bay.

During the summer months the fog often drifts in only as far as the Golden Gate, limiting visibility of the bridge and shoreline while the remainder of the bay is comparatively clear. Sausalito and Richardson Bay have much less fog than the Golden Gate.

Westerly winds prevail in this section of the Pacific coast throughout the greater part of the year. In July and August southwesterly winds prevail, while northerly winds are most prevalent during the months of December and January. Southerly gales are not infrequent in the winter. The wind normally attains its greatest velocity about 4:30 p.m. and its least velocity about 6 a.m.

During certain portions of the year, especially in May and June, the northwesterly winds attain high velocity. This is also true regarding the north-northeasterly winds of November, December, and occasionally January. In the winter the most prevalent high wind is from the southeast and is followed by a southwesterly wind.

The San Francisco Bay section has comparatively few storms. Except in the winter, very few low-pressure areas move from the ocean across California, nearly all the storms that enter the United States from the west passing far northward of central California.

**Chart 5535.**—**San Francisco**, the largest city in San Francisco Bay, is on the northern end of the peninsula separating the southern arm of the bay from the ocean. The depths at the wharves are ample for deep-draft vessels.

The port of San Francisco is under the control of the State of California, and its management is vested in the Board of State Harbor Commissioners. The office of the chief wharfinger is on the Embarcadero at the foot of Pier 1. The port maintains extensive terminals with belt-line rail connections and modern cargo-handling facilities.

**Prominent features.**—Fort Winfield Scott, in the

Presidio and on the south side of the Golden Gate, was built in 1860. **The Presidio**, now a United States military reservation, was once the garrison of Spanish soldiers.

**Point Cavallo**, a sharp rocky point with some visible covered rocks under its western face, is about 0.5 mile north-northwestward of Lime Point. Between the points is **Horseshoe Bay**, a shallow bight within the area of restricted anchorages. From Point Cavallo the rocky steep shore trends northward 0.3 mile to **Yellow Bluff**, thence northwestward to Sausalito.

The western end of **Presidio Shoal** is about 0.5 mile eastward of Fort Point. A degaussing range is in the main channel about 800 yards 360° from the foot of Fillmore Street and extends 700 yards northward between two lighted bell buoys. Vessels are requested not to foul the submarine cables that extend southward from the range to the observation house on the Marina Seawall.

The entrance to St. Francis Yacht Club harbor, 1.6 miles eastward of Fort Point, is marked by a 30-foot lighted stone tower. In the basin east of the harbor a depth of 10 feet is available 200 yards northwest of the flagpole, but in 1956 a dangerous shoal was reported as extending about 100 yards channelward from the jetty.

**Black Point**, the site of several large Government buildings and piers, is 2.3 miles eastward of Fort Point. A prominent gas tank is just westward and a conspicuous stack is eastward of the point.

**The United States Military reservations**, embracing Fort Point and Black Point, are on the northern shore of the peninsula.

**Aquatic Park** is a pleasure resort with a curved recreation pier built out from the eastern side of Black Point. In June 1957 there was a depth of 14 feet at the entrance to Aquatic Park. A fog signal is on Pier 3 just westward of Black Point.

**Telegraph Hill**, about 1 mile eastward of Black Point is surmounted by a tall cylindrical light-colored tower called **Coit Tower**. The tower is an excellent landmark by day, and is frequently floodlighted at night.

**Alcatraz Island**, 2.5 miles eastward of Lime Point and 1 mile northward of Black Point, is one of the leading marks in entering from seaward. The small island is 148 feet high and has many prison buildings on it. **Alcatraz Light** (37°49.6' N., 122°25.3' W.), 214 feet above the water and visible 21 miles, is shown from a gray tower on the highest part of the island. Fog signals are on the extreme northwestern and southeastern ends of the island. Unless authorized, vessels are prohibited from navigating within 200 yards of the shoreline of Alcatraz Island; regulations are given in § 207.640, Chapter 2.

A rock awash, marked on its westerly side by a bell buoy, is 125 yards westward of the northwestern end of Alcatraz Island.

**Yerba Buena Island**, about 345 feet high and 2.5 miles eastward of Alcatraz Island, is of small extent, irregular in shape, and is covered with a scrubby growth of trees. On its summit is a lookout tower used by the Navy. The wharves of the Naval Training Station and Corps of Engineers are in the small cove on the eastern face of

the island. A Coast Guard buoy depot is on the southeast end of the island. On the end of the southernmost wharf is a light.

**Yerba Buena Island Light** ( $37^{\circ}48.4' N.$ ,  $122^{\circ}21.7' W.$ ), 95 feet above the water and visible 16 miles, is shown from a white octagonal tower at the extreme southeastern point of the island; a fog signal is at the light. The buildings are white and part of the bluff is whitewashed to make the station more discernible.

**Naval restricted areas** are off the north end of Treasure Island and between this island and Yerba Buena Island; limits and regulations are given in § 207.640, Chapter 2.

**Treasure Island** is a low filled area northward of and connected by a causeway to Yerba Buena Island. Built originally for the San Francisco International Exposition of 1939-40, it is now used by the Navy. Some of the piers around the island have lights and fog signals. A shoal with a least depth of 13 feet over it off the northerly end of the island is marked by a buoy.

When the prevailing westerly winds are blowing, deep-draft vessels proceeding to the berthing area on the eastern side of the island may have extreme difficulty making the 90° turn from the narrow channel between the 30-foot curves southeastward of Yerba Buena Island.

A **measured course**, 6,105 feet long in a  $330^{\circ}45'$  direction, on the west side of Treasure Island, is marked by white poles with small white targets. The southern range is on the northwestern extremity of Yerba Buena Island and the northern range is near the northwestern end of Treasure Island.

**Ferry Building**, with a 240-foot clock tower, is one of the most prominent marks on the waterfront. It is at the foot of Market Street and in the central part of the Embarcadero.

**China Basin**, 1.1 miles southward of the Ferry Building, is used principally as a banana terminal, but is also a railroad car-ferry terminal. **Channel Street** is a dredged slip crossed by several drawbridges and extending about 0.5 mile in a southwesterly direction from the basin. The channel is used by coastwise vessels in the banana trade.

**Mission Rock**, just southeastward of China Basin, is the site of an enlarged deep-draft terminal. Pier 50 extends out to this terminal. A fog signal is on the Santa Fe Ferry Slip between Mission Rock and Pier 54.

**Islais Creek**, about 1.6 miles southward of Mission Rock, has a project depth for the entrance channel of 35 feet, and 25 feet inside the bridge. Shoaling occurs frequently, requiring dredging by the Board of State Harbor Commissioners. In June 1957, the controlling depth in the channel was 35 feet.

**Channels.**—From the Golden Gate to the anchorage off San Francisco and southward of Point Avisadero, and northward to the entrance of San Pablo Bay, the channels are wide and have ample depth for deep-draft vessels.

**Anchorage.**—The usual anchorages are westward of Yerba Buena Island and in the general anchorage off Mission Rock; limits and regulations are given in § 202.224, Chapter 2. Vessels subject to quarantine are boarded westward of Treasure Island at Anchorage 7.

When awaiting or undergoing examination, vessels must anchor in this anchorage area.

Quarantine Anchorage 17, is in the channel leading to San Pablo Bay, about 2.5 miles north-northwestward of Angel Island. Vessels use the anchorage only when so directed by the quarantine officer; limits and regulations are given in § 202.224, Chapter 2.

**Dangers.**—**Anita Rock**, bare at low water, is about 300 yards northward of Presidio wharf. It is marked by buoys.

**Arch Rock**, 33 feet deep, is about 0.9 mile westward of Alcatraz Light. **Shag Rocks**, 35 feet deep, are 1 mile northwestward of Alcatraz Light. **Harding Rock**, 35 feet deep, is 1.3 miles northwestward of Alcatraz Light and is marked by a lighted buoy. **Blossom Rock**, 40 feet deep, is about 1 mile southeastward from the southeastern end of Alcatraz Island. Anchorage 7 lighted bell buoy is southeastward of the rock.

Heavy tide rips occur in the vicinity of Alcatraz Island.

**Bridges.**—**San Francisco-Oakland Bridge** crosses the bay from Rincon Point in San Francisco to Yerba Buena Island, then to Oakland. The overhead clearance between piers B and D is 215 feet.

Four bridges cross the tributary waterways within the city of San Francisco. The three crossing Channel Street are: Third Street Bridge, which has a bascule span with a horizontal clearance of 103 feet and an overhead clearance of 1½ feet; the Fourth Street Bridge, which has a bascule span with a horizontal clearance of 75 feet and an overhead clearance of 8 feet; and the Sixth Street Bridge, which has a swing span with a horizontal clearance of 50 feet and an overhead clearance of 7 feet. In June 1957 the Sixth Street Bridge was inoperative and the span kept open to water traffic. The bridge over Islais Creek at Third Street has a bascule span with a horizontal clearance of 75 feet and no overhead clearance. Operating regulations for these bridges are given in § 203.1 and § 203.710, Chapter 2.

**Tides.**—The mean range of tide at San Francisco is 4 feet. The range between mean lower low water and mean higher high water is 5½ feet. A range of about 9 feet may occur at the time of maximum tides. Daily tide predictions for San Francisco (Golden Gate), together with differences for obtaining predictions for various other places throughout the bay and its tributaries, are given in the Tide Tables, West Coast.

**Currents.**—Inside the Golden Gate the flood current sets into all parts of the bay and causes swirls from the Golden Gate as far eastward as Alcatraz and Angel Islands and through Raccoon Strait, northward of the latter island. The ebb current, inside the Golden Gate, is felt first along the southern shore. In the Golden Gate, the average duration of the ebb stream is somewhat greater than that of the flood. At periods of great freshets in the Sacramento and San Joaquin Rivers, there have been instances of very slight surface current, or none at all, on the small flood in the Golden Gate.

At the San Francisco-Oakland Bridge there are large

current eddies near the foundation piers which cause ships to sheer off course.

The flow of tidal currents throughout San Francisco Bay is clearly depicted on the Tidal Current Charts, San Francisco Bay. The charts which may be used for any year are referred to the times of the maximum flood and ebb currents at San Francisco Bay entrance (Golden Gate), daily predictions for which are included in the Tidal Current Tables, Pacific Coast.

See Appendix for storm warning displays.

**Pilotage** into and out of San Francisco Bay is compulsory for foreign vessels and vessels from or to a foreign port and vessels sailing under a register between the port of San Francisco and any other port of the United States. Vessels sailing under an enrollment and licensed and engaged in the coasting trade between the port of San Francisco and any other port of the United States are exempt from pilotage unless a pilot is actually employed.

The San Francisco pilot boats keep station between the lightship and the bar, and at times anchor just eastward of the lightship. When on station under sail, a white light is carried at the masthead; when under power, a red light is displayed under the white light. A flare or torch is also burned frequently. To signal for a pilot in fog, approach the lightship as closely as possible, blow four whistles, and lie-to. In answer, the pilot boat will sound four blasts on the siren. When clear, burn blue light or show four flashes of the Morse lamp, or by day show the Union Jack at the fore. Pilot boats fly the Union Jack at the mainmast. Requests for a pilot can also be made by radiotelephone. Such requests should be made 3 to 4 hours in advance.

**Towboats** may be had at San Francisco, but they no longer cruise off the bar. Under favorable conditions of wind and tide, sailing vessels do not require them when entering, but strangers are advised to take on a pilot.

**Quarantine** is enforced in accordance with regulations of the U.S. Public Health Service. There is a Public Health Service Hospital in the city.

**Customs.**—San Francisco is the headquarters of the customs collection district and a port of entry; marine documents are issued.

**Immigration** officials are stationed at San Francisco.

Other local offices of the following Federal agencies are in the area, see Appendix for addresses: Coast and Geodetic Survey, Navy Branch Hydrographic Office, Coast Guard, Federal Communications Commission, Weather Bureau, and Corps of Engineers, U.S. Army.

The office of the **Chief Wharfinger** is at the foot of Pier 1, just north of the Ferry Building.

**Harbor regulations** are prescribed by the Board of State Harbor Commissioners, and their enforcement is in charge of the chief wharfinger and his assistants who will furnish information on request.

**Terminal facilities.**—The port of San Francisco maintains extensive terminals with belt-line connections and modern cargo-handling facilities.

**Supplies.**—Coal, fuel oils, provisions, and ship chandlery stores may be had in any desired quantity. Fuel oil

is usually delivered by barge, for which there is no extra charge. Coal can be had at the wharves or in lighters. Water can be obtained on the wharves or by water boat.

**Repairs.**—Repairs to vessels and machinery of all kinds and sizes can be made at San Francisco, Oakland, or Alameda. The largest commercial floating drydock in San Francisco has a length of 584 feet at the keel blocks, clear width of 100 feet, and lifting capacity of 22,000 tons. There are several smaller drydocks on the San Francisco side, and several marine railways and floating docks on the Oakland side.

**Communications.**—San Francisco is the terminus of several trans-Pacific steamship lines and is the port of call of numerous lines of coastal and intercoastal vessels. It is served by four lines of transcontinental railroads, and has through rail connection with all points. There is excellent air service; also complete radio, telegraph, and telephone facilities. It is the terminus of a trans-Pacific cable via Honolulu and Midway Island.

**Special signals.**—Special signals in use at San Francisco by International Code Flag and whistle include the following: Quarantine, letter Q, 1 long 1 short; Police, Ensign in rigging, 5 short; Fire, no flag, Standard signal of 5 prolonged blasts for ships afire in port; Waterboat, letter W, no whistle; Customs-Barge office, no flag, 3 short 1 long; Immigration, no flag, 1 short 1 long 1 short; Marine Dept., S.F.C. of C. letter M, 1 short 1 long; Stockton pilots, letter U, 1 long 3 short; Towboat companies: Bay Cities, letter B, 1 long 3 short; Crowley, letter C, 4 short 1 long; Harbor, letter H, 2 long 2 short; Smith-Rice, letter S, 3 short; Red Stack, letter T, 1 long 3 short 1 long.

**Chart 5531.**—Southward of San Francisco, Point Avisadero, which is the eastern extremity of Hunters Point, Sierra Point, Point San Bruno, and Point San Mateo, all on the western shore of the bay, are prominent natural features. The San Francisco Naval Shipyard is located at Hunters Point, where a naval restricted area is offshore; limits and regulations are given in § 207.640, Chapter 2. The Bayshore Freeway extends southward on a filled area from the vicinity of Candlestick Point, and cuts back inland at Sierra Point. Point San Mateo is covered by a heavy growth of trees and is raised as an island.

There is an aviation light at San Francisco International Airport, 1 mile southward of Point San Bruno. A seaplane landing channel and protected anchorage are here. In June 1954 the controlling depth was 4 feet in the channel and 7 feet in the anchorage. The channel is marked by buoys. Seadrome buoys are maintained in this area. A seaplane restricted area extends offshore from Point San Bruno to off Point San Mateo; limits and regulations are given in § 207.640, Chapter 2.

The San Mateo Bridge crossing the lower part of San Francisco Bay near San Mateo has a vertical lift with a horizontal clearance of 270 feet and an overhead clearance of 35 feet, down, and 135 feet, up. A fog signal is on the westerly pier of the lift span. An overhead

power cable crosses the bay just southward of the bridge. The permit clearance is 160 feet at the lift.

**Redwood Creek** enters the bay at Redwood Point about 4 miles southeastward of San Mateo Bridge. A Federal project provides for a channel 30 feet deep from deep water in the bay to an including a second turning basin at Yacht Harbor, thence a channel 5 feet deep for about 1 mile upstream. The channel is marked by lighted and unlighted buoys, and lights. In February 1958 the controlling depth was 25 feet to the first turning basin, thence in May 1954, 7 feet to Yacht Harbor, and thence 3 feet to the end of the project. The power cable over the entrance of the creek has a permit clearance of 135 feet. The municipal wharf at the upper end of the turning basin has a 450-foot face. About 0.5 mile above the turning basin is a yacht harbor with small piers. Water and supplies are available for yachtsmen. **Redwood City** is 3 miles from the mouth of the creek. The head of navigation is the bridge at the Bayshore Highway.

**Westpoint Slough** enters Redwood Creek at the lower end of the turning basin. A prominent cement plant at this junction can always be recognized by the cloud of dust that hangs about it. The shells in the old oyster-beds are being utilized in the manufacture of cement and, consequently, there is continual dredging on the former beds.

**Ravenswood Point** and **Dumbarton Point** are at the head of the bay and the mouth of Coyote Creek. Two bridges and an aqueduct cross the bay at this point. The **Dumbarton Bridge**, the northern of the two, is a lift span with a horizontal clearance of 200 feet and an overhead clearance of 9 feet, down, and 135 feet, up. A fog signal is on the western pier. About 1,100 yards southeastward of the bridge are two flumes, with a clear opening between them of about 900 yards, which supply the city of San Francisco with water. The eastern flume tunnels the entire way and is marked by a large sign showing the word PIPELINE. The western flume is carried on a trestle to a concrete house at the edge of the channel where it tunnels. The railroad bridge, just southward, has a swing span with a horizontal clearance of 125 feet and an overhead clearance of 13 feet. A fog bell is on the bridgekeeper's house.

**Coyote Creek** has many tributary sloughs. The main channel is marked as far as **Calaveras Point**, about 4 miles above the railroad bridge at Dumbarton Point. The overhead power cable 1.3 miles above Calaveras Point has a permit clearance of 65 feet.

A narrow marked channel extends from the railroad bridge to the mouth of **Mayfield Slough**, on the east side of **Palo Alto Municipal Airport**. A power cable over the entrance to the slough has a permit clearance of 125 feet. A yacht club is about 0.5 mile above the entrance.

**Jagel Slough** is on the opposite side of Coyote Creek from Calaveras Point. The power cable over the entrance has a permit clearance of 125 feet. **South Shore Port**, a mile above the entrance to the slough, has some domestic trade in fruit, farm products, and general merchandise. The channel to the port is used by scows and

light-draft vessels at high tide. The bar bares at low water.

**Alviso** is at the headwaters of Alviso Slough. There is little water traffic by scows and light-draft vessels. The trade is similar to that of South Shore Port.

On the eastern side of the bay from Dumbarton Point to the **Oakland International Airport** on **Bay Farm Island**, about 12 miles, the low waterline extends from 0.5 to 1 mile offshore. In 1957 construction was in progress on an area southward of Bay Farm Island to increase the facilities at Oakland International Airport. **Coyote Hills Slough**, **Alameda Creek**, and **Mount Eden Slough** enter the bay on this side.

**Chart 5535.**—Alameda and Oakland are two cities on the eastern shore of the bay opposite San Francisco.

**Alameda** is on an island separated from the mainland by **San Leandro Bay** on the east, and Oakland Harbor and Tidal Canal on the north. The **Naval Air Station** is on a filled area just west of the city and south of Oakland Inner Harbor.

There is a **seaplane restricted area** southward of the Naval Air Station where no vessel may enter without prior approval of the Naval authorities; limits and regulations are given in § 207.640, Chapter 2.

**Aviation lights.**—There are aviation lights at the Naval Air Station and the Oakland Airport. High up in the hills 8 miles eastward of the entrance to the Oakland Harbor is another aviation light that can be seen from the bay.

**Repairs.**—Alameda has shipbuilding and repair yards with marine ways and floating drydocks. The largest drydock has a length of 617 feet, width of 93 feet, 24 feet on the blocks, and a lifting capacity of 18,000 tons.

**Oakland** is on the eastern or mainland shore opposite San Francisco, and is the second largest city on San Francisco Bay. It is the physical terminus of the various transcontinental railroads entering the San Francisco Bay area.

The **Port of Oakland** is under the jurisdiction of the Board of Port Commissioners of the city of Oakland and is entirely distinct from the Port of San Francisco. Oakland is a separate customs port of entry. There is an appraiser's store in the city at the foot of Grove Street.

**Oakland Inner Harbor**, which is adjacent to the most highly developed section of Oakland, is an estuary 9 miles long. It is bordered on the north by Oakland and on the south by Alameda. At the eastern end is an artificial Tidal Canal leading to San Leandro Bay and thence to the Oakland International Airport by a channel.

**Channels.**—A Federal project provides for channel depths as follows: Bar Channel to and including Oakland Outer Harbor, 35 feet; Oakland Inner Harbor Channel to Park Street, 30 feet; thence 25 feet to San Leandro Bay; and Brooklyn Basin North Channel, 25 feet. The channels are maintained at or near project depths, except the controlling depth for the Brooklyn Basin North Channel was 18 feet in August 1950, the Park Street Bridge Reach was 22 feet in September 1957; thence 16 feet to San Leandro Bay, in April–September 1957. A sunken wreck

extends into the north side of the widened channel west of Government Island.

For information as to conditions of the channel to Alameda Naval Air Station, mariners are advised to consult the Naval Port Control Office, San Francisco.

A measured nautical mile on course 105°32' is in the Inner Harbor, just inside the entrance channel. The markers are on the northerly side of the channel.

A restricted area is in Oakland Inner Harbor from the entrance to the easterly boundary of the Naval Air Station; limits and regulations are given in § 207.640, Chapter 2.

**Bridges.**—There are four bridges over the Tidal Canal, one over San Leandro Bay, and a fixed bridge over the east end of Brooklyn Basin. The bridges over the Tidal Canal have the following dimensions: Park Street, double-leaf bascule, horizontal clearance 240 feet for the center 100-foot width, overhead clearance 15 feet; Fruitvale Avenue railroad bridge, vertical-lift span, horizontal clearance of 200 feet, overhead clearances of 13 feet down and 135 feet up; Fruitvale Avenue, swing span, horizontal clearance 64 feet on the northern side and 58 feet on the southern side, overhead clearance 6½ feet; and High Street bascule bridge, horizontal clearance 240 feet for the center 100-foot width, overhead clearance 16 feet. The bridge to Bay Farm Island has a bascule span with a horizontal clearance of 92 feet and an overhead clearance of 20 feet; operating regulations are given in § 203.712, Chapter 2. The fixed bridge over the southeasterly end of Brooklyn Basin has a horizontal clearance of 12 feet and an overhead clearance of 6½ feet.

All vessels whether towing, being towed, or acting singly, including barges, but not motorboats unless engaged in towing, are forbidden to approach the Fruitvale Avenue Bridge except during slack water or when an ebb-tide may be expected. Vessels and barges are forbidden to attempt passage through the draw while running with a fair tide; the bridge will not be opened for vessels under such conditions.

The Naval Supply Depot occupies Middle Harbor, between Oakland Inner Harbor entrance and the Oakland Mole. A channel from the entrance to the depot piers had a controlling depth of 28 feet in July 1958, except for depths of 26 feet in the south part of the harbor. Regulations for navigation in this area are given in § 207.640, Chapter 2. Adjacent to the Naval Supply Depot on the north is the terminus of the Southern Pacific Railroad, which is used largely for passenger ferry service.

The Oakland Outer Harbor, between the Oakland Mole on the south and the Bay Bridge approach on the north, is the site of several large terminals. The entrance channel is marked by two lighted side ranges and buoys.

The Port of Oakland contains several shipbuilding and repair yards with marine ways and floating drydocks. The largest has a length of 610 feet, width of 90 feet, 25 feet on the blocks, and a lifting capacity of 19,000 tons.

Emeryville is a small manufacturing town on the bay shore northward of Oakland. Several small wharves, accessible for light-draft vessels at high tide, are built out in this vicinity.

Berkeley, the seat of the University of California, adjoins Oakland and Emeryville to the northward. There is a long pier extending into the bay, but it is used for fishing purposes only. There is a 32-foot opening in the pier about 1 mile offshore that can be used by small craft in emergency. In clear weather the Campanile (bell tower) at the University of California shows prominently from the bay.

**Chart 5532.**—Berkeley Yacht Harbor on the northern side of the long pier is enclosed by breakwaters, the southern side of the entrance being marked by a light. A fog signal is also located on the breakwater on the southern side of the entrance. Gasoline and oil may be obtained at the city wharf which has sufficient depth alongside for the deepest draft vessel able to enter the harbor. The harbor master's office is on the city wharf. There is a boat repair shop and marine lift on the southeastern corner of the basin. A draft of 7 feet could be carried through the entrance channel of the yacht basin in 1957.

Southampton Shoal extends in a northwesterly and southeasterly direction for about 2 miles, with an average width between the 18-foot curves of 0.25 mile.

Southampton Shoal Light (37°52.9' N., 122°24.0' W.), 52 feet above the water, is shown from a white square frame building on piers, near the southern end of the shoal; a fog signal is at the light. Two degaussing ranges each marked by two buoys are between Angel Island and Southampton Shoal Light.

The deep-water channel between Red Rock Bank and the northerly extremity of Southampton Shoal is marked by lighted buoys.

Red Rock, 169 feet high, in the northern part of the bay, is visible in clear weather from the anchorage near Yerba Buena Island. It is reddish, and of small extent. It is about a mile from the eastern shore and 2.3 miles southward of Point San Pablo.

A fog signal on an iron stand just south of the rock is maintained from October 1 to March 31.

A shoal 19 to 30 feet deep extends about 1.3 miles southward of Red Rock. The bottom rises gradually toward the shoal; the usual course of vessels leads eastward of the 30-foot curve surrounding it, through the dredged channel and the easterly opening of the Richmond-San Rafael Bridge. A lighted buoy is near the western edge of the shoal.

The channel eastward of Red Rock and The Brothers is frequently used by river steamers on the ebb, as the current has less velocity, although the rips and swirls are heavy at times.

Point Richmond (Richmond Harbor), on the eastern shore of the bay nearly 4 miles southward of Point San Pablo, is the terminus of the Santa Fe Railroad, and is an important oil refining center. In the inner harbor are two modern deep-water terminals, two oil wharves, three inactive shipbuilding yards, and numerous wharves for small yachts.

Between Point Richmond and Potrero Point is a huge gas tank which is one of the most prominent objects in

the bay area. A large concrete water tank about 0.7 mile north of Point Richmond is conspicuous from the westward.

**Channels.**—A Federal project provides for a channel with a depth of 35 feet from the deep water in San Francisco Bay through Southampton Shoal Channel to about 2,000 feet of Santa Fe Channel, thence 30 feet for the remainder of the channel and basin. The channel is maintained at or near project depths. A lighted range bearing  $132^\circ$ , and lighted buoys mark the entrance channel. The inner channel is marked by lights and buoys.

A training wall 10,000 feet long extends westward from **Brooks Island**, and has a light and fog signal on the outer end. The railway car ferry slips are built out from Point Richmond just northward of the dredged channel. The oil tanks on the hill back of **Potrero Point** are prominent. The overhead power cable between Brooks Island and El Cerrito has a permit clearance of 84 feet, 300 yards northeast of the island, and 50 feet under the remainder of the span. Many deep-draft vessels now make Richmond Harbor a regular port of call. They approach from the south through the buoyed channel and make a sharp turn just off the Standard Oil Co. dock. The dock will permit berthing of vessels on both sides of the outer pier. Dredging in the approaches to the pier is privately maintained. The large basin dredged to the eastward of Potrero Point is the site of an inactive shipbuilding yard.

Midway between Potrero Point and Point San Pablo are numerous oil tanks. This area as far northward as Point San Pablo is part of Richmond Harbor, and is an important oil shipping point. Many large vessels load petroleum products from the wharf 1.2 miles north of Point Richmond and from the wharf at **Point Orient**.

The Richmond-San Rafael Highway Bridge, 21,343 feet long over its main structure, is one of the largest in the world. There are two fixed-span openings: The westerly one with a horizontal clearance of 1,000 feet and an overhead clearance of 185 feet, and the easterly one with a horizontal clearance of 970 feet and an overhead clearance of 135 feet. The bridge is well lighted, and the channels leading to it are marked with lighted and unlighted aids. Fog signals are on the bridge.

A ferry slip and pier at Castro Point is no longer used. A T-wharf extends about 625 yards west from Molate Point. Each end of the head is marked by a light; a fog signal is on the south end. The outer end of the wharf is in a basin dredged to 30 feet, marked by buoys. A private wharf, partially in ruins, is at **Winehaven**, just northward of **Molate Point**. A restricted area is north of Molate Point; limits and regulations are given in § 207.640, Chapter 2. The wharf at Point San Pablo is used by large vessels for general cargo and petroleum products. In 1957 the controlling depth in the approach area to Richmond Long Wharf (Standard Oil Dock) was 31 feet; and the controlling depth to the wharves at Point Orient and Point San Pablo was 33 feet.

**Castro Rocks** are small and low, and lie 0.3 mile off **Castro Point**, on the eastern shore abreast **Red Rock**.

The southwestern edge of the surrounding shoal is marked by a lighted buoy. Vessels should not pass eastward of this buoy.

**Invincible Rock**, 7 feet deep, is 0.5 mile southwestward of East Brother Island Light, and is marked on its southwestern side by a lighted buoy. **Whiting Rock**, with 13 feet over it, is northward of **Invincible Rock** and about 0.4 mile southwestward of East Brother Island Light. It is marked off its southern side by a buoy.

The **Brothers** are two small low flat-topped islands 0.3 mile westward of Point San Pablo. **East Brother Island Light** ( $37^\circ 57.8' N.$ ,  $122^\circ 26.0' W.$ ), 61 feet above the water and visible 13 miles, is shown from a square white tower on dwelling on the eastern island; a fog signal is at the light.

**Point San Pablo** is the northwestern extremity of a low ridge of hills on the eastern shore of the bay at its junction with San Pablo Bay. The point rises abruptly to a height of 140 feet. A railway wharf with a warehouse is southward of the point parallel to the channel. There are several oil tanks just to the southward of the point. The dredged channel off the northeastern shore of Point San Pablo is used by commercial fishermen and yachtsmen. In April 1951, the controlling depth in the channel was 10 feet. San Pablo Bay and the area northward are described later in this chapter.

**Sausalito** is on the western shore about 2 miles northward of Lime Point. The harbor is used by commercial fishing boats, yachts, and pleasure craft. Several boat-building and repair yards with marine ways are available; the largest being able to handle a craft 100 feet long and a capacity of 90 tons. Marine supplies are available locally. The entrance channel and turning basin are maintained by the Corps of Engineers, who have their shops and dredges located in the harbor. In 1948 the controlling depth in the entrance channel was 16 feet and 12 feet in the turning basin.

**Richardson Bay**, northward of Sausalito, is shoal and of little commercial importance. The upper end of the bay is crossed by a fixed highway bridge having a horizontal clearance of 56 feet and an overhead clearance of 40 feet. Limits and regulations for the anchorage area in the bay are given in § 202.224, Chapter 2.

**Belvedere**, on the eastern shore of Richardson Bay opposite Sausalito, is a residential area and of little commercial importance. Two private yacht clubs are located in Belvedere Cove. In June 1957 construction had begun on a breakwater and slips in the cove to accommodate a large number of pleasure craft.

**Tiburon**, near **Point Tiburon**, is the terminus of a railroad connecting with interior points to the northward.

**Angel Island**, partially wooded, is about 1.5 miles northward of Alcatraz Island, and is separated from the mainland by Racoon Strait on its northern side. The island is irregular in shape, its greatest length being about 1.3 miles in an easterly direction, and its width over a mile. The center of the island has been leveled to about 775 feet, and electronic installations made.

**Point Knox** is the southwestern point of Angel Island. **Angel Island Light** ( $37^\circ 51.3' N.$ ,  $122^\circ 26.5' W.$ ), 50 feet

above the water and visible 12 miles, is shown from a white square dwelling on the point; a fog signal is at the light. A shoal 16 feet deep at its outer end, marked by a lighted buoy, extends 400 yards southward of Point Knox. **Point Knox Shoal**, westward of Point Knox, has a least depth of 35 feet.

**Point Blunt**, the southeastern extremity of Angel Island, terminates in a knob 60 feet high, and is connected with the island by a low neck of land. A shoal with visible and covered rocks extends southeastward for about 0.1 mile. The tide rips and swirls are heavy around the point, especially on the ebb of a large tide. A light, 60 feet above the water and visible 13 miles, is shown from a white house; a fog signal is at the light.

**Quarry Point**, the eastern extremity of the island, is a bold bluff, with deep water close-to. Just northward of **Point Simpton**, the northeastern point of the island, are a wharf and buildings partly destroyed by fire.

**Point Stuart**, the westerly point of Angel Island, has a light, 80 feet above the water, shown from a white frame house; a fog signal is at the light.

**Raccoon Strait**, on the northwestern side of Angel Island, is nearly 0.5 mile wide, and is sometimes used by vessels bound northward in San Francisco Bay from Lime Point. The strait is free of dangers, but the tidal currents have considerable velocity and the rips and swirls are heavy at times. A midchannel course can be followed with safety. A strong ebb current sets directly across the channel at the east entrance.

**Caution.**—In navigating Raccoon Strait with a deep-draft vessel, care should be taken to avoid **Raccoon Shoal**, least depth 26 feet, 600 yards northward of Point Stuart Light.

A Naval net depot, 0.5 mile northward of Bluff Point, is marked by an elevated water tank. **Point Chauncey** is 0.9 mile northwestward of Bluff Point at the northern end of the net depot.

**California Point**, about 1.7 miles northwestward of Point Chauncey, is a flat sandy point where a development for residential purposes and yacht storage had been started in 1957. The 30-foot curve is 1,400 yards east of the point and extends about 1,400 yards northward and 400 yards southward from that position. Mariners should proceed with caution in this vicinity as shoaling may extend northward of this area.

**Point San Quentin**, on the western shore, about 3 miles southward of Point San Pedro, is prominent on account of the low land on either side. The buildings of the State Prison, and the wharf built out from the eastern extremity of the point, are prominent. Just southward of the wharf are the approaches to the Richmond-San Rafael Highway Bridge.

**Corte Madera Creek** is at the head of the bight southward of Point San Quentin. A railroad and a highway bascule bridge cross the creek about 0.4 mile from the mouth; both have a horizontal clearance of 40 feet and an overhead clearance of 8½ feet; operating regulations are given in § 203.712, Chapter 2. The overhead power cable at the highway bridge has a permit clearance of

125 feet, and the one at the entrance of the creek has a permit clearance of 120 feet.

The **Marin Islands**, about 1.3 miles northward of Point San Quentin in **San Rafael Bay**, are two small islands lying close together about 1 mile offshore. There is shoal water all around them. There are several houses on the northern side of the eastern island.

**San Rafael** is about 3 miles westward of Marin Islands. A Federal project provides for a channel 8 feet deep and 100 feet wide across the flats in San Francisco Bay to the mouth of **San Rafael Creek**, thence 6 feet deep and 60 feet wide in the creek to Irwin Street in San Rafael with a turning basin 6 feet deep. In June 1957 the controlling depth was 6 feet across the flats to the mouth of the creek, thence 4 feet to the turning basin. The entrance to the channel is marked with a light and a fog signal, and the channel is marked by a lighted range and lights. The power cable over the entrance to the creek has a permit clearance of 120 feet. There are three yacht harbors in the city where fuel and marine supplies can be obtained; three repair yards with boat launching facilities are available.

**Point San Pedro**, at the western entrance to San Pablo Bay, extends about 100 yards eastward of **San Pedro Hill**, 356 feet high. There is a large quarry just northward of the point.

**Chart 5533.**—**San Pablo Bay** is nearly circular, about 10 miles long in a northeasterly direction, with a greatest width of about 8 miles. The northern part consists of low marshes intersected by numerous sloughs and a large area of shoal water and mudflats that bare at extreme low tides. The southern shore is bolder, except between Point San Pablo and Pinole Point, where it is low and marshy for about 3 miles. Carquinez Strait joins San Pablo Bay with Mare Island Strait and Suisun Bay at its eastern extremity. There is considerable traffic through the bay. Deep-water vessels pass through to load grain at points on Carquinez Strait, and to South Vallejo to load flour and discharge lumber, while many oil tankers and sugar-laden vessels pass through the bay bound for Crockett and Martinez, and up the San Joaquin River to Stockton. Light-draft vessels pass through bound for points on Suisun Bay, Sacramento and San Joaquin Rivers, and Petaluma Creek. There are several landings on the southern shore of San Pablo Bay used by light-draft vessels.

The main channel through the bay extends in a gentle curve northward and eastward from the entrance to the eastern end of the bay. A Federal project provides for a channel 35 feet deep and 600 feet wide across **Pinole Shoal**. In February 1957, the controlling depth was 31 feet from San Pablo Strait to deep water in Carquinez Strait. The channel is marked by lighted buoys. Regulations for navigation in Pinole Shoal Channel are given in § 207.640, Chapter 2.

Limits and regulations for anchorage areas in San Pablo Bay are given in § 202.224, Chapter 2.

Shoals and flats, bare at low water, extend from Point

San Pablo to Pinole Point, and from Pinole Point north-westward to Lonetree Point.

**Pinole Point** is a moderately high, rocky bluff projecting about a mile from the southeastern shore of San Pablo Bay. A wharf is built out from the eastern side. Powder works are on the point, and about 2 miles back of it are numerous oil tanks. The elevated tank at the powder plant about 3.5 miles eastward of Pinole Point is prominent. A wharf is located here. A pleasure fishing pier is located at **Lonetree Point**, 4.6 miles easterly of Pinole Point. The twin-gable storage shed is prominent in the bay. **Oleum**, on **Davis Point**, is an oil town, where many oil tanks in the hills back of the town are conspicuous. A T-shaped wharf, which is frequently used by oil tankers, extends out to deep water. A depth of 32 feet is available at the outer face of the wharf. Lights are privately maintained on the eastern and western end of the wharf, and white lights are shown at night about every 40 feet along the trestle leading to the wharf. A neon "76" sign, about 255 feet above the water and about 0.5 mile southeastward from Davis Point, is very conspicuous at night.

**Selby** is a smelting town about a mile eastward of Oleum. The smelter is distinguished by a concrete stack about 630 feet high, claimed to be the tallest in the world.

The fixed highway bridge and the pyramidal skeleton towers that carry electric power cables across Carquinez Strait, are prominent. The cables have a permit clearance of 179 feet.

A 3½-foot channel leads to Hamilton Field, on the western side of San Pablo Bay, 3.6 miles northerly of Point San Pedro. The channel is southward of a line of lights and daybeacons. There is a tall black and yellow tank just northward of the channel.

**Petaluma Creek** enters San Pablo Bay at its western end. The city of **Petaluma** is 12 miles above the mouth of the creek. It is the center of an extensive poultry and egg industry. Large quantities of feed and petroleum products are shipped in, and fruit, poultry and eggs are shipped out.

A Federal project provides for a channel 8 feet deep and 200 feet wide across the flats in the bay to the mouth of the creek, thence 8 feet deep and 100 feet wide to Western Avenue in Petaluma, including a turning basin 8 feet deep, thence 4 feet deep and 50 feet wide to Washington Street, thence 4 feet deep and 40 feet wide to about 300 yards above the Washington Street Bridge. The controlling depths were 7 feet across the flats to Haystack Landing in June 1956, thence 3 feet to the turning basin, and thence 4 feet to the head of navigation in May 1957. Lights mark the entrance channel.

The power cable over the creek near the entrance has a permit clearance of 125 feet. The railroad bridge a mile above the entrance has a swing span with a horizontal clearance of 110 feet and an overhead clearance of 7 feet. A fixed highway bridge 500 yards above the railroad bridge has permit clearances of 140 feet horizontally and 70 feet overhead. The overhead power cable 200 yards above the highway bridge has a permit clearance of 100 feet.

The railroad bridge about a mile below Petaluma has

a swing span with a horizontal clearance of 68 feet and an overhead clearance of 5 feet. An overhead power cable 300 yards below this bridge has a permit clearance of 100 feet. About 250 yards above the railroad bridge is a fixed highway bridge with a horizontal clearance of 100 feet and an overhead clearance of 70 feet.

In Petaluma, a bridge at D Street has a bascule span with a horizontal clearance of 64 feet and an overhead clearance of 7 feet. The nearby power cable has a permit clearance of 100 feet. The Washington Street bridge has a bascule span with a horizontal clearance of 51 feet and an overhead clearance of 12 feet. The nearby overhead power cable has a permit clearance of 70 feet.

A **danger zone** is in the eastern end of San Pablo Bay adjacent to the westerly shore of Mare Island; limits and regulations are given in § 204.215, Chapter 2.

**Chart 5525.**—**Mare Island Strait**, at the mouth of the Napa River, is between the mainland and **Mare Island**. South Vallejo and Vallejo are on the eastern side of the strait, and the Navy Yard is on the western side, about 2 miles above the southern entrance. A Federal project provides for a channel 30 feet deep and 700 feet wide through Mare Island Strait, flaring to a turning basin generally 1,000 feet wide from just below Pier 23 to within 75 feet of the first bridge, and thence 26 feet deep to the second bridge. The channel is maintained at or near project depths.

**Notice.**—Ships destined for the Navy Yard, Mare Island, should await arrival of a Navy Yard pilot at Carquinez Strait. The waters around Mare Island are included in a **restricted area**; limits and regulations are given in § 207.640, Chapter 2.

An overhead power cable crossing lower Mare Island Strait between South Vallejo and Mare Island has a permit clearance of 155 feet. If the clearance between the masthead and the cable is less than 10 feet or if the clearance is not known, vessels shall not move under the cable without authority from the pilot.

**Carquinez Strait Light** (38°04.2' N., 122°14.6' W.), 40 feet above the water, is shown from a white frame tower on a dwelling at the end of the jetty on the eastern side of the entrance to Mare Island Strait; a **fog signal** is at the light.

**South Vallejo**, on the eastern shore of Mare Island Strait, inside the entrance, is the terminal of a railroad connecting interior northern points. A large flour mill is southward of the railroad wharf, and lumber wharves to northward are prominent in entering. The flour mill wharf has 30 feet alongside and 28 feet can be carried from the entrance to this point with local knowledge. From 10 to 21 feet can be taken alongside the other wharves, depending on the locality.

Communication may be had by rail and highway with other points on the bay; there are telegraph and telephone facilities.

**Vallejo**, about 1 mile above South Vallejo, is of little commercial importance. It supplies a large amount of fresh provisions to the Naval Station and affords residences for employees and others attached there. It is

also a distributing point for a considerable agricultural area in its vicinity. Communication with San Francisco and other points may be had by rail and bus. Napa is at the head of navigation on the Napa River. The United States Naval Station, on the western side of Mare Island Strait, has drydocks and extensive facilities for repairing and building vessels of all sizes.

The Vallejo-Mare Island Causeway and drawbridge connects Mare Island with the city of Vallejo at the northern end of the Navy Yard. It has a bascule span with a horizontal clearance of 73 feet and an overhead clearance of 5½ feet. At **Sears Point**, 1 mile above Vallejo, is a highway bridge with a bascule span having a horizontal clearance of 75 feet and an overhead clearance of 11 feet. Operating regulations for these bridges are given in §203.712, Chapter 2. If practicable, approach the bridges only when running against the current. No passage should be attempted during periods of peak flood or ebb current.

**Chart 5533.—Napa River**, The continuation of Mare Island Strait above the Navy Yard, has been improved by dredging. A Federal project provides for a channel 15 feet deep and 100 feet wide from Mare Island Strait Causeway to and including the Horseshoe Bend Channel; thence 10 feet deep and 75 feet wide to Third Street in Napa, and a turning basin 300 feet wide at Jacks Bend.

In November 1953, controlling depths were 12½ feet to the railroad bridge, thence 12 feet to Imola, thence 6 feet to Jacks Bend, and thence 4 feet to the head of the project. The former channel through **Horseshoe Bend** is closed to navigation by a dam near the northern end. The mean tidal range is about 5 feet, and the river channel is subject to some shoaling. The channel is marked by lights and buoys.

There is barge and towboat freight service on the river and some traffic in farm and dairy products by light-draft vessels. Petroleum products, principally gasoline, are shipped to Napa in large quantities.

The Napa River is crossed by several bridges and overhead power cables. Near **Slaughterhouse Point** an overhead cable has a permit clearance of 125 feet. A railroad swing bridge crosses the river just above **Dutton Landing**, about 8 miles above Vallejo, with a horizontal clearance of 75 feet and an overhead clearance of 5 feet. This bridge is built over a curved section of the river where the thread of the deep-water channel crosses from one bank to the other. The ebb current flows in a direction as much as 50° from the axis of the navigation channel through the bridge. This condition constitutes a hazard, particularly in taking loaded barges downstream.

Above **Suscol** an overhead cable has a permit clearance of 125 feet. Above **Imola**, 0.5 mile southward of Napa, a highway lift bridge has a horizontal clearance of 90 feet and an overhead clearance of 25 feet, down, and 60 feet, up. The two fixed bridges in Napa have a minimum horizontal clearance of 47 feet and an overhead clearance of 10 feet. The two overhead cables crossing the river in Napa have permit clearances of 75 and 40 feet, respectively.

**Chart 5534.—Carquinez Strait** connects San Pablo and Suisun Bays and is about 6 miles in length in a general easterly direction. For the first 3.5 miles it is a little less than 0.5 mile in width, and then expands to a width of about a mile. It is deep throughout with the exception of a small stretch of flats on the northern shore, and a small area in the bight on the southern shore near the eastern end. There are several small settlements on both shores.

The **California State Maritime Academy** and pier are in **Morrow Cove**, on the northern shore of the western entrance to the strait.

Two fixed highway bridges cross the strait at **Semple Point**. Fog signals are on the north and south sides of the center pier. There is a bell on the northern pier. An aviation light is on top of the center pier. Both bridges have permit clearances of 1,000 feet horizontally and 146 feet overhead through the north span and 135 feet through the south span.

**Crockett**, on the southern shore, is built around a large sugar refinery. The wharves accommodate the deep-draft vessels that discharge sugar from Hawaii. Just to the eastward of the town is a pier built out to deep water for use in handling oil. In 1956 the depth at the face was reported to be 35 feet.

Overhead cables cross at a point about 0.3 mile west of Carquinez Strait Bridge with a permit clearance of 179 feet and another overhead cable crosses between **Eckley**, on the southern side of the strait and about 0.6 mile eastward of **Crockett**, and **Dillon Point** on the northern side, with a permit clearance of 200 feet.

**Chart 5574.—Port Costa**, on the southern shore, is of little commercial importance. There is a light and fog signal at the town and a light at the northwestern extremity of the old wharf ruins about 0.7 mile to the westward.

An oil wharf with deep water alongside is on Point Carquinez, about 0.5 mile southeastward of Port Costa. Several large oil tanks are on top of the hill above the wharf. A brickyard with a wharf for lighters and small craft is about 0.2 mile above the oil wharf. About 1 mile southeastward of Point Carquinez is a privately owned T-wharf built out to deep water and used for loading small tankers and barges. Just inshore is a commercial processing plant with storage tanks.

**Benicia** is on the northern point at the eastern entrance. The U.S. Army reservation and arsenal are at the eastern end of the town. A restricted area is in the vicinity of the Benicia Arsenal: limits and regulations are given in § 207.640, Chapter 2. A railroad lift bridge across the strait from **Army Point** to **Suisun Point** has a horizontal clearance of 291 feet and an overhead clearance of 71 feet, down, and 136 feet, up. Three fog signals are on the bridge, two on Pier 13 and the other on Pier 17. An automobile ferry operates between Benicia and Martinez.

**Martinez**, on the southern shore in the bight near the eastern entrance, is a town of some commercial importance. There are two wharves off the town. The

shorter and westernmost pier is in poor condition and not used. The longer pier is used by light-draft vessels, fishermen, and yachts. It has a ferry slip built on the western side at the outer end. In 1957 there was 20 feet at the end of the pier. There is a small yacht harbor on the eastern side of this pier with depths of from 1 to 6 feet. It is protected in most weather. A harbormaster whose office is on the pier, assigns berths to yachts. Just to the eastward of the town are two piers built out to deep water and used as oil terminals. In 1955 there was a depth of 35 feet at the face of the westerly T-shaped pier, and in 1957 a depth of 37 feet at the face of the easterly pier. Both piers have lights and each has a fog signal.

**Bulls Head Point** shows as a rounding hill and is 100 feet high. The high brick stack on the point is prominent.

At **Avon**, about 1.5 miles eastward of **Bulls Head Point**, an oil wharf has been built across the flats to the deep water of the channel to accommodate large oil tankers. Dredging is maintained to accommodate vessels drawing 35 feet. The wharf is marked by two lights and a fog signal.

**Chart 5534.—Suisun Bay** is a broad shallow body of water with marshy shores and filled with numerous marshy islands, many of which have been reclaimed and are now under cultivation. It is practically the delta of the Sacramento and San Joaquin Rivers which empty into the eastern part of the bay. Two narrow winding channels lead to the mouths of the rivers. They are marked by buoys, daybeacons, and lights. The rivers and the channels near the mouths have been improved by the Government to increase the depth, remove obstructions, and provide relief during the freshet seasons. A Federal project provides for a main channel 30 feet deep through the bay to the San Joaquin River. The channel is maintained at or near project depth. The bay is used by many light-draft vessels having local knowledge. Strangers should take a pilot if bound above Benicia. Limits and regulations for anchorage areas in Suisun Bay are given in § 202.224, Chapter 2.

**Suisun Slough**, emptying into the northwestern side of Suisun Bay, about 5.5 miles northward of Benicia, has been improved by dredging. In April 1955, the controlling depth was 8 feet through the entrance channel and thence 7 feet to the head of the project at **Suisun City**, about 15 miles above the entrance. The mean range of tide is about 5 feet. Fuel oil is carried by vessels of not over 6-foot draft, and rock for building purposes is barged out. Two overhead cables cross Suisun Slough, the first, about 7 miles above the entrance, has a permit clearance of 120 feet and the second, just south of Suisun City, has a permit clearance of 110 feet.

Northward of the main channel are two shallow bays, several islands, and many sloughs. **Grizzly Island** is separated from the mainland by **Montezuma Slough**. **Grizzly Bay**, very shallow, cuts into the island on the southwestern side. **Honker Bay** is just northward of the channel and is bounded on the north and east by **Dutton**, **Wheeler**, and **Chippis Islands**. **Spoonbill Creek** separates

**Chippis Island** from **Van Sickle Island**. A light on **Van Sickle Island** is about 1.5 miles westward from **Sherman Island North End Light**. Entrance to **Grizzly Bay** from the eastward is by **Suisun Cutoff**, which passes westward of **Snag**, **Freeman**, and **Simmons Islands**, and eastward of **Ryer Island**. **Roe Island** is northward of the channel opposite **Port Chicago**. A white square house on piles is on the southern point of **Roe Island**.

**Chart 5575.—Sealbluff Landing**, 2.5 miles eastward of **Avon Pier**, is the site of a former shipyard. The lumber wharf 0.5 mile eastward of **Sealbluff Landing** is still standing, but the mill has burned down. Three large Government piers are along the waterfront of **Port Chicago**, and the area is closed to navigation. Limits and regulations of the restricted area along the waterfront of **Port Chicago** are given in § 207.640, Chapter 2. An aviation light is on the hill about a mile southeastward of the town of **Port Chicago**.

**Chart 5576.—Pittsburg**, a manufacturing town of growing importance at the mouth of **New York Slough**, has rail connections and an increasing amount of waterborne commerce. Oil tankers discharge their cargo at the power plant pier about 0.3 mile westerly from **New York Point**. Ocean liners load ammonium sulphate for foreign ports at the wharves in the town where depths up to 33 feet alongside are available. There is a yacht basin with a depth of about 6 feet, and a boat building and repair yard with marine railway; fuel, fresh water, and marine supplies are obtainable.

**Antioch**, about 5 miles eastward of **Pittsburg**, is a manufacturing city with little waterborne commerce. The water of the **San Joaquin River** is generally fresh at this point.

**Chart 5527.—The San Joaquin River** rises in the **Sierra Nevada** and flows 275 miles westerly and northerly to enter the eastern side of **Suisun Bay** on the southern side of **Sherman Island**. The river, a winding stream navigable for deep-draft vessels to **Stockton**, is tidal as far as **Mossdale**. The mean tidal range is about 6 feet at the mouth and 3 feet at the **Stockton Channel**. Major floods in the river valley occur from November to April, caused by intense general storms of several days duration. At the mouth of the river an ordinary flood will cause a rise of 8 feet and an extreme flood a rise of 10 feet in the river level. At **Stockton**, ordinary flood will cause a rise of 8½ feet, and extreme flood a rise of 13½ feet in the river level. The delta of the river is formed of many marshy islands intersected by sloughs and channels. The islands are reclaimed tulle and cattail marshes which have been converted to agriculture. **Tulle** is the name given to a tall aquatic plant growth similar to bulrush. Bordering the river are levees which are 12 feet or more higher than the land behind them.

Current reports of gage heights of the **San Joaquin River Delta** can be obtained from the **Sacramento Weather Bureau Office** at any time of the year. The information is published in the **Sacramento Bee** and, in addition, is

reported on the radio broadcasts from station KFBK whenever the gage heights are of sufficient magnitude to be of general interest.

Information on gage heights can also be obtained from the State Department of Public Works, Division of Water Resources, Public Works Building, Sacramento.

A Federal project provides for a channel 30 feet deep from the mouth of the San Joaquin River at Pittsburg to Stockton, and a channel 9 feet deep in Mormon Channel to the head of navigation at Washington Street. The project also provides for suitable passing and turning basins. Corps of Engineers project maps for June 1958 show that the controlling depths in the channels were: 30 feet to Mormon Channel, thence 22 feet to Edison Street, thence 9 feet to the head of navigation at Center Street; 9 feet in Fremont Channel and McLeod Lake; 9 feet in Mormon Channel to Main Street, thence 6 feet to the head of navigation at Washington Street; and 3 feet from the junction of Stockton Channel to Hills Ferry.

Limits and regulations for anchorage areas in the San Joaquin River are given in § 202.224, Chapter 2.

Two overhead cables cross the main channel about 2 miles eastward of Antioch with a permit clearance of 125 feet. The Antioch Bridge, 7.2 miles above the mouth has a lift span with a horizontal clearance of 265 feet and an overhead clearance of 78 feet down, and 143 feet up, at mean lower low water during lowest river stages.

Four overhead cables cross the San Joaquin River between the Antioch Bridge and the turning basin at Stockton with a permit clearance of 135 feet.

From the span of the Antioch Bridge the channel crosses to the eastern side, passing close to **Blind Point** and **Jersey Point**. False River enters about 0.6 mile north-eastward of Jersey Point. The tributaries of the San Joaquin River are described later in this chapter. The channel follows the **Bradford Island** shore to the turn where it swings northward along **Twitchell Island** shore, and then swings back to **Bradford Island**, with **Santa Clara Shoal** between the channel and **Twitchell Island**. After passing the mouth of **Fishermans Cut**, it swings northward close to **Oulton Point**, again skirting the point of **Twitchell Island** to the mouth of **Sevenmile Slough**, and then turns southerly between tule banks and **San Andreas Shoal**. Then the channel turns sharply southward at **Webb Point** to **Potato Point**.

Mokelumne River enters from the eastward opposite **Webb Point**. **Potato Slough** enters from the eastward at **Potato Point**. Old River enters from the southward at this point. The channel then continues southward by **Hayes Point** to **Prisoners Point**; then enters the **Mandeville Cut**, crossing **Middle River**, and continuing through **Venice Cut** and **Burns Reach**, it enters **Wards Cut**, where **Little Connection Slough** intersects from the northward. **Disappointment Slough** enters the channel from the eastward. **Hog Island Cut** is the last cut on the river. **Turner Cut** enters **Hog Island Cut** from the southwestward.

**Caution.**—At **Mandeville** and **Venice Cuts**, care must be exercised in navigating the dredged channel of the San Joaquin River. The river still follows its old channel and violent sheers are experienced if the navigator is not

prepared to meet the river current when passing from the cuts into the river and from the river into the relatively quiet waters of the dredged channel.

**Rules and regulations** governing maximum speed, passing, right-of-way, collision, and wrecks in the San Joaquin River are given § 207.640, Chapter 2.

Detailed directions are not given for this river. Deep-draft vessels should have no difficulty with the chart as a guide. The channel is well marked between Antioch and Stockton.

**Stockton** is in the center of the fertile San Joaquin Valley. The harbor, which is open to deep-water traffic, is near the westerly city limits.

**Tides and currents.**—The mean range of tide is 3 feet and the tidal current is negligible.

**Pilotage.**—River pilots, commissioned by the Port of Stockton, may be obtained through the office of the Port of Stockton or San Francisco Bar Pilots.

**Towage.**—It has not been necessary for towage companies to operate at this port because all vessels operate under their own power. A tugboat of 410 horsepower is available.

**Quarantine** is enforced in accordance with regulations of the U.S. Public Health Service.

**Customs** matters are handled through an agent whose office is located at Shed 8 in Stockton.

**Terminal facilities.**—There are four terminals at the Port of Stockton: the oil terminal, the bulk-loading facilities terminal, and two general cargo terminals for deep-draft vessels. The wharves for deep-water shipping are on the southern side of the channel westward of the turning basin. They are of modern concrete construction with a total berthing space of over 4,000 lineal feet, capable of accommodating nine vessels at a time. These wharves are provided with ample transit shed areas, railroad facilities, and cargo handling equipment. In 1957 the depths at the deep-water berths ranged from 29 to 33 feet. A privately owned grain terminal is on the south side of the turning basin. The wharves eastward of the turning basin are for small craft. The average depth alongside these shallow draft wharves is 5 feet.

There are warehouses available for general cargo, grain, cotton, and cement; and facilities for the storage of crude molasses and lumber. The oil terminal is just westward of the port docks. **Rough and Ready Island**, west of the San Joaquin River, is restricted to Government use.

**Supplies.**—Supplies and water may be obtained in any quantity. Gasoline and oil are available for small craft. There are no provisions for bunkering large vessels.

**Repairs.**—There are several small marine railways and a skidway at Stockton. Vessels up to 140 feet in length and 300 tons in weight can be hauled out. A machine shop is available.

**Communications.**—Communication may be had to all points in the United States by railroad, bus, truck, airplane, telephone, and telegraph.

**San Joaquin River above Stockton.**—From its junction with Stockton Channel, the river is navigable to Hills Ferry, a distance of 70 miles. Navigation above the

Southern Pacific Railroad bridge near Lathrop is impracticable in the low stages after June. The river is tidal as far as Mossdale. At the San Joaquin Bridge the ordinary flood range is 17 feet and the extreme flood is 21 feet. At Hills Ferry the ordinary flood is 12 feet and extreme flood is 16 feet.

Current reports of gage heights of the San Joaquin River below the mouth of the Tuolumne River can be obtained from the Sacramento Weather Bureau Office at any time of the year. The information is published in the Sacramento Bee and, in addition, is reported on the radio broadcast from station KFBK whenever the gage heights are of sufficient magnitude to be of general interest. Gage heights of the San Joaquin River above the mouth of the Tuolumne River can be obtained from the Fresno Weather Bureau Office. Information on gage heights can also be obtained from the State Department of Public Works, Division of Water Resources, Public Works Building, Sacramento.

**Bridges.**—Fifteen bridges cross the river between Stockton and Hills Ferry; operating regulations are given in § 203.714, Chapter 2. **Overhead clearances that follow are at mean lower low water during lowest river stages.** The Stockton Port District railroad bridge just above the junction with Stockton Channel has a swing span with a horizontal clearance of 100 feet and an overhead clearance of 17 feet. The San Joaquin County Highway bridge, a short distance above the railroad bridge, has a swing span with a horizontal clearance of 102 feet on the north and 70 feet on the south side, and an overhead clearance of 18 feet. The Atchison, Topeka and Santa Fe Railway bridge about 1.3 miles above the junction with Stockton Channel has a bascule span with a horizontal clearance of 98 feet and an overhead clearance of 17 feet. The Garwood Ferry Highway bridge, 2.2 miles above the junction with Stockton Channel has a swing span with a horizontal clearance of 102 feet on the east side and an overhead clearance of 17 feet. Brandt Highway Bridge, 6.5 miles above the junction with Stockton Channel has a swing span with a horizontal clearance of 103 feet and an overhead clearance of 18 feet.

Four bridges cross the San Joaquin River near Lathrop. The Southern Pacific Company railroad bridge, 14.2 miles above the junction with Stockton Channel, has a lift span with a horizontal clearance of 100 feet and an overhead clearance of 25 feet, down, and 121 feet, up. The Mossdale Highway Bridge, 14.3 miles above the junction, has a bascule span with a horizontal clearance of 100 feet and an overhead clearance of 29 feet. A bascule highway bridge, 14.3 miles above the junction, parallels the Mossdale Highway Bridge, with a horizontal clearance of 88 feet and an overhead clearance of 26 feet. The Western Pacific Railroad bridge, 14.8 miles above the junction, has a swing span with a horizontal clearance of 81 feet and an overhead clearance of 24 feet.

Six bridges are between Paradise Dam and Hills Ferry, which is the head of navigation. The San Joaquin City-Durham Ferry bridge, 29.7 miles above the junction with Stockton Channel, has a bascule span with a horizontal clearance of 120 feet and an overhead clearance of 21

feet. At Modesto, 37.4 miles above the junction, a fixed highway bridge has a horizontal clearance of 130 feet and an overhead clearance of 39 feet. At Grayson, 46.8 miles above the junction a bascule bridge has a horizontal clearance of 130 feet and an overhead clearance of 19 feet. At Patterson, 59.5 miles above the junction, a removable-span highway bridge has a horizontal clearance of 20 feet and an overhead clearance of 21 feet. At Crows Landing, 65.1 miles above the junction, a bascule highway bridge has a horizontal clearance of 110 feet and an overhead clearance of 25 feet. At Hills Ferry, 74.6 miles above the junction, a bascule highway bridge has a horizontal clearance of 100 feet and an overhead clearance of 20 feet. The drawbridges above Paradise Dam require at least seven days' advance notice.

**Chart 5527.**—The tributaries of the San Joaquin River are the feeder rivers, sloughs, and canals which flow into or connect with it. They are described in sequence as the river is ascended. **Bridge clearances are at mean lower low water during lowest river stages.** Overhead power cables cross most of the sloughs and rivers in the valley; see Chart 5527 for clearances.

Bordering the various waterways are levees which are 12 feet or more higher than the land behind them. The levees are built up from dredged material taken from the adjacent waterway, and due to settlement of the levees, dredging has to be done periodically to keep the top at height and grade. As material is needed for levee work, the dredge pays more attention to the requirements of the levee than to the depth of the channel for navigation purposes. This leaves an uneven bottom. The tops of the levees for the most part have dirt roads. Tule is often found growing on the channel side of the levees.

Practically all of the waterways are used for navigation, either by pleasure craft or by commercial vessels. The pleasure craft draw from 1½ to 4 feet, while tugs and barges draw from 4 to 9 feet. There are very few wharves on these sloughs. The boats and barges using the channels make fast alongside the levee at practically any place desired. Usually landings are made at various sheds located on the levee.

**Caution.**—The river and its tributaries are crossed by ferries which are guided by cables fastened to shore, and sometimes propelled by a cable rig attached to the shore. Caution must be used not to navigate in the vicinity of the ferry lane when the ferry is underway because of the danger of fouling the cables.

**Dutch Slough** enters the San Joaquin River at Blind Point, 8.5 miles above the mouth; to the eastward it joins **Sand Mound Slough** which in turn makes junction with Old River at a point about 2.5 miles from its mouth. Two fixed bridges cross the slough; the Jersey Island Bridge, between **Jersey Island** and **Veale Tract**, a fixed highway bridge with a horizontal clearance of 17 feet and an overhead clearance of 14 feet, and the Farrar Park bridge, between **Bethel Tract** and **Veale Tract**, a fixed highway bridge with a horizontal clearance of 18 feet and an overhead clearance of 18 feet.

**False River** enters the San Joaquin River 11.5 miles

above the mouth and connects with the Old River near its mouth, about 2.6 miles to the eastward. **Taylor Slough** and **Piper Slough** branch off from False River to southward and connect with Dutch Slough and Sand Mound Slough, respectively. **Fishermans Cut** branches to northward and joins the San Joaquin River.

**Threemile Slough**, about 1.5 miles north of the mouth of False River, follows a northerly and westerly direction for about 2.5 miles and joins the Sacramento River at the north end of Decker Island. The slough is a route frequently used by river steamers making passage between Sacramento and Stockton. Near the junction with the Sacramento River is a highway lift bridge with a horizontal clearance of 150 feet and an overhead clearance of 12 feet, down, and 106 feet, up.

**Sevemile Slough** enters the San Joaquin River 17 miles above the mouth.

The **Mokelumne River**, one of the principal tributaries of the San Joaquin River, rises in the Sierra Nevada and empties into it 19 miles above the mouth. The river separates, 3.5 miles above its mouth, into two branches, the **North Fork** and the **South Fork**. The forks continue in a northerly direction and rejoin at **New Hope Landing**, about 11 miles north-northeastward from the mouth. The river then describes a semicircular route to the northward and eastward to the head of navigation at the Galt-New Hope bridge, a distance of about 7 miles.

A Federal project provides for the removal of snags and obstructions, and occasional dredging of shoals from the mouth of the river to Galt-New Hope bridge, a distance of 30.4 miles, including both forks. In June 1953 the controlling depths were 12 feet from the mouth to the lower junction of the North and South Forks; thence 9 feet via North Fork to Snodgrass Slough; thence 6 feet to upper junction of the North and South Forks, via North Fork; 8 feet from the lower junction to the upper junction of North and South Forks at New Hope Landing; and thence 3 feet to the Galt-New Hope bridge.

The Mokelumne River is crossed by six bridges. A highway swing bridge, about 0.8 mile below the junction of north and south forks, has a horizontal clearance of 100 feet and an overhead clearance of 11 feet. A highway swing bridge, near the junction of North Fork, Mokelumne River and Snodgrass Slough, has a horizontal clearance of 84 feet. A highway swing bridge near the upper junction of the north and south forks, has a horizontal clearance of 55½ feet. A highway swing bridge, just below the junction of the Cosumnes and Mokelumne Rivers, has a horizontal clearance of 80 feet in the south draw and an overhead clearance of 20 feet. A railroad swing bridge, about 0.4 mile above the junction of Cosumnes and Mokelumne Rivers, has a horizontal clearance of 61 feet and an overhead clearance of 19 feet. A highway swing bridge at **Thornton**, the head of navigation, has a horizontal clearance of 62 feet and an overhead clearance of 19 feet. Operating regulations for these bridges are given in § 203.714, Chapter 2.

At low-river stages the range between mean lower low water and mean higher high water at the mouth is 4 feet, with extreme tidal range of 5 feet; there is no tide

at the upper end, just above Galt-New Hope bridge. Ordinarily flood fluctuation is 8 feet at the mouth and 17 feet at the upper end.

Freight is handled at small wharves, landings, or on the banks at various points.

**Beaver Slough**, a tributary of the South Fork, Mokelumne River, enters that river about 2.5 miles below the bridge at New Hope Landing. A highway removable-span bridge crosses the slough about 2 miles above the mouth. The horizontal clearance is 86 feet and the overhead clearance is 1 foot.

**Georgiana Slough** enters the Mokelumne River about 3 miles above the mouth, and connects that river with the Sacramento River at Walnut Grove. There is deep water the entire length of the slough. River steamers formerly used the slough in making the run from Sacramento to Stockton, but to avoid the snags and sharp turns they now favor the route through Threemile Slough.

Three bridges cross Georgiana Slough. A highway swing bridge, 3.9 miles above the mouth, has a horizontal clearance of 80 feet and an overhead clearance of 13 feet. A railroad bascule bridge, 5 miles above the mouth, has a horizontal clearance of 80 feet and an overhead clearance of 14 feet. A highway swing bridge, 10.8 miles above the mouth and near Walnut Grove, has a horizontal clearance of 79 feet in the west draw and an overhead clearance of 18 feet. Operating regulations for these bridges are given in § 203.715, Chapter 2.

**Snodgrass Slough**, a tributary of the North Fork, Mokelumne River, enters that river near the upper junction of north and south forks, Mokelumne River. The slough is crossed by two bridges. A railroad swing bridge, about 2 miles above upper junction Mokelumne River, has a horizontal clearance of 66 feet and an overhead clearance of 19 feet. A highway swing bridge, about 0.8 mile above the railroad bridge, has a horizontal clearance of 75 feet and an overhead clearance of 21 feet. Operating regulations for these bridges are given in § 203.714, Chapter 2.

**Potato Slough** enters the San Joaquin River about 0.7 mile above the mouth of the Mokelumne River. It joins **Little Potato Slough** and **Little Connection Slough** about 3.3 miles to the eastward. **Little Connection Slough** joins the San Joaquin River at **Wards Island** to the southward and **Little Potato Slough** joins the South Fork, Mokelumne River, at **Terminus** to the northward. There is a small amount of barge traffic on the river but most commodities are shipped by rail or truck.

The Western Pacific Railroad has warehouses at **Terminus**. At this town a highway swing bridge across the slough has a horizontal clearance of 100 feet and an overhead clearance of 14 feet. Operating regulations for this bridge are given in § 203.714, Chapter 2.

The **Old River** leaves the San Joaquin River 47 miles above the mouth and enters about 0.7 mile above the mouth of Potato Slough. It is the most westerly branch of the interconnecting tidal channels into which the San Joaquin River divides in crossing its delta.

A Federal project provides for the easing of three sharp bends between its mouth and Orwood (Santa Fe) Bridge;

a channel 10 feet deep to the Santa Fe wharves and Phillips Cannery at Orwood Station; entrances 8 feet deep to the Fabian-Bell Canal at its western end, and just westward of the Grant Line Highway Bridge; enlargement of Grant Line Canal, westward of Doughty Cut, to a depth of 10 feet; a channel 10 feet deep from the westerly end of Doughty Cut to the Holly Sugar Factory; a channel 8 feet deep from the southerly end of Doughty Cut to the head of Old River; and a channel 6 feet deep in the original channel of Old River from the westerly end of Grant Line Canal to the Lammers Ferry Road. Corps of Engineers project maps for June 1958 show that the controlling depths were 10 feet from the mouth to Orwood; 10 feet to the lower end of Grant Line Canal; 5 feet to Holly Sugar Factory near Tracy; and 5 feet to the head of Old River in San Joaquin River.

Three bridges cross Old River. A railway bascule bridge at Orwood has a horizontal clearance of 98 feet and an overhead clearance of 14 feet. A highway swing bridge above North Victoria Canal and connecting Victoria Island with Bryan Tract, has a horizontal clearance of 100 feet in the left span and 98 feet in the right span, and an overhead clearance of 14 feet. A highway fixed bridge at Naglee has a horizontal clearance between the middle pier and north shoreline of 67 feet and an overhead clearance of 13 feet. Proceed with caution under the bridge to avoid the piles which are spaced 20 feet apart and bare at mean lower low water.

Old River has many sloughs and canals which connect with the Middle River to the eastward. The principal ones in ascending order are as follows: Connection Slough separating Mandeville Island and Bacon Island; North Victoria Canal between Woodward Island and Victoria Island; Victoria Canal between Victoria Island and Union Island; the Grant Line Canal and Fabian-Bell Canal between Union Island and Fabian Tract. Tom Paine Slough enters the Old River above Grant Line Canal.

Connection Slough is crossed by a pontoon bridge with a horizontal clearance of 85 feet.

Grant Line Canal is crossed by a highway swing bridge with a horizontal clearance of 94 feet and an overhead clearance of 16 feet.

Tom Paine Slough is crossed by a private highway fixed bridge with a horizontal clearance of 14 feet and an overhead clearance of 10 feet. The tidal range between mean lower low water and mean higher high water at the head of Old River is about 2 feet, and at its mouth about 4 feet; ordinary flood fluctuations are 15 feet and 5½ feet, respectively, and extreme flood fluctuations are 19 feet and 8 feet, respectively.

The Santa Fe Railway has a warehouse and wharf at Orwood for transfer of farm produce from boat to rail. The Phillips cannery at Orwood has similar facilities. The Holly Sugar Company refinery and terminal near Tracy has a large wharf and an unloading basin; a passing basin is about 0.5 mile downstream from the terminal. Along the project channel are about 100 private bank landings; some have sheds for storage.

Middle River enters the San Joaquin River 22.5 miles above the mouth. The river and connecting channels are a part of a complicated network of tidal canals, some natural and some artificial, in the delta of the San Joaquin. One of the principal channels, Middle River, is a by-channel of the San Joaquin River leaving Old River above the city of Stockton and rejoining the San Joaquin River about 13 miles below the city. Middle River is not considered navigable any farther upstream than Union Island (Mowry) bridge, 22.3 miles above its mouth.

Turner Cut enters the San Joaquin River 28 miles above the mouth and is connected by Empire Cut, an artificial waterway, with Latham Slough and Middle River. Whiskey Slough terminates in a dead end at a point 3 miles above its junction with Turner Cut.

A Federal project provides for a channel 9 feet deep in Middle River below Borden Highway Bridge, in Latham Slough between Middle River and Empire Cut, and in Empire Cut, Whiskey Slough, and Turner Cut between Middle River and San Joaquin River. In June 1949, the controlling depth was 9 feet in all of the channels.

Six bridges cross the Middle River: The highway swing bridge from Bacon Island to the Lower Jones Tract, has a horizontal clearance of 129 feet and an overhead clearance of 12 feet. The Atchison, Topeka, and Santa Fe Railway bridge at the town of Middle River, 8.5 miles above its mouth, has a bascule span with a horizontal clearance of 90 feet and an overhead clearance of 13 feet. The highway swing bridge between Victoria Island and Drexler Tract, about 13 miles above the mouth, has a horizontal clearance of 105 feet and an overhead clearance of 16 feet. The highway bridge between Union Island and Drexler Tract, at Fish Camp Landing, about 15 miles above the mouth, has a swing span with a horizontal clearance of 100 feet and an overhead clearance of 16 feet. The Williams highway bridge between Union Island and Roberts Island, about 19.3 miles above the mouth, has a swing span with a horizontal clearance of 75 feet and an overhead clearance of 20 feet. The Union Island (Mowry) highway bridge between Union Island and Roberts Island, about 22.3 miles above the mouth, has a fixed span with a horizontal clearance of 45 feet and an overhead clearance of 18 feet. Operating regulations for these bridges are given in § 203.714, Chapter 2. A cable ferry crosses Middle River near its junction with Connection Slough. When not in operation, the cable lies on the bottom.

The mean range of the tide is about 3 feet during stages of extreme low water.

There are no extensive terminal facilities on these waterways, other than bank landings along the channels. At Middle River is one large wharf with warehouse and rail connection.

Disappointment Slough enters the San Joaquin River 25 miles above the mouth. The slough connects with White Slough by Honker Cut and Bishop Cut. A highway swing bridge across Honker Cut, at the western end of King Island, has a horizontal clearance of 75 feet and an overhead clearance of 10 feet. A highway swing bridge crossing Bishop Cut has a horizontal clearance of

75 feet and an overhead clearance of 10 feet. A fixed highway bridge across the entrance to **Telephone Cut** has a horizontal clearance of 15 feet and an overhead clearance of 9 feet. Operating regulations for these bridges are given in § 203.714, Chapter 2.

**Fourteenmile Slough** enters the San Joaquin River at **Morrison Island** 29.5 miles above the mouth, and joins the Disappointment Slough near its junction with Bishop Cut.

**Burns Cutoff**, a channel with a controlling depth of 4 feet, branches off to the westward from the San Joaquin River 0.8 mile above the junction with Stockton Channel and rejoins the river about 2 miles below the junction, thus forming **Rough and Ready Island**. The cutoff is crossed by two bridges. The Lower (Jacobs Road) Highway bridge, 1.4 miles above the mouth, has a swing span with a horizontal clearance of 75 feet and an overhead clearance of 17 feet. The Upper Highway bridge, 2.6 miles above the mouth, has a swing span with a horizontal clearance of 61 feet on the north side and 67 feet on the south side, and an overhead clearance of 14 feet.

**Mormon Slough** enters the Stockton Channel from the southeastward at the end of the turning basin. A Federal project provides for a channel 9 feet deep in Mormon Slough to Main Street. In June 1957, the controlling depth was 9 feet.

**Sacramento River** rises in the Trinity Mountains in north central California, flows in a general southerly direction for 324 miles, and enters the eastern side of Suisun Bay on the northern side of Sherman Island. The river has been improved by dredging to Sacramento and by snagging to Red Bluff, about 246 miles above the mouth. A Federal project provides for the development of a ship channel 30 feet deep and 200 to 300 feet wide from deep water in Suisun Bay to Washington Lake; a basin of equal depth, 1,000 feet wide and 1,200 feet long at Washington Lake; and a connecting canal 13 feet deep and 120 feet wide, with lock and drawbridge, thence to Sacramento River; thence 6 feet deep at low water to Colusa; thence 5 feet deep at low water to Chico Landing; and thence such depths as practicable to Red Bluff. The 10-foot project by the river route has been completed and is still to be maintained for local navigation. In June 1957, the controlling depths were 10 feet from the mouth to Sacramento, 6 feet to Colusa, and 2 feet to Chico Landing, 169 miles above the mouth. There is no regular navigation above Colusa. There is no regular steamer service between San Francisco and Sacramento. Most of the river landings have been abandoned, but there is occasional traffic by barges and tugs between river points and San Francisco.

**Bridges.**—The clearances for bridges over the Sacramento River below Sacramento are at mean lower low water during lowest river stages. Operating regulations are given in § 203.716, Chapter 2.

The submarine cables crossing the river are marked by signs. The clearances for the many overhead power cables are shown on Charts 5527, 5528, 5529, and 5530.

**Currents** in the Sacramento River depend on the river

stage. During high-river stages there is little or no flood current and the ebb current is strong to Sacramento. During the dry season a flood current can be carried to Paintersville and from there slack water to Freeport. At times of extreme low-river stages flood current may be evident as far as Sacramento. Local knowledge is required to estimate current conditions for a particular time.

Major floods in the Sacramento River valley usually occur from November to April and are generally caused by intense general storms of several days' duration, the runoff from which may be augmented by the melting of snow in the mountains. At the mouth of the river an ordinary flood will cause a rise of 8 feet and an extreme flood a rise of 10 feet in the river level. At Sacramento ordinary flood will cause a rise in the river level of 20 feet and extreme flood, a rise of 30 feet.

Current reports of gage heights of the Sacramento River can be obtained from the Sacramento Weather Bureau Office at any time of the year. The information is published in the Sacramento Bee and, in addition, is reported on the radio broadcast from station KFBK whenever the gage heights are of sufficient magnitude to be of general interest. Information on gage heights can also be obtained from the State Department of Public Works, Division of Water Resources, Public Works Building, Sacramento.

**Directions, Sacramento River.**—From a position 200 yards northward of Mallard Island car ferry slip, steer **087°** for 1.4 miles to a position 200 yards northward of the lighted bell buoy off New York Point; then the course is **054°**, distance 1.5 miles to abeam Van Sickle Island Light, distant 300 yards. Alter course gradually to **085°**, distance on course 1.1 miles to a position 200 yards northward of the light on Point Sacramento. The lighted buoy northwest of Fraser Shoal will be passed 125 yards to starboard. After passing the light on Point Sacramento, set a midchannel course. Keep to midchannel or slightly favor the western shore until Rio Vista is reached. The bridge opening here is on the western side of the river. Take the righthand or eastern fork 1.4 miles above the Rio Vista Bridge, keeping near midchannel and favoring the ebbtide bends. **Ida Island** is 1.2 miles above that fork.

From Ida Island for a distance of 3.5 miles upstream there are shifting shoals. After passing Ida Island, work gradually over to the southern shore and keep within 200 feet or less of it until near the bridge above Isleton, then gradually work over to the western half of the channel and favor that side around the next bend. From this point to Clarksburg the channel is all clear, and midchannel courses may be followed favoring the ebbtide bends. At Clarksburg favor the eastern shore a little until just past the town, then swing into midchannel again. From just below Freeport the channel is rather shoal and wing dams have been built at several places to scour out the channel. These are covered at high-water stages and may be struck if the shore is approached too closely. By favoring the ebbtide bends no trouble should be encountered from here to Sacramento.

**Note.**—Care should be exercised at all times to keep clear of the levees, as most of them are faced with rock which may damage vessels that drag along them.

**Chart 5527.**—**Rio Vista**, 10.5 miles above the mouth of the Sacramento River, is the most important town commercially below Sacramento. Gasoline, diesel and lubricating oils, and provisions may be obtained. There are hotels, telephone, and bus service. A highway bridge with a double-bascule span across the river at the northern end of the town has a horizontal clearance of 200 feet and an overhead clearance of 18 feet. In 1957 a new bridge was under construction at this site.

About 1.4 miles above the highway bridge the river turns sharply eastward and Cache and Steamboat Sloughs enter from the northward.

**Isleton**, on the south bank, is 15 miles above the mouth of the river. There is an oil landing where gasoline and other petroleum products, and supplies in moderate quantities may be obtained. Communication may be had by rail, bus, telegraph, and telephone. About 0.5 mile above Isleton, on the south bank, are conspicuous grain elevators. A highway bridge with a double-bascule span across the river about 0.7 mile above Isleton has a horizontal clearance of 200 feet and an overhead clearance of 20 feet.

**Ryde** is a small village with a hotel and telephone communication, 21 miles above the mouth of the river.

**Chart 5528.**—**Walnut Grove**, 24 miles above the mouth of the Sacramento River, is at the junction with the Georgiana Slough. Gasoline, oils, and supplies may be obtained in moderate quantities. There are railroad, telephone, telegraph, and paved highway connections. The river is crossed here by a highway bridge with a double-bascule span having a horizontal clearance of 200 feet and an overhead clearance of 20 feet. Five miles above Walnut Grove at the small village of **Paintersville**, a highway bridge with a double-bascule span across the river has a horizontal clearance of 200 feet and an overhead clearance of 24 feet.

**Courtland** is 31 miles above the mouth of the river. Supplies may be had in moderate quantities, and gasoline and oils may be obtained from an oil company's landing. There are hotel accommodations, and telephone and telegraph service.

**Hood** is a small village on the east bank 34.5 miles above the mouth of the river.

The small village of **Clarksburg** is 37.5 miles above the mouth of the river. Two oil companies have landings here and it is a distributing point for petroleum products.

**Freeport** is a small town 41.5 miles above the mouth of the river. Gasoline, oils, and provisions may be obtained in small quantities. There is railroad, telegraph, and telephone service. The highway bascule bridge at Freeport has a horizontal clearance of 200 feet and an overhead clearance of 30 feet.

Two bridges cross at Sacramento. The Capitol Street bridge is a railway and highway vertical-lift bridge with a horizontal clearance of 170 feet and an overhead clear-

ance of 34 feet, down, and 131 feet, up. The I Street bridge is a railway and highway swing bridge with a horizontal clearance of 150 feet and an overhead clearance of 32 feet.

A paved highway between Antioch and Sacramento runs along the levee of the river for nearly its entire distance.

**Sacramento**, the State capital, 62 miles above the mouth, is the head of navigation for most of the shipping on the river. A draft of well over 10 feet can be carried to Sacramento except at low-river stage, which usually occurs during July, August, and September. Dredges work as needed during this period to maintain a depth of 10 feet.

**Tide.**—At low-river stages the mean range of tide at Sacramento is 2½ feet, but at other stages it is negligible. Currents have been described earlier.

**Pilotage.**—The River Lines, acting for the city of Sacramento, will furnish pilots between Sacramento and other points on the Sacramento River, San Joaquin River, and San Francisco Bay area, on call.

**Towage.**—Towboats up to 750 horsepower will be furnished by the River Lines, on call.

**Quarantine, customs, and immigration.**—Control is exercised by the offices of these services having jurisdiction over San Francisco Bay.

**Terminal facilities.**—On both sides of the river the wharves have ample depths alongside to accommodate vessels able to negotiate the river. There are transit sheds and storage warehouses. Nearly all freight is handled by shipside loading, shifting the ship if necessary.

**Supplies.**—Fuel, diesel oils, and water are available; coal for bunkers is not supplied.

**Repairs.**—A skidway has a depth of water over the foot of about 3½ feet at extreme low water. Flat-bottom river craft up to 6-foot draft can be handled on the marine ways.

**Communications.**—Two railroads serve the city. There is airplane service in all directions.

**Charts 5529, 5530.**—Above Sacramento the prevailing flood conditions are as follows: At Verona at the junction of Feather River and 70 miles above the mouth, 20 feet at ordinary floods and 24 feet at extreme floods. At Colusa, 125 miles above the mouth, 25 feet at ordinary floods and 32 feet at extreme floods. At Chico Landing, 167 miles above the mouth, 20 feet at ordinary floods and 25 feet at extreme floods. At Red Bluff, 214 miles above the mouth, 24 feet at ordinary floods and 29 feet at extreme floods.

Between Sacramento and Chico Landing are numerous warehouses and small landings. Freight is also handled on the bank.

**Bridges.**—Ten bridges cross the Sacramento River above the city. All overhead clearances are at low water. A railway swing bridge, about 77.8 miles above the mouth at **Knights Landing**, has a horizontal clearance of 105 feet and an overhead clearance of 25 feet. A highway bascule bridge, about 0.2 mile above the railway bridge, has a horizontal clearance of 200 feet and an overhead

clearance of 29 feet. A railway and a highway swing bridge, about 116.3 miles above the mouth at **Meridian**, has a horizontal clearance of 150 feet and an overhead clearance of 34 feet. A highway swing bridge, about 124.6 miles above the mouth at Colusa, has a horizontal clearance of 94 feet and an overhead clearance of 30 feet. A highway swing bridge, about 146.2 miles above the mouth, has a horizontal clearance of 105 feet and an overhead clearance of 35 feet. A highway swing bridge, about 174.6 miles above the mouth, has a horizontal clearance of 135 feet and an overhead clearance of 29 feet. A highway swing bridge, about 189.8 miles above the mouth, has a horizontal clearance of 115 feet and an overhead clearance of 29 feet. A highway vertical-lift bridge, about 199.7 miles above the mouth, has a horizontal clearance of 160 feet and an overhead clearance of 29 feet. A railway swing bridge, about 35 yards beyond the vertical-lift bridge, has a horizontal clearance of 100 feet and an overhead clearance of 25 feet. A highway fixed bridge is at **Red Bluff**, the head of navigation. Operating regulations for these bridges are given in § 203.716, Chapter 2.

**Charts 5527, 5528.**—The principal rivers and sloughs which flow into the Sacramento are described in sequence as the river is ascended. The overhead clearances of the bridges are at mean lower low water during lowest river stages.

**Threemile Slough** enters the Sacramento River from the east at the northern end of **Decker Island**. The slough is described under the tributaries of the San Joaquin River.

**Cache Slough** and **Steamboat Slough** join and enter the Sacramento River 12.5 miles above the mouth and 1.7 miles above **Rio Vista** bridge. **Cache Slough** has many smaller sloughs flowing into it, the largest of them being **Lindsey Slough**, **Shag Slough**, **Prospect Slough**, and **Miner Slough**. **Steamboat Slough** leaves the river about 0.8 mile southward of **Paintersville** bridge. The largest tributary of **Steamboat Slough** is **Sutter Slough** which joins **Miner Slough** at a point about 5 miles northwesterly

of **Walnut Grove**. **Elkhorn Slough** joins **Sutter Slough** about 3 miles northerly of this point.

**Miner Slough** is crossed by two bridges. A pontoon bridge, about 2.4 miles northeasterly of the junction at **Miner** and **Cache Sloughs**, has a horizontal clearance of 85 feet. A highway swing bridge, about 1.2 miles west of the junction of **Miner** and **Sutter Sloughs**, has a horizontal clearance of 75 feet and an overhead clearance of 21 feet.

A bascule highway bridge across **Steamboat Slough** at its junction with the **Sacramento River** at the head of **Grand Island** has a horizontal clearance of 200 feet and an overhead clearance of 24 feet. A highway swing bridge across **Sutter Slough** at its junction with the **Sacramento River** has a horizontal clearance of 75 feet and an overhead clearance of 23 feet. Operating regulations for these bridges are given in § 203.716, Chapter 2.

A highway removable-span bridge across the junction of **Elkhorn** and **Sutter Sloughs** has a horizontal clearance of 44½ feet and an overhead clearance of 21 feet.

**American River**, one of the principal tributaries of the **Sacramento River**, rises in the **Sierra Nevada**, flows in a westerly direction and enters the **Sacramento** about 1 mile above the city. The river is not navigable.

**Feather River** rises in the **Sierra Nevada** and empties in the **Sacramento River** at **Verona**, about 18 miles above the city. The river has been improved by snagging and the construction of wing dams at **Marysville**, about 26 miles above the mouth. The controlling depth is usually 3 feet from about February 15 to June 15. Ordinary flood fluctuation is 20 feet and extreme flood fluctuation is about 25 feet. With the exception of several small privately owned landings, all loading is handled on the banks. There has been no commercial navigation on the **Feather River** in recent years. A highway swing bridge across the river about 8.4 miles above the mouth has a horizontal clearance of 100 feet and an overhead clearance of 35 feet at low water (September 1915). A railroad fixed bridge crosses at **Marysville**, 24.7 miles above the mouth.

## 8. SAN FRANCISCO BAY TO POINT ST. GEORGE, CALIFORNIA

**Chart 5603.**—From Point Reyes, the coast trends in a general northerly direction for about 10 miles as a broad white sand beach backed by high grassy sand dunes.

A commercial radio station is about 7 miles northward of Point Reyes; the large white building is prominent from seaward. A radiotelephone station, about 0.5 mile southwesterly from this station, is not prominent.

The entrance to **Abbotts Lagoon**, about 7.5 miles northward of Point Reyes, is completely closed by a sand and gravel bar.

From the northern end of the sand beach the coast curves northwestward for about 6 miles in high yellow cliffs, terminating in **Tomales Point**, which is the southern point at the entrance to Bodega Bay. A **naval aircraft operating area** is offshore westward of Tomales Point; limits and regulations are given in § 204.219, Chapter 2. **Bird Rock**, small and rocky, 60 feet high, lies 0.6 mile southward of the point and about 0.2 mile offshore.

**Bodega Head**, 266 feet high, is about 4.5 miles northwestward of Tomales Point. The summit is rounding and grassy, with steep rocky cliffs on the southern and western ends. **Bodega Rock**, low in elevation, is 0.3 mile southeastward of the southeastern face of the head. Foul ground extends southward and southeastward of the rock. A lighted whistle buoy is about 1.5 miles southwestward and a lighted gong buoy is about 0.7 mile southeastward of the rock.

**Bodega Bay**, included between Tomales Point and Bodega Head, is about 6 miles in length in a northwesterly direction, and 1.5 miles in width. It affords shelter from northwesterly weather at its northern end, but is dangerous in southerly or westerly weather.

**Bodega Harbor** is at the north end of the bay. It is used extensively by small fishing craft based in the harbor and small craft enroute between ports north and south along the coast. The entrance is marked by a lighted bell buoy and two jetties extending in an easterly direction from shore. A Federal project provides for a channel 12 feet deep and 100 feet wide from the entrance to the town of Bodega Bay, thence southward along the shore for 0.6 mile with turning basins inside the entrance at the town of Bodega Bay and at the inner end of the channel. In July 1957 the controlling depth was 8 feet from the entrance to the inner turning basin where the depth decreased from 5 feet to ½-foot. The channel is marked by lighted ranges, lights, and daybeacons. At the town of **Bodega Bay** are numerous small privately owned fishing and pleasure wharves, a repair yard, marine railways, and one marine fueling station. **Boats** up to 40 feet in length and 5 feet in draft can be hauled out on the marine railways.

To anchor in Bodega Bay, round Bodega Rock, giving it a berth of 0.6 mile until Bodega Head bears 280° and is just open northward of Bodega Rock, then steer 333° for about 0.8 mile and anchor in 30 to 36 feet, 0.5 mile from the beach, with Bodega Rock bearing 215°. Anchorage may be had closer to the beach if the vessel's draft permits. On the approach of southerly or westerly weather, vessels should leave at once.

In good weather small boats having local knowledge sometime use the passage between Bodega Head and Bodega Rock, but the passage is dangerous during periods of heavy ground swells because of the combers.

**Tomales Bay** enters the southern part of Bodega Bay immediately eastward of Tomales Point, and extends southeastward for about 12 miles with an average width of 0.5 mile. A whistle buoy is 0.8 mile northwestward of **Tomales Bluff**, and the bar, which has 8 to 9 feet over it, is marked by buoys. In 1957 there was no commerce by water in the bay. Fish, clams, and oysters are hauled by truck from here to San Francisco. Communication may be had by rail and telegraph from points at the head of the bay. An excellent paved highway follows along the eastern shore of the bay. **Point Reyes Station** is at the head of the bay.

A 300-foot wharf, having a depth of about 10 feet at the outer end, is just inside **Sand Point**, on the eastern side at the entrance to the bay. It is used by sport fishermen; boats and gasoline are available. Pleasure and fish wharves are in most of the small villages southward from the point. Depths at the wharves are from 1 to 2 feet; marine railways, electric hoists and small boat repairs are available.

At the entrance to Tomales Bay a current of 6 knots may be encountered on a spring tide. The bar is dangerous and should not be attempted by a stranger.

**Chart 5502.**—The coast from Bodega Head to Point Arena, about 57 miles, trends in a general northwesterly direction. There are some dangers offshore, but they do not extend over a mile from shore, and in thick weather the 30-fathom curve may be followed with safety. During the summer months the rocks are generally marked by kelp which extends in some cases to the 10-fathom curve. During the winter gales much of this is torn away, but it is a safe rule to avoid all kelp.

In clear weather the mountains inland may be readily seen, and at times are visible when the lower land is shut in by haze or fog. In thick weather soundings should taken frequently, as the currents are extremely irregular both in direction and velocity.

Protection from the prevailing northwesterly winds of

summer may be had at several places, but there is no shelter from the winter winds, which are usually accompanied by a heavy westerly swell.

Northward of Bodega Head the cliffs are about 200 feet in height for 2 miles, and then are succeeded by a broad sand beach 2 miles long, backed by sand dunes 120 feet high. From this point the coast northward consists of abrupt rocky cliffs, broken by gulches, to the mouth of the Russian River, about 10 miles northward of Bodega Head.

Numerous rocks, from 20 to 130 feet high, are offshore, in some cases over 0.3 mile. **Gull Rock**, 100 feet high, is about 1.7 miles southeastward of the mouth of the Russian River and 0.3 mile offshore. About 0.5 mile northwestward of Gull Rock and 400 yards offshore is a large arched rock, 85 feet high with a flat top. This is the largest arched rock on this part of the coast.

**Duncans Landing**, about 6 miles northward of Bodega Head, is a fair smallboat landing in northwesterly weather.

The spit making out from the southern point of the **Russian River** has been partially reinforced by a short rock jetty, but the mouth of the river is closed by a shallow bar. The bold sharp point immediately to the southward of the river appears as an island from the southward; it is connected to the mainland by a roadway which is bare at all stages of the tide. Many summer resorts are on the shores of the Russian River.

**Ross Mountain**, 2,204 feet high, is the highest knob on the ridge backing the coast northward of Russian River. It is about 3 miles inland, northward from its mouth. A few clusters of trees are near its summit; the slopes are bare of trees and the gulches are wooded.

From Russian River to Fort Ross Cove the coast is high, consisting of bare steep spurs from **Ross Mountain**. **Sunken Reef** extends about 0.8 mile from shore 4.5 miles northwestward of Russian River. It is marked by a buoy about 0.3 mile southward of the reef. Vessels should not attempt to pass eastward of the buoy.

**Fort Ross Reef**, about 5.7 miles northward of Russian River and nearly 1 mile eastward of Fort Ross Cove, consists of pinnacle rocks 35 feet high, about 600 yards offshore, and connected with the beach by a reef which is partially marked by kelp.

**Fort Ross Cove**, about 15 miles northward of Bodega Head and nearly 33 miles northward of Point Reyes, affords good shelter in northwesterly weather. The holding ground is poor and the anchorage is contracted by a rock, awash at low water, in the middle of the cove and a sunken rock about 50 yards northward of it with only 14 feet over it. The cove is divided into two bights, the western one being slightly the larger. The anchorage is suitable for small vessels only, and if used by strangers should be entered with caution as no directions can be given that would be of value. Communication by paved highway and telephone may be had with the interior.

**Fort Ross** was first settled by the Russians in 1812, and the old Russian church is still standing. The buildings have been restored and the area is now a State

Historical Monument. There is no sea-borne commerce here, and the landing facilities have been abandoned.

From Fort Ross Cove the coast extends northwestward and is nearly straight. It is bold and wooded to the crests of the hills which approach the coast closely, and is cut by numerous gulches and bordered by many rocks which, as a rule, are close inshore. Several landings, practically all abandoned, are along this stretch of the coast. The 30-fathom curve is at an average distance of 0.7 mile from shore from Fort Ross Cove to near the Gualala River.

**Salt Point**, about 5 miles northward of Fort Ross Cove, is about 35 feet high, very rocky, and bare of trees; it is bordered by outlying rocks for about 200 yards. The 30-fathom curve is less than 0.5 mile off this point.

**Gerstle Cove** is a contracted cove under Salt Point with a landing that is now abandoned.

**Fisk Mill Cove**, 2.5 miles northward of Salt Point, affords fair shelter for small vessels in northwesterly weather. The bottom is rocky but there are no hidden dangers.

**Horseshoe Point**, about 3 miles northward of Salt Point, is a cliff 180 feet high, with a depression of 60 feet immediately behind it. It is bare of trees; the summit is marked by several projecting rocks.

From Horseshoe Point the coast trends northwestward for about 12.5 miles to the Gualala River, and consists of cliffs about 60 feet high, bordered by numerous outlying rocks. The tree line is from 0.1 to 0.5 mile back from the edge of the cliffs.

**Stewarts Point** is a village with a post office about 3 miles northward of Horseshoe Point. It is in a small cove that was formerly used as a shipping point. About 350 yards off the southern point of the cove are two sunken rocks, each of which is well marked by kelp. The cove is a fair shelter for small craft in northwesterly weather. There is a general store, and the buildings are readily seen from seaward. Communication may be had by telephone and by bus over improved roads north and south, and to the interior.

**Black Point** is about 5.5 miles northwestward of Horseshoe Point. The landing at this point is unprotected and is no longer used.

About 4 miles northwestward of Black Point and 3 miles southeastward of the Gualala River is a sand beach about 0.5 mile long, backed by high dunes parallel with the beach. The dunes are quite prominent.

**Del Mar Landing** is about 5 miles northwestward of Black Point and 2 miles southeastward of Gualala River. It is unprotected and is no longer used.

**Local magnetic disturbance** has been reported in the vicinity of Del Mar Landing and Saunders Reef, amounting to 4° to 8° easterly of the normal magnetic variation.

**Gualala Point Island** is about 16 miles southeastward of Point Arena and 1 mile southward of Gualala River. It is 42 feet high, about 300 yards offshore, and connected with the bluff by a rocky reef, covered with sand and bare at high water. Sand dunes extend behind the bluff for 600 yards.

The **Gualala River** intersects the coast about 15 miles southeastward of Point Arena. A long sand beach extends a mile southward from the mouth. The mills at **Gualala** and the white hotel building can be seen from the west and southwestward.

**Robinson Reef** lies northward of the mouth of Gualala River and 1.1 miles northward of Gualala Point Island. It consists of a cluster of 25 or 30 rocks above water, about 600 yards offshore, with a covered rock 70 yards west-northwestward of the outer visible rock.

**Bournes (Bowen) Landing** is about 1.5 miles northwestward of Gualala River. The anchorage here is exposed and can be used only in the summer. Local knowledge is necessary because of several covered rocks in the approaches. Lumber from the Gualala mills was formerly shipped from here. An improved highway parallels this section of the coast.

**Havens Anchorage** is 12 miles southeastward of Point Arena and 4 miles northwestward of Gualala Point Island. Shelter from the prevailing northwesterly winds may be had in the cove southward of Fish Rocks. Vessels of 200 tons may use the cove which is constricted by rocks and sunken ledges, extending 250 yards southeastward from the western head. Strangers should approach the anchorage with caution. During the summer the anchorage is used extensively by fishing boats in northwesterly weather. Communication may be had by bus and telephone.

**Fish Rocks** are two rocky islets about 4.2 miles northwestward of Gualala Point Island, connected at low water with the shore and surrounded by numerous smaller rocks. The outer rock is 150 feet high and the inner 100 feet high and 100 yards offshore. A rock 40 feet high lies 175 yards southeastward of the outer rock.

**Havens Neck**, 145 feet high and prominent, is about 0.6 mile northwestward of Fish Rocks. It is bare of trees and connected with the bluffs by a narrow neck.

**Gualala Mountain**, 2,238 feet high and heavily wooded, is a prominent feature in clear weather. It is about 5 miles inland northeastward of Havens Neck.

**Sail Rock**, 44 feet high, is a sharp, pyramidal rock 800 yards offshore, about 2.8 miles northwestward of Fish Rocks. From off Point Arena it resembles a small vessel under sail.

**Saunders Reef**, about 4.5 miles northwestward of Fish Rocks, is about 0.5 mile offshore. It shows several rocks awash at low water and is well marked by kelp. Foul ground exists between it and the shore. A lighted whistle buoy is 0.4 mile southwestward of the outer rock and 7.5 miles southeastward of Point Arena. Vessels should not pass inside the buoy.

**Arena Cove**, about 2.5 miles southeastward of Point Arena, is a slight indentation affording shelter to small vessels in northwesterly weather. The southern head is a high yellow cliff that under favorable circumstances is visible for a considerable distance seaward. A wharf in fair condition is at the head of the cove with 14 feet of water at its outer end. Water is piped to the wharf and fuel oil can be obtained by truck. A fish house is near the foot of the wharf. Some provisions may be had. The village of **Point Arena** is about 1 mile back from the land-

ing. It has a post office and communication may be had by bus and telegraph. A lookout tower, white enclosure with a red roof on a steel tower, is prominent. A lighted gong buoy is 0.6 mile southwestward from the end of the wharf. To enter, make the lighted gong buoy, then bring the end of the wharf to bear  $074^\circ$  and stand in on this course. This leads about 150 feet southward of a rock with 16 feet over it that lies 300 yards  $264^\circ$  from the end of the wharf. In thick weather during the summer in approaching the cove from northward or southward, the edge of the kelp may be followed, which will lead to within 300 yards of the lighted gong buoy.

A breaker is reported in a heavy southwesterly swell about 0.8 mile west-southwestward of the northern point of Arena Cove and scattered kelp extends almost out to that position.

**Point Arena**, 68 miles northwesterly of Point Reyes, consists of a long level plateau, diminishing in height to the end of the point which is 60 feet high. It is the first prominent point northward of Point Reyes. The point is bare of trees for about a mile from the shore.

**Point Arena Light** ( $38^\circ 57.3' N.$ ,  $123^\circ 44.4' W.$ ), 155 feet above the water and visible 19 miles, is shown from a white cylindrical tower at the extremity of the point; the radiobeacon and the fog signal at the light are synchronized for distance finding. A Loran station is near light. A sunken reef, usually showing breakers, extends about 0.6 mile northwestward from the extremity of the point.

**Arena Rock**, with 13 feet over it, is a little over 1.2 miles northward of Point Arena Light and shows a breaker except in very smooth weather. A submerged rock which breaks only in heavy weather has been located about 200 yards northward of Arena Rock. It is probably a part of Arena Rock, and should be given a good berth as it rises abruptly from deep water.

**Caution.**—In view of the fact that Arena Rock is only 0.8 mile inside the 30-fathom curve, and that the shoaling is abrupt, vessels approaching Point Arena from northward in thick weather are advised to keep outside a depth of 40 fathoms.

**Chart 5602.**—From Point Arena the coast extends in a general north-northwesterly direction for about 50 miles and then trends northwesterly for nearly 35 miles to Punta Gorda, from which point it trends north-northwesterly for 10 miles to Cape Mendocino. The southern portion is less bold and rugged than the northern portion, and the mountains are neither as high nor as close to the coast. The dangers are all included within the 30-fathom curve, and with exception of Blunts Reef and the other reefs in the vicinity of Cape Mendocino, do not extend more than a mile offshore. Between Point Delgada and Cape Mendocino are several deep submarine valleys, heading in some cases within 0.5 mile of the beach; great caution and frequent soundings are necessary in thick weather when in the vicinity, owing to the irregularity of the currents and soundings.

From Cape Mendocino to Trinidad Head the coast trends in a north-northeasterly direction for 40 miles and,

with the exception of the rocks off False Cape, is free of dangers if the beach is given a berth of over 0.5 mile. The land is generally low with sandy beaches, broken by the mouths of the Eel and Mad Rivers and the entrance to Humboldt Bay, the only marked elevations northward of False Cape being Table Bluff and Buhne Point.

In clear weather the mountains are good landmarks and can frequently be seen when the lower land is obscured by fog or haze.

Between Point Arena and Elk, protection from the prevailing northwesterly winds of summer may be had in a few places, but there is none from southward or westward.

From Point Arena the cliffs of the point extend 0.5 mile northeastward to the mouth of the Garcia River, from which sand dunes and beaches extend northward for about 4 miles. Beyond this point for 40 miles to Ten Mile River Beach the coast is rugged, with high, bold cliffs bordered by numerous outlying rocks.

Mal Pass is a steep gulch about 5.2 miles northward of Point Arena; the bluffs on each side are nearly 280 feet high.

Red Bluff, a prominent reddish cliff about 200 feet high, is 8 miles northward of Point Arena.

Elk Rock, 95 feet high and 0.5 mile offshore, is about 8.5 miles northward of Point Arena.

Chart 5703.—Elk is about 10.5 miles northward of Point Arena. The ruins of an incline from the 150-foot cliff down to the most easterly of a cluster of three large rocks are prominent. The shelter is only fair. Communication may be had by bus and telephone. Some provisions are available. The group of cypress trees in the graveyard 500 yards northward of Cuffey Cove is a good landmark from any direction. Nose Rock, 24 feet high, lies about 0.6 mile southwestward of the cliff. Casket Rock, 91 feet high, is the outermost of the three large rocks westward of the cliff.

Approaching from the southward, steer 082° heading for the yellow and red church spire with cross. This course passes about 200 yards southward of a group of sunken rocks with a least depth of  $\frac{3}{4}$  fathom over them.

Cuffey Cove, about 0.8 mile northward of Elk, is a small, contracted anchorage affording fair shelter in northwesterly winds. The outer point at the entrance to the cove is 140 feet high, with a rocky islet 49 feet high 450 yards westward and a series of three small off-lying rocks extending 170 yards southwestward. Immediately east of this point is an inlet 300 yards long which is an excellent anchorage for small boats in northerly and westerly weather. A small kelp-covered rock, awash at low tide, lies near the center of the entrance to the inlet, and boats enter midway between this rock and the point. Vessels entering the cove pass midway between the rock awash at the entrance to the inlet and the foul ground 300 yards southward of the inlet. The cove is covered with patches of kelp during most of the year. The landing and village are abandoned.

From Cuffey Cove to the Navarro River, a distance of about 3 miles, the coast consists of cliffs 200 feet high,

bordered by outlying rocks. A landing at the mouth of the river is abandoned. Although the mouth of the river is nearly always closed by a bar with only 1 or 2 feet of water over it, there is fair shelter at the entrance from southwesterly winds. Navarro Head, 405 feet high, is on the northern bank of the river.

Chart 5711.—Salmon Point, the southern entrance point to Whitesboro Cove, about 1.2 miles northward of the Navarro River, is a treeless cliff 109 feet high. Detached rocks extend westward of the point for 0.2 mile, with Bull Rock, a sunken ledge, usually showing a breaker 0.5 mile northwesterly of the extremity of the point. In a heavy swell there are breakers showing between it and the visible rocks off the point. Whitesboro Cove is rocky, exposed to northwest and west winds, and is seldom used as an anchorage.

Albion River and Albion Cove are about 2 miles northward of Navarro Head, and 16.5 miles northward of Point Arena. The cove affords good shelter in northerly weather, but is open southwestward. The south point at the river entrance rises to a knoll 179 feet high and lies 0.7 mile from Salmon Point. Low rocks extend nearly 0.25 mile westward of the point. The north point is a rocky islet 80 feet high lying close to the point which has the same elevation; both are bare. Small visible rocks lie 200 yards westward of the islet and sunken rocks, showing breakers in a moderate swell, extend out more than 0.25 mile west-southwestward from it. Two hundred and fifty yards southward of the islet and about in the middle of the entrance lies a sunken rock, usually showing a breaker, which is the principal danger in the approach. In the middle of the cove as seen from seaward lies Mooring Rock, a pyramidal rock about 30 feet high, from which small rocks stretch to a point on the northern shore. A whistle buoy is about 0.7 mile westward of Mooring Rock.

The village of Albion, which has a post office, is on both high banks of the river. Considerable lumber was formerly shipped to both foreign and domestic ports, but the landing wharf has been removed and there has been no shipping for many years. There are several small piers in the river where commercial and sport fishing craft are moored. Fuel, water, and some provisions may be obtained. Communication may be had by bus, truck, and telephone. A fixed highway bridge crosses the Albion River about 0.1 mile above the mouth.

To enter Albion Cove from the whistle buoy head for Mooring Rock on course 084° until within 200 yards of it.

Northward of Albion River, between it and Colby Reef, breakers are seen in heavy swell nearly 0.5 mile from shore, and vessels should not approach closer than 1 mile.

Stillwell Point is a bold, sharp cliff 190 feet high about 1.6 miles northward of Albion River. A rocky islet, 141 feet high, lies close inshore on its northwestern side. A yellow slide is on the southern face of Stillwell Point.

Colby Reef, 1.6 miles northward of Albion River, is 0.5 mile offshore, abreast Stillwell Point. It consists of a

rocky patch with a least charted depth of  $1\frac{1}{2}$  fathoms. Numerous other dangers are just inside the 20-fathom curve along this stretch of coast.

**Little River** is 4.6 miles northward of Navarro Head and about 19 miles northward of Point Arena. The northwestern shore of the cove is bluff and rocky, and bare of trees for over 0.5 mile. Good shelter from northwestward and fair protection from southward is afforded by the reef and rocks on the southern side of the cove which are well marked by kelp. It is open westward, and bad, especially for sailing vessels, owing to the narrow entrance and heavy undertow when in the vicinity of the rocks. The anchorage is about 300 yards in diameter, with depths of 4 to  $4\frac{1}{2}$  fathoms. The channel in entering is about 125 yards wide but is obstructed by two sunken rocks which reduce it to about 60 yards in width abreast the inner visible rock. A bell buoy is about 0.6 mile southwestward from the mouth of the river. Strangers should not enter the cove without a pilot. No supplies are obtainable. Communication may be had by bus, truck, and telephone. The beach area at Little River is now a State Park.

From Little River to Mendocino Bay the coast is a broad tableland with a seaward face of cliffs, 40 to 60 feet high, bordered by numerous low rocks. The tree line is over 0.5 mile from the cliffs.

**Mendocino Bay** is about 21 miles northward of Point Arena and affords fair shelter in northwesterly weather, but vessels are obliged to leave in southerly or westerly weather. In heavy southwesterly gales the sea breaks clear across the entrance. The bay is about 0.8 mile long in a northerly direction and about 0.3 mile wide. The northern point at the entrance is a broken cliff 60 feet high, bordered by numerous rocks close inshore. The southern point is a rocky, irregular cliff 100 feet high, bordered by numerous rocks extending 150 yards offshore. A knoll 156 feet high is 300 yards inshore from the point. A reef with a least depth of  $3\frac{1}{4}$  fathoms extends 500 yards northwestward of the outermost bare rock. This area should be avoided when there is any swell running. A bell buoy is 0.4 mile southwestward of the northern point.

**Big River** enters in the northeastern part of the bay. The town of **Mendocino** is on the northern shore of the bay. Provisions, fresh meat, and water may be had; coal is not available. Communication may be had by bus, truck, and telegraph or telephone. The buildings in the town are the prominent features when in the vicinity of the bay.

To enter bring the south bluff of the river to bear  $068^\circ$  and stand in on that bearing, passing southward of the bell buoy and giving the northern point at the entrance a berth of 250 yards. When this northern point is a little abaft the beam, anchor in from 5 to 6 fathoms. The course clears the dangerous sunken ledge lying 500 yards northwestward of the outer visible rock off the southern point.

**Russian Gulch**, 2 miles northward of Mendocino, is a small indentation of no commercial importance. The

cove is occasionally used as an anchorage by small craft with local knowledge as it affords excellent protection. A State Park is located at the head of the cove. The concrete arch highway bridge across Russian Gulch should show well from southward to westward. An important danger is a rock awash 400 yards northwestward of the southern entrance point. A reef with a least depth of  $1\frac{1}{4}$  fathoms extends 200 yards southeastward of the rock.

**Point Cabrillo** is about 3 miles northward of the town of Mendocino and 24 miles northward of Point Arena. It is a flat-topped point 50 to 60 feet high, terminating seaward in nearly vertical cliffs; numerous low rocks extend offshore over 200 yards, and the 30-fathom curve is barely 0.2 mile outside of them. The point here is bare except for a few trees at the houses near the light.

**Point Cabrillo Light** ( $39^\circ 20.9' N.$ ,  $123^\circ 49.5' W.$ ), 84 feet above the water and visible 15 miles, is shown from a white octagonal frame tower on a dwelling on the point; a fog signal is at the light.

From Point Cabrillo the coast trends northward for about 9 miles to Laguna Point as a nearly straight line of bluffs, with numerous rocks close under the cliffs. It is moderately high, partly wooded to the face of the cliffs, and is broken by several indentations and small streams. The 30-fathom curve is an average distance of 1 mile from shore.

**Caspar Anchorage**, about a mile northward of Point Cabrillo, is a small cove about 0.3 mile wide, at the head of which is the mouth of **Caspar Creek**. Fair shelter, except from westward, is afforded. The anchorage is contracted and is seldom used. The village of **Caspar**, which has a post office, is on the northern bank of the creek near its mouth. Communication may be had by bus, truck, and telephone. Provisions may be obtained in limited quantities.

**Chart 5703**.—From Caspar Creek to Noyo Anchorage the coast consists of broken irregular cliffs, 40 to 60 feet high, with numerous rocks extending in some cases 400 yards offshore. These are fairly well fringed by kelp, especially in summer.

**Noyo Anchorage**, about 5 miles northward of Point Cabrillo, is less than 0.5 mile long and 0.25 mile wide, and while affording fair shelter from northward or southward, is open westward. The anchorage is limited to an area about 400 yards long and less than 200 yards wide, with depths of  $3\frac{1}{2}$  to  $6\frac{1}{2}$  fathoms. A lighted whistle buoy is 0.8 mile westward of the anchorage and a bell buoy 600 yards west-southwesterly from the northwest point of the cove.

**Noyo River** enters at the head of the cove. A jetty with a light on the outer end and a fog signal 80 yards inshore is on the north side of the entrance, and a small jetty with a daybeacon on the outer end is on the south side of the entrance. A fixed highway bridge crosses the river 300 yards east of the mouth with a horizontal clearance of 150 feet and an overhead clearance of 80 feet. A Federal project provides for a channel 10 feet deep and 100 to 150 feet wide from the entrance to about 1 mile upstream. In

April 1955, the controlling depth was 5 feet to the fish company dock. The channel is marked by buoys and a light.

In July 1957 fishermen using the river reported the deepest water in the entrance to be about midway between the jetties. Caution must be used in entering so as to avoid the reefs on the southern side of the entrance. With a heavy westerly or southwesterly swell there are breakers at the entrance to the river, so that it is necessary to enter before this condition occurs. Inside the river is shelter from any condition of wind or sea.

The village of **Noyo** is on the banks of the river 0.4 mile above the mouth. It is the principal commercial and sport fishing center of this section of the coast and many fishing boats are based here. There are several fish houses with wharves having depths from 4 to 8 feet along-side where water can be obtained. Fuel is available at two oil wharves; general and marine supplies are available in the village and at Fort Bragg. There are machine shops and marine railways where boats up to 60 feet in length with a draft of 6½ feet can be hauled out. Communication by rail and bus is available in Fort Bragg, 1 mile north of Noyo.

From Noyo River to Fort Bragg, about 0.7 mile, the coast consists of rocky cliffs, 40 to 60 feet high, bordered by rocks and sunken ledges extending 100 to 400 yards offshore.

**Fort Bragg**, about 30 miles northward of Point Arena, is the largest coast town between San Francisco and Eureka. It is located near the head of a cove formerly known as **Soldiers Harbor**. The former loading wharf has been removed; lumber is now shipped out by rail and truck. The buildings of the town are prominent by day and the electric lights prominent by night.

The cove is 0.4 mile long and 0.2 mile wide, but is contracted by the rocks and ledges extending from both the north and south, leaving only a limited area for small boats to anchor. A rocky reef, partly bare at high water, extends southwestward from the northern head and breaks the force of the swell from northwestward. In westerly weather the cove is wide open. Since Noyo River gives better protection, the cove is seldom used.

Fort Bragg is on the California Western Railroad which connects with the mainline of the Northwestern Pacific Railroad at Willits. Provisions can be obtained, and minor repairs to machinery can be made at the sawmill machine shop. Communication is available by rail and bus.

From Fort Bragg to Laguna Point, about 3 miles, the coast is moderately low and rocky and cut by two small streams; the tree line is within 0.2 mile of the beach.

**Laguna Point**, 8.5 miles northward of Point Cabrillo, is near the southern end of Ten Mile Beach. It is a small, projecting cliff, 30 feet high, flat-topped, and bare of trees for 600 yards. It is noticeable only when close inshore. A bare reef extends 300 yards northwestward from the point.

**Cleone**, immediately northward of Laguna Point, is of little commercial importance. It is exposed and only

available for small boats. It affords fair protection in southerly weather and is occasionally used in winter.

**Bald Hill**, 810 feet high, is about 2.5 miles southeasterly of Laguna Point and is a prominent landmark; its summit and southwestern slope are bare of timber.

**Chart 5602.**—For about 0.5 mile northward of Laguna Point the bluffs are low, and northward of these a straight sand beach extends for about 3 miles to the mouth of **Ten Mile River**. The beach is backed by sand dunes for 0.5 mile inland, with the tree line about 1.5 miles from the beach. The concrete highway bridge over Ten Mile River is conspicuous from the westward.

From Ten Mile River the coast extends in a general northwesterly direction for about 52 miles to Punta Gorda. This stretch of the coast is particularly bold and rugged, bordered by numerous rocks, and as far as Point Delgada, is heavily timbered. Northward of Point Delgada the tops of the ridges are generally bare or only partly covered with trees and brush. The cliffs along the shore range from 40 to 100 feet in height. The high, rugged mountains in the vicinity of the coast, which reach elevations of 3,000 to 4,000 feet, are prominent.

**Kibesillah Rock**, 1.2 miles northward of Ten Mile River, is a rock awash and is the farthest offshore of any rock for many miles north and south. It is a small rock washed over almost continuously even in ordinary weather, and is 0.4 mile off the line of the cliffs. Other rocks and rocky islets are inside of it, some of which are 80 feet high and some 100 to 200 yards in extent, flat topped and covered with soil.

**Bruhel and Bells Points** are two small points, 3 and 4.5 miles, respectively, northward of Ten Mile River. They are not noticeable unless close inshore.

**Bells Mountain**, 0.5 mile eastward of Bells Point, is 1,040 feet high, bare on top, and with a few trees on the oceanside. It is the principal landmark for Westport.

**Westport**, 12 miles northward of Fort Bragg, is a small community adjacent to farms and timber. The landing which is exposed and suitable only in summer and in smooth weather is abandoned. All shipments are made by truck. The schoolhouse, in a clearing northward and slightly higher than the town, is useful as a landmark. No ship supplies are available.

**Switzer Rock** is a small low rock 600 yards broad off the coast and 0.6 mile to the northwestward of Westport. Every large swell washes over it. About 170 yards southeast of it is a sunken rock marked by a breaker. Switzer Rock has 6 fathoms of water close around it. The 3-fathom curve is 200 yards inside, and the 10-fathom curve 400 yards outside of it.

**Gordon Hill**, 772 feet high, lies about 6.5 miles northward of Ten Mile River. It is bare to the summit and terminates seaward in **Abalone Point**, 60 feet high, with low outlying rocks.

**Union Landing and Hardy Creek Landing**, about 0.5 mile apart, near the mouths of **Juan Creek** and **Hardy Creek**, respectively, are 2.5 miles northward of Abalone Point. They were formerly wire-cable landings. The

wharf at Hardy Creek is gone; the loading structure at Union Landing is in ruins, but is fairly prominent. Both landings have been abandoned.

**Hardy Rock**, about 2.3 miles north-northwest of Abalone Point, is a small islet 47 feet in elevation.

From Abalone Point the coast trends northwestward for about 4 miles to **Cape Vizcaino**, which is a broad, irregular line of precipitous cliffs, 100 feet high, very broken, and bordered by low rocks, 200 to 300 yards offshore.

A rocky, lime-covered islet, **Island Knob**, 200 yards long and 120 feet high, lies close to and almost connected with Cape Vizcaino. A breaker lies 275 yards westward and southward from the northwestern point of the islet. **Cottaneva Rock**, 20 feet high, is a small rock about 500 yards southeastward of Island Knob, 275 yards offshore. Several smaller rocks lie inside of it and two others about 160 yards northwestward.

**Rockport Landing** is about 0.5 mile northward of Cape Vizcaino. The shelter is poor. It was formerly used as a cable landing for loading lumber. The sawmill situated in the narrow Cottaneva Valley is in operation, but all lumber is shipped by truck. A pinnacle rock having 3 fathoms over it lies 200 yards westward of the outermost visible rock in the cove.

**Cahto Mountain**, 4,231 feet high is about 11.5 miles eastward of Cape Vizcaino, and in clear weather is a prominent landmark.

**Sea Lion Rock** is 325 yards northwest of the high north-west point of Rockport Cove. It is 5 feet above water, 35 yards long, and 15 yards wide. It is resorted to by sea lions.

**Cottaneva Needle**, 0.5 mile north of Sea Lion Rock, is a prominent black pinnacle rock 55 feet high.

Between Cape Vizcaino and Point Delgada are several small exposed landings available for use only in the summer and in smooth weather. The landings formerly were used to ship ties, tanbark, and shingles which were loaded on vessels by means of wire cables. There are no good roads along this section of the coast and supplies are not obtainable. The principle landings are **Monroe Landing**, **Usal** and **Needle Rock**. None of these have been used for many years. All traffic is handled by truck.

**Double Cone Rock** is 3.5 miles northward of Cape Vizcaino and 300 yards offshore.

**Usal Rock**, about 5.5 miles northward of Cape Vizcaino, is 45 feet high and black in color. It lies 200 yards off a small point of rocks.

The mouth of **Usal Valley** is about a mile northward of Usal Rock, and is a narrow, steep gulch, in front of which is a small area of flat land with a low beach. A small grassy hillock is just inside the gulch. The view up the valley is open for a very short time while passing.

**Big White Rock**, 95 feet high, lies about 2 miles northward of Usal Valley, and 125 yards offshore from the steep cliffs, which are bordered by numerous rocks. The rock is a prominent feature when the higher points of the land are in fog. A whistle buoy is about 0.8 mile westerly of the rock.

**Anderson Cliff**, about 2 miles northward of Big White Rock, is a projecting rocky spur 715 feet high, with one large rock and numerous smaller ones close inshore.

**Jackson Pinnacle**, about 1.1 miles northward of Anderson Cliff, is a black rock 45 feet high so close to the rocky beach that from seaward it is hard to distinguish it from the bluff behind it. When seen from along shore it is prominent.

**Cluster Cone Rock**, a prominent 68-foot pinnacle, is the largest and whitest of a small cluster of 6 high rocks, 200 yards offshore, lying about 4.8 miles northward of Big White Rock.

**Morgan Rock**, a large white-topped, block-shaped rock 57 feet high, and about 0.5 mile northwestward of Cluster Cone Rock, shows prominently. It is the largest of a group of rocks extending some 200 yards from a high rocky cliff and is particularly valuable as a landmark when higher land is covered by fog.

**Bear Harbor Ridge**, a detached coastal ridge about a mile northwestward of Cluster Cone Rock, has two peaks, the southern one, 375 feet high, being the higher. It is the most prominent feature in this vicinity when viewed from the northwestward. The seaward face of the ridge is marked by steep, loose slides.

**Needle Rock**, 46 feet high, is 2 miles northward of Morgan Rock; the rock blends into the bluff from offshore. A group of old mill buildings, a few houses, and an old landing platform about midway up the flat, mark the abandoned landing.

**Small White Rock**, 37 feet high, lies 5 miles northward of Cluster Cone Rock and 4 miles southward of Point Delgada. It is close inshore and just outside the low-water beach; once identified, this rock makes a valuable landmark.

From just below Small Rock to Point Delgada, the country is not timbered but is covered with dense, low brush, which presents a uniform dark green appearance.

A submarine ridge known as the **Tolo Bank** extends southward from Point Delgada for about 7 miles. The depths are quite irregular, the least found being 9 fathoms. The area was swept by wire drag in 1936 to a depth of 47 to 50 feet and no dangers of less depth than 9 fathoms were found. No kelp was found on the bank at any time during the summers of 1935 and 1936.

**Caution.**—The area just south of Shelter Cove is subject to slides which might deposit rocks along the shores.

**Chart 5773.**—**Point Delgada** is about 66 miles northward of Point Arena, and nearly 20 miles southward of Punta Gorda. It is a cliff-faced plateau making out about a mile from the general trend of the coast. The seaward face of the plateau is a mile long and bordered by numerous rocks. A lighted whistle buoy is 1.1 miles southwestward from the point and a bell buoy 0.8 mile southeastward from the point. The small white bell tower on the east end of the point is prominent from the anchorage.

On the point is a county airplane landing strip 1,500 feet long. The words **SHELTER COVE** in large white

letters are painted on the slanting roof of a building 100 yards northward of the bell tower. The sign shows well from seaward.

**Shelter Cove** lies under the southern face of Point Delgada and affords fair shelter in northwesterly weather, but is exposed and dangerous with southerly or westerly winds. There is nearly always a swell running. In 1957 there were no wharves in the cove. Gasoline and water can be obtained ashore but must be carried down from the plateau.

Shelter Cove is used extensively as an anchorage by a large fishing fleet. A good dirt and gravel road is kept open in all but the worst weather; there are telephone facilities. Two pinnacle rocks close together with  $2\frac{1}{2}$  fathoms over them, lie 1,200 yards south-southeasterly of the point. A rock with  $1\frac{1}{4}$  fathoms over it lies 500 yards southeastward of the point. These rocks are usually well marked by kelp.

The following directions lead over an area covered by the wire drag: From a position 100 yards southward of Point Delgada lighted whistle buoy, steer  $110^\circ$  for 0.9 mile; then steer  $016\frac{1}{2}^\circ$  for 1 mile, passing 150 yards east of the bell buoy, and anchor in  $9\frac{1}{2}$  fathoms, with the bell tower bearing  $315\frac{1}{2}^\circ$ , distant 0.7 mile. The  $2\frac{1}{2}$  and  $2\frac{3}{4}$ -fathom spots are within 500 yards to the westward of this anchorage. The  $3\frac{1}{4}$ -fathom spot lying 1.15 miles  $184^\circ$ , and the  $3\frac{1}{2}$ -fathom spot 0.85 mile  $201^\circ$  from the bell tower will be avoided if a careful course is steered.

**Chart 5602.**—From Point Delgada the coast extends northwestward for about 19 miles to Punta Gorda, backed by steep mountains covered with chaparral and trees. About 0.8 mile northward of Point Delgada is a sand beach that extends northward for 4 miles. **Kaluna Cliff**, 1,474 feet high, overlooks the southern end of the sand beach and its steep face, scarred by frequent slides, is a noticeable landmark.

**King Peak**, 4,090 feet high, the highest of three, is the well-known landfall generally called **Three Peaks**. It lies about 8.5 miles northward of Point Delgada, 2.5 miles from the coast, and in clear weather is visible seaward for about 75 miles.

About 6 miles northward from Point Delgada is the head of **Delgada Canyon**, a submarine valley, the 100-fathom curve lying within 0.5 mile of the beach. This valley extends in a northerly direction, with an average width of 1 mile between the 100-fathom curves for 3.5 miles, and then expands, funnel-shaped, for 3 miles more. Over 400 fathoms are found at its mouth and 300 fathoms within 4 miles of the beach. The side slopes are steep.

**Big Flat** is a narrow strip of low, flat land about 7 miles northwestward of Point Delgada. It is 2 miles long and is bordered by sand beaches. A few abandoned ranch houses and barns are at the southern end of the flat. **Shubrick Rock**, low and small, lies 300 yards off the southern end.

About 11.5 miles northward of Point Delgada is the head of **Spanish Canyon**, a submarine valley. The 100-fathom curve lies within 2 miles of the shore.

**Reynolds Rock**, 10 feet high, is about 6.5 miles northwestward of Big Flat. It is about 550 yards offshore and when seen from close inshore appears as a double-headed rock over which the swell breaks in nearly all weather.

**Rodgers Break** is a sunken rock with  $\frac{1}{2}$  fathom over it, 0.5 mile westward of Reynolds Rock. It lies about 4 miles southeastward of Gorda Rock and 6.8 miles west-northwestward of Big Flat. It is a pinnacle rock that seldom breaks; the top is occasionally seen in a heavy swell. The rock is marked by a lighted whistle buoy. A pinnacle rock with 3 fathoms over it lies about 0.5 mile northwestward of Rodgers Break and about the same distance offshore. It probably breaks in very heavy weather. This pinnacle and Rodgers Break are the outermost known dangers on this stretch of the coast.

From Reynolds Rock northwestward to Punta Gorda the shore is bordered by numerous rocks extending about 0.3 mile offshore. The sharp depression in the hills near the coast, caused by the gulch of **Cooskie Creek**, 3.5 miles southward of Punta Gorda, is sometimes useful on dark nights to vessels close inshore in making the point from southward.

**Chart 5795.**—**Punta Gorda** is a high, bold, rounding cape about 83.5 miles northwestward of Point Arena and 11 miles southward of Cape Mendocino. The seaward face rises to 800 or 900 feet, 400 yards back from the beach, and terminates in a spur, 140 feet high, almost overhanging the sea. It is bare of trees except in the gulches. A gray rectangular structure of an abandoned lighthouse, about 25 feet high, is southerly of the point. For over 1.5 miles northward and about 2 miles southward of the point, the beach is bordered by numerous rocks and shoals extending in some cases 0.6 mile offshore.

The wind, sea, and currents off Punta Gorda are probably as strong as off any point on the coast; frequent and strong tide rips have been noted. Many times when the weather at Shelter Cove and even at Big Flat is clear and calm and the sea smooth, both the wind and the sea will pick up as Punta Gorda is approached, until just northward of this point strong breezes to moderate gales will be experienced. At other times clear weather southward of this point will lead to fog northward, or vice versa.

**Gorda Rock**, 10 feet high, is a conical rock about 0.7 mile southward of Punta Gorda and 0.6 mile offshore. A lighted whistle buoy is 300 yards southwest from the rock.

**Conical Rock**, 20 feet high, lies 200 yards off the point. A small, low rock lies 350 yards westward from it, with foul ground between.

From Punta Gorda to Cape Mendocino the hills back of the coast are lower than those southward; they are bare of trees and bordered by stretches of low, narrow, sandy flats with a narrow, low-water beach. The outlying rocks are not more than 0.7 mile offshore until about 2.5 miles south of Cape Mendocino, where they extend offshore to Blunts Reef, 2.5 miles west of the cape. **Mattole Canyon**, a narrow submarine valley, is 3 miles northward

of Punta Gorda where the 100-fathom curve is about a mile from the beach. **Mendocino Canyon** is 4.5 miles southward of Cape Mendocino where the 100-foot curve is about 2 miles from the beach.

**Christmas Rock**, with a depth of  $1\frac{1}{4}$  fathoms over it, is 0.9 mile northwesterly of Punta Gorda.

The **Mattole River** enters 2 miles northward of Punta Gorda. This river is not navigable and cannot be entered with a small boat at any stage of the tide. The northern head is bare and about 360 feet high, and the southern head is about the same height and partially covered with oak trees. The mouth of the river is subject to continual change. A prominent sand dune is on the southern side at the entrance to the valley. Another large sand dune about 3.5 miles to the northward marks the northern side of **McNutt Gulch** and should not be confused with the one at Mattole River.

**Mattole Point** is about 0.3 mile northward of the river at the base of **Moore Hill**, 1,210 feet high. A rock 8 feet high is 0.3 mile northward of Mattole Point and 250 yards off the beach at the head of Mattole Canyon. This rock was formerly used to support the end of a wharf. A rock with one-half fathom over it lies 0.4 mile northwest by north of Mattole Point.

**Sea Lion Rock**, 16 feet high, is the largest of a cluster of small rocks 0.5 mile offshore and nearly 4 miles northward of Punta Gorda. **The Brothers**, 8 feet high, consist of two small rocks, close together, 800 yards offshore and 0.5 mile northward of Sea Lion Rock. **Mussel Rocks**, 0.9 mile north of The Brothers, form a ledge that projects 400 yards from the shore.

**Devils Gate Rock**, 20 feet high, lies nearly 2.8 miles southward of Cape Mendocino and 0.5 mile offshore. It is low and pyramidal, with a smaller rock close under the northwestern face. A reef extends 200 yards westward from the rock; numerous rocks lie inshore. A rocky shoal of  $3\frac{1}{4}$  fathoms lies about 1.4 miles westward of Devils Gate Rock.

**Outer Break**, which bares 1 foot at MLLW, lies 1.8 miles southerly of Cape Mendocino. **Steamboat Rock**, 30 feet high, lies 1.5 miles southward of Cape Mendocino and 600 yards offshore. The upper part of the rock is white and the lower black somewhat resembling a steamer with a low black hull and white upper works.

**Cape Mendocino** is a mountainous headland, the famous landmark of the old Spanish navigators and the galleons from the Indies. The cape is the turning point for nearly all vessels bound northward or southward. In view of the dangers in the vicinity, it should be approached with considerable caution in thick weather; the bottom and the currents are very irregular. It is in the latitude of great climatic change; the meteorological conditions northward of the cape are quite different from those southward. The winds do not blow home so violently in the bight southward of it, and the amount of rainfall increases rapidly to the northward. Fog is more prevalent southward. The strong northwesterly winds of summer are less violent southward of the cape which forms a partial lee for vessels working their way northward.

The seaward face of Cape Mendocino is steep, rocky and water worn toward the shoreline. Above the light the general appearance is rolling and grass-covered, except in the deep ravines and upon some of the steep hillsides where the northern exposure is covered with forest or brush. For about 3 miles southward of the cape the beach is bordered by numerous rocks and sunken ledges extending in some cases to over 0.5 mile offshore. **Cape Mendocino Light** ( $40^{\circ}26.4' N.$ ,  $124^{\circ}24.4' W.$ ), 422 feet above the water and visible 28 miles, is shown from a white pyramidal tower on one of the western spurs about 400 feet above the sea.

**Sugar Loaf**, 326 feet high, is 250 yards westward of Cape Mendocino and is connected with it at low water by a narrow neck of rocks and shingle beach. This rock is a prominent feature in making the cape from either northward or southward, but in thick or hazy weather care should be taken to avoid mistaking it for False Cape Rock, which it somewhat resembles, that is in a similar position off False Cape, 4.5 miles northward of Cape Mendocino. False Cape Rock is about 216 feet high and is not so regular in outline as the Sugar Loaf, and from the westward or northwestward, shows two large rocks, 95 and 54 feet high, immediately inside of it, whereas the Sugar Loaf stands solitary and compact. As seen from the southwestward, Sugar Loaf shows a cave on its southwestern face, extending about one-third the height of the rock.

**Blunts Reef** is one of the outermost visible dangers off Cape Mendocino. It consists of two small, black rocks awash at high tides, about 230 yards apart with 15 fathoms between. The southern and outer rock lies 2.6 miles west by north of the Sugar Loaf. This is the larger of the two rocks.

**Blunts Reef Lightship** ( $40^{\circ}26.4' N.$ ,  $124^{\circ}30.3' W.$ ), is in 31 fathoms 1.7 miles west-southwestward of the outer rock. The vessel has a red hull with the word BLUNTS on each side and two masts with a gallery at each masthead. The light, shown from the main mast only, is 65 feet above the water and visible 14 miles. The radio-beacon and the fog signal are synchronized for distance finding. The code flag and radio call is NNCB. **Storm warnings** are displayed daytime only. The currents at the lightship are described in the Tidal Current Tables, Pacific Coast.

An area about 1.5 miles long in an easterly direction, having rocky patches from  $4\frac{1}{2}$  to  $5\frac{3}{4}$  fathoms, is about 3 miles northwestward of Blunts Reef.

**Fautleroy Rock**, with  $\frac{3}{4}$  fathom over it, is 1.65 miles west-southwestward of Cape Mendocino Light.

A rock with  $1\frac{1}{4}$  fathoms over it, is 0.5 mile south-south-eastward of the outer rock of Blunts Reef. **The Great Break**, with  $3\frac{3}{4}$  fathoms over it, is 0.75 mile southward of the outer rock of Blunts Reef.

Vessels should not attempt the passage between Blunts Reef and the cape under any circumstances, because of the dangerous rocks and sunken ledges. A heavy westerly swell breaks even in 9 to 10 fathoms in this locality.

From Cape Mendocino to False Cape, a distance of 4.5

miles, the coast is straight and bold and, bordered by a broad, low-water beach.

**Bear River**, a small stream, enters through a narrow valley about midway between the two capes.

**False Cape** is a steep, bold headland, rising to a height of over 600 feet in less than 0.2 mile from the beach; it projects slightly from the general trend of the coast. It is covered with grass, but the gulches on its sides are wooded. The base of the cape is bordered by a narrow, low-water beach of shingle and sand. For about a mile on each side of the cape are numerous rocks and sunken ledges, the outermost of which are about a mile from the beach.

**False Cape Rock**, 216 feet high, lies 0.4 mile westward of the cape, with two rocky islets, 95 and 54 feet high between. It is not as regularly shaped nor as high as the Sugar Loaf off Cape Mendocino, and the top is much flatter. A rock with  $1\frac{3}{4}$  fathoms over it lies 0.6 mile westward of False Cape Rock. **Mussel Rock**, 7 feet high, is 0.8 mile northward of False Cape Rock.

**Chart 5602.**—Northward of False Cape the hills decrease in height; 4 miles beyond the cape is the beginning of a stretch of sand beach and dunes, broken only by Table Bluff and Buhne Point, that extend to Trinidad Head.

**Centerville**, about 4 miles northward of False Cape, is not prominent from seaward. A white cross is on the 120-foot bluff just southward of Centerville. A number of buildings, comprising the U.S. Naval Facility for oceanographic research, are on the bluffs about 0.8 mile southward of the village.

**Eel River** empties 8 miles northward of False Cape. This is a stream of considerable size and is occasionally entered by light-draft vessels, but the channel over the bar is continually shifting. The depth on the bar varies largely with the amount of water in the river, depending upon the character of the winter, and has been at times as much as 14 feet, but generally the depth is about 8 or 9 feet. The river is seldom entered except by fishing boats and other very small craft, and then only by those with local knowledge of the bar.

**Eel Canyon** is a submarine valley extending in a northwesterly direction. It comes to a head 10 miles northward of Cape Mendocino. Vessels are cautioned against mistaking this valley for one of those southward of the cape.

**Chart 5832.**—**Table Bluff**, about 12 miles northward of False Cape and 4.5 miles southward of Humboldt Bay entrance, is a prominent feature from seaward. The western face is 0.5 mile long, 165 feet high, very steep, and has a narrow sand beach under it. The elevated tank and white buildings at Table Bluff are prominent. **Table Bluff Light** ( $40^{\circ}41.7' N.$ ,  $124^{\circ}16.4' W.$ ), 176 feet above the water and visible 20 miles, is shown from a white square tower near the extreme western edge of the bluff.

From Table Bluff to Humboldt Bay entrance the coast consists of a narrow sand spit for 4 miles, behind which lies the southern part of Humboldt Bay.

**Humboldt Bay**, 21 miles northward of Cape Mendocino Light, is the first important harbor northward of San Francisco. It can be used as a harbor of refuge in impending bad weather, providing a vessel can get inside before the bar becomes impassable. The bay consists of two shallow basins, South Bay in the southern part and Arcata Bay in the northern part, connected by a narrow channel about 5 miles long.

A large quantity of lumber is shipped to both foreign and domestic ports; some farm and dairy products, livestock, leather, and fish are also shipped, mostly to San Francisco. General merchandise, gasoline, and fuel oil are received.

**Prominent features.**—Table Bluff Light, 4 miles southward of the entrance, is the best landmark by night. By day the tall stacks and the smoke from the sawmills in the bay can usually be seen. North Spit has clumps of trees along the bay shore near the channel while South Spit is barren. The red bluff at **Buhne Point** on the eastern shore of the bay, a power plant about 0.5 mile eastward, with a stack and large storage tanks nearby, and a lighted radio tower about 0.5 mile farther eastward, are conspicuous in entering the bay. A Coast Guard station is inside the North Spit, 0.5 mile from the southerly end.

The approach to the bay is marked by a lighted whistle buoy and a bell buoy off the entrance, and a radio-beacon, fog signal and approach range lights on the outer end of the North Spit. A light is on the south jetty, 165 yards from its outer end. The entrance channel inside the bar is marked by range lights and lighted buoys.

**Note.**—The outer range should not normally be used beyond its intersection with the inner range. The inner range should not normally be used seaward of the outer end of the jetties.

Two jetties are at the entrance to the bay, 750 yards apart. The south jetty extends northwestward a distance of 0.7 mile from the South Spit and the north jetty extends in the same direction from the North Spit. The bar northward of the south jetty is subject to considerable shifting and shoaling at times, especially during the winter months. Local pilots keep careful watch over the bar conditions, and sometimes sound out the channel before attempting to take out deep-draft vessels. In 1957,  $22\frac{1}{2}$  feet was the usual maximum draft to which vessels were loaded in Humboldt Bay due to conditions of the inside channel as well as the bar.

In the past **Humboldt Bar** was considered treacherous and dangerous, and many disasters have occurred here. With the present improvements, however, and by employing local pilots, vessels may enter or leave with comparative safety. The strong currents that may be encountered, and the abrupt turn at the outer end of the south jetty are apt to be dangerous for strangers. The bar is the smoothest during the last of the flood current and it is often passable at this time and impassable two hours later, when the ebb current has set in. Caution should also be exercised inside the jetties due to the rapid change in the channel conditions. Deep-draft vessels are usually taken in and out of the bay during daylight hours.

**Channels.**—A Federal project provides for a channel 30 feet deep from the entrance northward to the turn in the channel at Eureka, thence 26 feet to the foot of "N" Street; a channel 26 feet deep westward of Gunther Island to Samoa; and a channel 26 feet deep southward from the entrance to and including a turning basin at Fields Landing. The channels are maintained at or near project depths, except in July 1957, the controlling depth of the channel north of Eureka from the foot of "C" Street to the foot of "N" Street was 14 feet.

**Arcata Bay**, in the northern part of Humboldt Bay, is about 3 miles in diameter, with low, marshy shores, cut by many sloughs. There are two channels, the **Mad River Slough Channel**, leading into **Mad River Slough**, and the **Arcata Channel**, leading to the railroad wharf, now in ruins, at Arcata. **Gunther, Woodley, and Daby Islands**, low and marshy, lie in the entrance to Arcata Bay.

Along the eastern shore of the bay, northward to Eureka, are several sawmills, with docks built out to the channel, from which lumber is shipped.

**Fairhaven** is a small town on the western shore, 2 miles southward of Samoa. A small boatyard has a marine railway capable of hauling out craft up to 50-ton weight, 65-foot length, and 6-foot draft. A plywood plant, with a concrete stack and tall silver elevated tank, is here.

**Eureka**, the principal town on the bay, is on the eastern shore, about 4 miles northward of the entrance. It handles most of the waterborne traffic of the bay, and is the terminus of a railroad from San Francisco, although a branch of the road continues to Arcata and Samoa.

The approach to Eureka from the main channel through the bay is through an almost straight natural channel which has been improved by dredging.

**Samoa**, on the western shore opposite Eureka, is the terminus of a railroad from Arcata. There are large sawmills, and a considerable amount of lumber is shipped. There is a depth of 23 feet alongside the docks. The high concrete stack is very prominent from offshore. There are three black tanks westward of the stack and two similar tanks to the southward. A privately owned passenger ferry provides regular service between Samoa and Eureka.

**Arcata** is on the northern shore of the bay. There are no serviceable wharves in the town. The ruins of several old wharves are near the head of Arcata Channel.

**South Bay**, in the southern part of Humboldt Bay, is about 3 miles long and 2 miles wide. There are two channels, one leading toward **Southport Landing**, the other past Fields Landing to **Hookton**, at the head of **Hookton Slough**. The **Southport Channel** has a least depth of 6 feet, but is little used. The **Hookton Channel** to Fields Landing is marked by lights, buoys, and a daybeacon.

**Fields Landing**, on the eastern shore of South Bay, has terminals where lumber is shipped by water and rail. There are depths of 18 to 20 feet alongside the loading wharves. A small boatyard has a marine railway having a capacity of 150 tons and capable of hauling out boats not over 80 feet in length or 8½-foot draft. A railroad and highway pass through the town.

**Anchorage.**—The best anchorage is between **Bucksport**

and the light at the southern end of Gunther Island, according to draft of vessel. Vessels in anchoring must keep clear of the cable crossing the channel just above Fairhaven. It is forbidden to anchor in Eureka Channel longer than 24 hours at a time. If obliged to anchor outside the bar, the best anchorage will be found southward and westward of the lighted whistle buoy in about 90 feet, sand and clay bottom.

**Directions, Humboldt Bay.**—A pilot should be engaged by strangers if there is any sea on the bar or if they have deep-draft vessels. It should be borne in mind that the bar is subject to change, so that strangers cannot rely on finding the charts correct or the ranges indicating the best water.

**From southward.**—From a position 1.5 miles 260° from Blunts Reef Lightship, steer 356½° for 5.0 miles, when Table Bluff Light should bear 048°; thence a 038½° course made good for 20.0 miles leads to Humboldt Bay Entrance lighted whistle buoy HB. At night Table Bluff Light should be made shortly after passing Blunts Reef Lightship, and when nearing the entrance, the lights in Eureka will be seen. In thick weather, after passing False Cape Rock, all dangers will be cleared by keeping in a depth of over 15 fathoms until up with the lighted whistle buoy, where anchorage should be made until a pilot is obtained.

**From northward.**—From a position 3 miles westward of Trinidad Head Light, a 187° course, made good for 17 miles, leads to the Humboldt Bay Entrance lighted whistle buoy HB. On this course Table Bluff Light, 5 miles southward of the Humboldt Bay Entrance lighted whistle buoy HB, should be made ahead. In thick weather the depths should not be shoaled to less than 20 fathoms between Turtle Rocks and Trinidad Head and, when southward of the head, the depths should not be shoaled to less than 15 fathoms until up with the lighted whistle buoy, where a vessel should anchor until a pilot is obtained.

**From seaward.**—In clear weather the high land of Cape Mendocino and Punta Gorda southward, and Trinidad Head northward of the entrance, are good landmarks. At night, the lights are a good guide. In thick weather soundings should be taken frequently, and upon getting depths of 30 fathoms or less great caution must be exercised until sure of the vessel's position, when the course should be shaped for the lighted whistle buoy.

Sailing vessels during the prevailing northwesterly winds of summer should endeavor to make the land in the vicinity of Trinidad Head, which gives them a fair slant for the entrance, and is an additional precaution against the irregular southerly set of the current. In thick weather soundings should be taken constantly when inside of 50 fathoms. Making the land northward of the entrance avoids the irregular bottom and dangerous currents in the vicinity of Cape Mendocino.

From the Humboldt Bay Entrance lighted whistle buoy HB, Humboldt Bay Approach Range, course 105°, and Humboldt Bay Entrance Range, course 140°, lead into the bay. The entrance range parallels the south jetty and is

only about 150 yards from it. The turn from the approach to the entrance range, 200 yards off the outer end of the south jetty, is rather abrupt and is difficult under certain conditions of wind, sea, and current. Inside the bay the channels are well marked by daybeacons and buoys, and are easy to follow.

**Tides.**—The mean range of tide at Eureka is 5 feet. The range between mean lower low water and mean higher high water is 6½ feet. A range of about 11 feet may occur at the time of maximum tides. Daily predictions for Humboldt Bay (South Jetty Landing) are given in the Tide Tables.

**Currents.**—The tidal currents follow the general direction of the channels. In the main channel, the average velocity at strength is less than 2 knots, and the maximum does not exceed 3 knots. Between the jetties, the average velocity at strength is about 2 knots, with a maximum of about 4 knots. For current predictions the Tidal Current Tables, Pacific Coast should be consulted.

See Appendix for storm warning displays.

**Pilotage.**—Vessels requiring pilots should radio their agents at Eureka, or contact the Humboldt Bar Pilot Association through the marine operator.

**Towboats** are available.

**Quarantine.**—Regulations of the U.S. Public Health Service are enforced. The quarantine station is at 507 F Street. An outpatient office of the Public Health Service is in the city.

**Customs.**—Eureka is a port of entry; marine documents are issued.

**Harbor regulations** are prescribed by the State and city Board of Harbor Commissioners. A wharfinger, located at the Eureka Boat Basin, foot of Commercial Street, has jurisdiction over fishing and pleasure craft using the facilities at the city-owned boat basin.

**Supplies.**—Fuel oils, provisions, water, and ship chandlery can be obtained at Eureka.

**Repairs.**—Minor repairs to machinery and to woodwork above water can be made. There are no drydocks in the area. Two marine railways are in the bay and boats up to 80 feet in length and with 8½-foot draft can be hauled out. The capacity of the largest railway is about 150 tons.

**Communication** is by rail to San Francisco and by bus and air to points north and south. Communication is available by telegraph and telephone or by commercial radio at Eureka.

**Chart 5602.**—Northward of the entrance to Humboldt Bay, the coast consists of sand dunes partly covered with timber for 11 miles to the mouth of Mad River, and for the first 7 miles forms the western shore of Humboldt Bay. Above the bay the land behind the dunes is low and marshy as far as the river.

From the mouth of Mad River, the sand dunes varying in height from 20 to 60 feet, continue for about 5.5 miles to Little River, a small shallow stream. The northern point at the mouth of the stream is rocky, and from this point the coast consists of rocky cliffs extending beyond Trinidad Head.

**Chart 5846.**—Little River Rock, 126 feet high, is 0.8 mile northwestward of the mouth of Little River, and about 0.3 mile offshore. Several rocks and foul ground are between it and the beach, and a rock 4 feet high is about 100 yards northwestward.

From Little River Rock to Trinidad Head the shore is bordered by numerous rocks and sunken ledges extending 0.3 mile offshore.

**Pilot Rock**, 93 feet high, is 0.5 mile southward of Trinidad Head. It is of small extent, conical, and whitish in color, rising abruptly from depths of 48 to 59 feet on all sides. Pilot Rock is marked on its western side by a gong buoy.

**Trinidad Head** is nearly 39 miles north-northeast of Cape Mendocino and 17.5 miles northward of the entrance of Humboldt Bay. It covers an area 700 yards long and 500 yards wide and rises to a height of 380 feet. The sides are steep and covered with chaparral. From northward or southward the head is generally raised as a dark, round-topped island. Near the northern end it is joined to the mainland by a narrow neck, from the southern side of which **Little Head**, a rocky knoll 125 feet high, projects into the bay. The white cross 200 yards northward of the southern point of Trinidad Head is fairly prominent. The old tank platform about 200 yards northward of the cross is prominent from the westward and eastward.

**Trinidad Head Light** (41°03.1' N., 124°09.0' W.), 196 feet above the water and visible 20 miles, is shown from a white pyramidal tower near the southwest side of the head; a fog signal is near the light. A lighted whistle buoy is 1 mile west of the head.

**Trinidad Harbor** is the small cove eastward of Trinidad Head. It affords shelter in northwesterly weather but is dangerous in westerly or southerly weather. The cove is small and is further contracted by several rocks, and as a rule, there is always a swell even in northerly weather. It is used by fishing boats to a considerable extent during the summer months even though the holding ground is only fair. A wharf with a fish house is in the bight west of Little Head. Fish are unloaded at the wharf and are trucked to Eureka and San Francisco.

**Trinidad** is a village on the northern shore of the cove. It is on the Redwood Highway, which parallels this section of the coast. There are motels, and telephone and bus service here. Provisions may be had in small quantities.

**Prisoner Rock**, 42 feet high, is the most prominent of the rocks in the cove, and consists of two rocks so close together that they are usually taken for one. From southward they resemble an animal lying down with its head toward the west. It is 220 yards eastward from the eastern shore of the head. A rock with 7 feet over it is 150 yards north-northwestward from it.

**Flat Rock**, low and small, lies 350 yards northeastward from Prisoner Rock; a rock with 5 feet over it lies 150 yards southeastward from it. A bell buoy is 175 yards west of a rock with 9 feet over it which lies 400 yards southeastward of Prisoner Rock.

The best anchorage is in 42 feet, muddy bottom, about

halfway between Prisoner Rock and Trinidad Head, with Flat Rock, bearing 073°, just open southward of Prisoner Rock.

In entering from southward, vessels should not pass eastward of the line with the west tangent of Prisoner Rock on range with Little Head to avoid the 9-foot spot southeastward of Prisoner Rock. Pilot Rock may be passed close-to on either side. From northward, at Turtle Rocks bell buoy steer 180° for 5.3 miles, when Trinidad Head Light and the lighted whistle buoy off the head should be in range, bearing 086½°. A 090° course will then lead to the bell buoy south of Prisoner Rock. The southern face of the head may be kept close aboard.

**Blank Rock**, 111 feet high, lies a little over 0.3 mile westward of the head. Foul ground is between it and the head. A smaller rock is 150 yards northward of Blank Rock. A rock awash and a ledge with 15 feet over it are 275 yards southeastward of Blank Rock.

**Off-Trinidad Rock**, 72 feet high, lies 0.3 mile northwestward of Blank Rock. It is considerably larger than Blank Rock, with two rocky heads of about the same height. A sunken rock lies 300 yards off its southwestern face, and numerous ledges extend southeastward toward the head.

**Chart 5702.**—From Trinidad Head to Rocky Point a distance of 5.5 miles, the coast is rocky, with numerous outlying rocky islets and sunken ledges, extending as much as 1.2 miles offshore, and cliffs reaching elevations of over 100 feet. The mountains back of Trinidad Head are good landmarks for vessels approaching from seaward. Above Rocky Point, the beach is low and sandy, with several lagoons behind it, for nearly 11 miles to the southern end of the Gold Bluffs. From this point to Point St. George, the coast is rocky, the cliffs being from 100 to 500 feet in height and bordered by numerous rocks. The Klamath River breaks through the cliffs 16 miles southward of Point St. George. From Point St. George to Cape Blanco, a distance of about 65 miles, the coast trends in a general northwesterly direction, with a shallow bight known as Pelican Bay immediately northward of Point St. George. The beach is fringed by numerous rocks and sunken ledges, but, with the exception of Rogue River and Orford Reefs, these in general do not extend over a mile from shore. The 30-fathom curve follows the general trend of the coast, and in thick weather may be considered as the limit inside of which it is unsafe to approach, but in the vicinity of Rogue River and Orford Reefs, the depths should not be shoaled to less than 50 fathoms.

**Rodgers Mountain**, 2,800 feet high and heavily wooded, is nearly 7 miles northeastward of Rocky Point and is easily identified. **Hupa Mountain**, 4,093 feet high, is farther inland, about 16 miles eastward of Rocky Point.

**Green Rock**, 108 feet high and of small extent, lies 1.5 miles northward of Trinidad Head and nearly 600 yards offshore. The top is covered with grass. Numerous rocks lie inshore, and a rock awash at high water lies 700 yards westward of it. A rock with 3 fathoms over it lies about

0.5 mile westward of Green Rock. It seldom breaks, and rises abruptly from 15 fathoms. Two sunken rocks lie 0.5 and 0.8 mile northeast by north of Green Rock.

**White Rock**, 118 feet high, lies 1.9 miles northward of Trinidad Head. It is of small extent and is 250 yards off a wooded, projecting head about the same height. Another rocky islet 129 feet high is 1 mile northward of White Rock.

**Cone Rock**, 17 feet high, is 3.8 miles northward of Trinidad Head and a little over a mile offshore. It is conical in shape and of small extent. A smaller rock 15 feet high lies 0.5 mile eastward.

**Turtle Rocks**, two rocks of small extent 20 and 29 feet high, are 1.5 miles northward of Cone Rock and abreast of Rocky Point. Eastward of Turtle Rocks the ground is foul, with two breakers 600 and 800 yards from the outer rock and numerous visible rocks extending to the beach. A bell buoy is 0.5 mile westward of Turtle Rocks.

**Rocky Point**, 5.5 miles northward of Trinidad Head, is a bold feature with cliffs about 200 feet high, bordered by numerous rocks and ledges extending 200 to 300 yards offshore. The point is covered with oak and scrub pine for 0.5 mile back to the redwood forest; through this oak growth two rocky pinnacles about 250 feet high are visible.

Northward of Rocky Point the cliffs are succeeded by a low sandy beach for 4.5 miles to the north end of **Big Lagoon**, which is immediately behind the sand beach. Above Big Lagoon the cliff formation is resumed and extends 2 miles to **Stone Lagoon**.

**Sharp Point**, 6.2 miles northward of Rocky Point, is a sharp-pointed conical rock cliff about 400 feet high. Its light-gray color makes it readily distinguishable for a distance of 15 miles in clear weather from any direction. The beach in this area is bordered by numerous rocks extending about 0.8 mile offshore.

**Gold Bluffs** begin about 9 miles northward of Rocky Point and extend northward for 9 miles, ranging from 100 to 500 feet in height, the first 3 miles being comparatively low and bordered by several outlying rocks. About 4 miles from the southern end the cliffs are broken by two moderately broad valleys. These bluffs are composed of gravel and sand, and are not rocky.

**Mussel Point**, 11.2 miles northward of Rocky Point, is a light gray cliff about 300 feet high, with a small, flat top distinguishable at 10 to 12 miles in clear weather.

**Redding Rock**, 94 feet high and of small extent, is about 4.5 miles offshore west of Mussel Point. It is dark for about one-third the height and white above with a cleft on the southern face. It rises abruptly from depths of 20 fathoms and can be approached close-to with safety. It is marked by a white 18-foot square pyramidal skeleton tower on a house. A lighted whistle buoy is 400 yards southwestward of the tower.

Northward of Gold Bluffs the coast becomes rocky, irregular, and broken, the bold cliffs being bordered by many rocks.

A yellow clay slide extending from the top of a 900-foot slope to the beach is 9 miles northward of Mus-

sel Point. It is sharp at the top, broad at the base, and the highest and most prominent of the bluffs in that vicinity. It may be seen in clear weather for a distance of 15 to 18 miles.

**Split Rock** is a slightly projecting head 3.5 miles northward of the northern end of Gold Bluffs; it is named on account of the cut on the northern face.

**High Bluff** is a slightly projecting head 0.8 mile northward of Split Rock. It is prominent on account of an enormous split or chasm on its northern face; at the southern edge of the cut the bluff is 340 feet high.

**White Rock**, 107 feet high, lies 600 yards northward of High Bluff and 300 yards offshore. Numerous rocks, covered and visible, lie between it and the beach. Its southern face is very precipitous and its western face is steep, sloping northward. It can be distinguished by its color for several miles.

**Flint Rock Head**, 177 feet high, is a detached rocky head connected with the cliffs by a low sandspit. It is at the southern end of the Klamath River sand beach, 1.8 miles northward of Split Rock. Its southwest face is precipitous. A rock awash lies 0.6 mile northwest from Flint Rock Head and about 0.5 mile offshore.

The **Klamath River** empties about 16 miles southward of Point St. George and 30 miles northward of Trinidad Head. It is a large river draining an extensive mountainous area. The mouth of the river in 1957 was on the northern side of the valley near the northern headland. The pilings formerly reinforcing the sand spit are practically covered. Local boats carry 2 to 3 feet into the river. The bar changes frequently and local knowledge is essential to make the entrance. The entrance is seldom used, but there are milling operations and small boat traffic on the river. There are several small wharves and float landings where sport fishing boats berth. Gasoline and water are available.

The coast highway crosses the river at **Klamath**, a small town 2 miles inland. **Requa**, a small village on the north shore of the river just inside the mouth, has a hotel and landings for sport fishing boats. At night the lights of the village are conspicuous.

**Red Mountain**, 4,305 feet high, 8 miles eastward of the mouth of Klamath River, is prominent. In clear weather it is visible about 60 miles seaward.

From the mouth of the Klamath River the coast curves northwestward for 3 miles to the mouth of **Wilson Creek**. The cliffs are high, irregular, and jagged, and the hills above are covered with grass and chaparral. Numerous rocks extend about 300 yards offshore.

A covered rock 0.6 mile offshore is 1.4 miles northwestward of the mouth of Klamath River. A rock 37 feet high is 1 mile offshore, 2.6 miles northwestward of the mouth of Klamath River and about 1.5 miles southward of Wilson Creek.

**False Klamath Rock**, 203 feet high, reddish, and rounded, is the most prominent rock on this part of the coast. It lies 650 yards westward of the southern point of the small cove into which Wilson Creek empties. **Wil-**

**son Rock**, 2½ feet deep, is 0.5 mile west of False Klamath Rock. A rock awash is 0.9 mile northwestward of False Klamath Rock. Numerous covered rocks lie eastward and northeastward of the line from this rock to the rock 37 feet high southward of False Klamath Rock.

From False Klamath Rock for 7 miles northward the coast consists of bold rocky cliffs, much broken and bordered by numerous covered and exposed rocks. Beyond these, extending about 4 miles to Crescent City, is a broad sand beach backed by flat cultivated land.

**Midway Point**, 4 miles northward of False Klamath Rock, is bold, rising to a height of 820 feet 800 yards from the beach.

**Sister Rocks**, a cluster of prominent rocks, 0.5 mile westward of Midway Point, consist of three large and several smaller rocks covering a limited area; the outer one is 69 feet and the inner one 72 feet high.

**Chart 5895.**—**Crescent City** is on the northern side of a small rocky constricted bay about 3 miles southeastward of Point St. George and midway between San Francisco Bay and the mouth of the Columbia River. The west breakwater extends 1,250 yards southeastward from Battery Point, thence 350 yards in an easterly direction. A rubble mound sand barrier extends from **Whaler Island** to the eastern shore, and an inner breakwater extends northward from this island for about 400 yards, forming a protected harbor for fishing boats.

**Crescent City Light** (41°44.7' N., 124°12.1' W.), 77 feet above the water and visible 14 miles, is shown from a white tower on a dwelling located on a small islet 45 feet high, 200 yards southward of **Battery Point**. The beach between the islet and the point is bare at half tide. An aviation light is 1 mile southeast of Point St. George.

A Federal project provides for a basin off the wharves 20 feet deep, except in rock. In May 1957 the controlling depth was 13 feet through the outer harbor and 10 feet inside. The west breakwater gives good protection from the northwestward, but the anchorage, except for Fishboat Harbor is open to the southward.

**Caution.**—Vessels anchored in the harbor should take precaution against a local southeasterly wind known as the **kick back** or **back draft**, which frequently blows with considerable violence at night. This wind follows only periods of strong northwesterly winds outside. It usually starts in about 9:30 p.m. and dies out about midnight.

The entrance to **Crescent City Harbor** is marked by a lighted whistle buoy 1 mile southwestward of Round Rock and a directional light on the outer end of the west breakwater. Caution should be exercised in approaching the harbor inside the fairway buoy due to the many rocks and shoals. **Chase Ledge** with 21 feet over it, lies 0.9 mile southward of Round Rock. **Mussel Rock**, only a few feet high, is 0.8 mile southward of Whaler Island. A rock with 7 feet over it, 700 yards to the southward, breaks only in heavy swell. **Round Rock**, 45 feet high, 550 yards southward of the outer end of the west breakwater, has

deep water close-to. A pinnacle rock with 22 feet over it, 750 yards to the westward, is marked on its southern side by a gong buoy. Northward and northwestward of lighted whistle buoy 3, which is 300 yards northwestward of Round Rock, are numerous rocks both below and above the water. Occasionally the buoy is forced out of position by heavy seas during southerly storms. Eastward of Round Rock are numerous covered rocks which extend northward to Whaler Island.

In approaching from southward, set a course from Crescent City lighted whistle buoy CC so as to pass about 100 yards eastward of Round Rock, thence a course between the lighted bell buoy and the buoy southeastward of Fauntleroy Rock to the basin. In thick weather the depth should not be shoaled to less than 100 feet until the fairway buoy is made.

In approaching from westward, pass to the southward of the gong buoy, 800 yards westward of Round Rock, and proceed as directed in the preceding paragraph.

There are three privately owned wharves in the western part of the harbor. The middle one was a fish cannery, but is in ruins and no longer used. The other two are used for shipping lumber.

**Fishboat Harbor** is formed by the inner breakwater extending northwestward from Whaler Island and the sand barrier from that island to the eastern shore. Although small, the harbor affords excellent shelter; it is used extensively by fishing boats. A town wharf called Citizens Dock has been built out to a depth of 13 feet. Lumber is shipped from the head of the wharf, and fishing boats use a spur built out near the end. Water is piped to the wharf; gasoline and fuel oil are delivered by truck. The end of the inner breakwater is marked by a light.

Crescent City has no facilities for hauling out vessels. Some local boats are beached for minor repairs. Pilots are not available, although towboats operate from the harbor. Communication is by motor vehicle over highways to the interior, north and south. There is no through rail connection. A hospital is in the town.

From Crescent City to Point St. George, a distance of 3.4 miles, the coast is moderately low but rocky with numerous rocks above and under water extending 0.8 mile offshore. **Castle Rock**, the largest, is 233 feet high, and lies 2.3 miles northwestward of Crescent City Light and 0.5 mile southward of the southern point of Point St. George. It has a rather flat top with a small knob near the eastern edge. By passing 0.8 mile or more southward of Crescent City Light and over 0.3 mile southward of the outer visible rocks, all dangers between the light and Castle Rock will be avoided.

**Point St. George** is low, with several irregular and rocky hillocks near the beach. The seaward face is about a mile long in a northwesterly direction, with sand dunes and low land immediately behind it. The tree line is about 0.6 mile inland, with a few trees near the southern end of the point. Numerous conspicuous rocks fringe the point between Castle Rock and Brown Rock, one of which, **White Rock**, 45 feet high, shows an arch

from westward. **Brown Rock**, 28 feet high, is at the end of the reef of exposed rocks that extends 0.5 mile west-northwestward of the northwestern end of Point St. George. An airport is 0.8 mile eastward of Point St. George.

**St. George Channel**, over a mile wide, is clear between the visible rocks fringing Point St. George and the easternmost rocks of St. George Reef. It is frequently used in clear weather by coastwise steamers.

**St. George Reef** is composed of rocks and covered ledges extending 6.5 miles northwestward and westward from Point St. George. Nine visible rocks are in the group.

**St. George Reef Light** ( $41^{\circ}50.2' N.$ ,  $124^{\circ}22.5' W.$ ), 146 feet above the water and visible 18 miles, is shown from a white square pyramidal tower on a pier on **Northwest Seal Rock**, the outermost rock; a radiobeacon and a fog signal are at the light.

**Star Rock**, the southeasternmost rock of the group, is 64 feet high. It is 2 miles westward of the southern end of Point St. George. Between Star and Northwest Seal Rocks are three rocks, Hump, Whale, and Southwest Seal, almost in line, varying in height from 18 to 45 feet. Southward of these visible rocks are two covered ledges, **Mansfield Break**, and **Jonathan Rock**. The latter is 2.5 miles northwestward of Star Rock and 3.2 miles southeastward of Northwest Seal Rock. It breaks only in a heavy swell, and not continuously then; deep water surrounds it. Mansfield Break lies 2.3 miles south by east of Northwest Seal Rock and nearly 3.5 miles northwestward of Star Rock. It is about 100 yards in extent with 20 fathoms close-to and around it.

**Great Break**, 0.5 mile southeastward of Southwest Seal Rock, is about 150 yards in extent. A covered ledge that breaks at low tide is 125 yards southwestward of Southwest Seal Rock.

**Dragon Channel**, which leads northward of Jonathan Rock and between Mansfield Break and Great Break, is not recommended.

**East and Long Rocks** are 2.1 and 1.6 miles, respectively, northward of Star Rock. On this line and 1 mile northward from Star Rock is a rock visible at lowest tides; 0.3 mile southeastward from this rock is a rocky patch 15 feet deep in which a rock 5 feet deep has been reported.

**Flat Rock** lies nearly midway between Long and Whale Rocks, and about 0.6 mile from the former. **Mussel Rock** is nearly 0.5 mile west by north of Long Rock; a covered ledge showing a breaker is 200 yards northward of the rock. A covered rock that breaks in moderate swells is 330 yards northeastward of Hump Rock.

All the rocks of St. George Reef rise abruptly; when in the vicinity soundings give no warning of their presence. In thick weather the greatest caution should be observed and the reef given a wide berth.

**Chart 5702.**—For about 10 miles northward of Point St. George, the shores of **Pelican Bay** are composed of sand dunes, with a broad beach extending to the mouth of **Smith River**. **Lake Talawa** and **Lake Earl** are sur-

rounded by low marshy land behind this stretch of dunes.

A small rock about 10 feet high is 1.8 miles southward of the mouth of Smith River and nearly 0.5 mile offshore. A cluster of three low rocks is nearly a mile offshore and 0.9 mile north-northeastward of the 10-foot rock.

**Chart 5896.**—Between Smith River and the California-Oregon boundary, a distance of 3.2 miles, the coast is composed of low rocky cliffs, bordered by numerous rocks and ledges, covered and awash, and backed by a low narrow tableland. Several prominent rocky knolls rise from 100 to 200 feet above this tableland.

**Pyramid Point**, a rocky knoll 213 feet high, marks the northern point of Smith River.

**Prince Island**, of small extent and 171 feet high, lies 0.1 mile offshore abreast Pyramid Point. **Hunter Rock**, 177 feet high, double-headed and somewhat smaller, is 0.3 mile northward of Prince Island. Several other smaller rocks are in the vicinity.

**Cone Rock**, 1.3 miles northward of Prince Island and 0.6 mile offshore, is the most prominent of the visible dangers in this vicinity. It is 68 feet high and of small extent.

## 9. CHETCO RIVER TO COLUMBIA RIVER, OREGON

**Chart 5896.**—Between the California-Oregon boundary and Chetco River, a distance of 3.8 miles, the coast is composed of low rocky cliffs, bordered by numerous rocks and ledges, covered and awash, and backed by a low narrow tableland. Several prominent rocky knolls rise from 100 to 200 feet above this tableland. Due to the numerous dangers, the coast should not be approached closer than 1.5 miles.

The **Winchuck River**, a small stream with 0.5 mile of low sand dunes on the southern side of its mouth, empties 0.5 mile northward of the California-Oregon boundary. A rock awash is 1 mile offshore southwestward of the entrance to the river.

**Chetco Cove** is about 15.5 miles northward of Point St. George. It affords an indifferent anchorage, with some protection from northwesterly winds, but is exposed in southerly weather. There are numerous visible and sunken rocks fringing the shore of the cove and its approaches, necessitating caution in its use. The **Chetco River** enters the middle of the cove northward of a sand and gravel beach. Two stone jetties are at the entrance to the river. In May 1958 the controlling depth was 6 feet to about 0.4 mile above the outer end of the jetties, thence less than 2 feet to the highway bridge. From southward the valley of the river is well marked, even in hazy weather. Just inside the entrance on the west bank is a conspicuous concrete bridge pier. The fixed highway bridge crossing the river at the village of **Harbor**, 0.6 mile upstream from the mouth, has a horizontal clearance of 160 feet and an overhead clearance of 10 feet.

On the northern shore of the cove, westward of the mouth of the river is the village of **Brookings**, which has a post office. The tall stack of the plywood mill in the village is conspicuous. The ruins of the wharf extend out from the shore 300 feet to **Bell Rock**.

Anchorage may be had in 9 fathoms, sandy bottom, about 1,100 yards southward of **Yellow Rock**. Protection from northerly weather and good holding ground are afforded.

From **Chetco Point** to Cape Ferrelo, about 4.5 miles, the coast is composed of high broken cliffs, bordered by numerous rocky islets and ledges extending, in some cases, over 0.5 mile offshore.

**Goat Island**, 184 feet high, lies 2 miles northward of Chetco Point, and 500 yards offshore. There is deep water off its western and southwestern faces, but rocks and foul ground extend 200 yards southward from the southeastern point. The island is readily identified; its profile closely resembles that of Prince Island off Pyramid Point.

**Cape Ferrelo** is the prominent headland northward of St. George Reef and, though not projecting seaward to any

extent, is conspicuous because of its bold, rugged face. Several rocks and islets lie directly off the cape to a distance of 0.5 mile.

From Cape Ferrelo to Crook Point, about 9.5 miles, the coast is very rugged and rocky, with several large and prominent islets and reefs extending well offshore. In some cases, these form anchorages for small vessels in northerly weather.

**Whalehead Island**, the outer of two rocky islets 2.3 miles northward of Cape Ferrelo, is 107 feet high. The inner of the two islets is 128 feet high. A rock awash lies 800 yards southward of the highest point of the island.

A rugged cliff from 200 to 300 feet high is 3.3 miles northward of Cape Ferrelo. The face is about a mile in length and behind it rises a treeless triple-headed hill to heights of 700 to 800 feet.

**Leaning Rock**, 49 feet high, lies 0.5 mile offshore and about 3.5 miles northward of Whalehead Island. It has a perpendicular face on its northwestern side and slopes gradually southeastward. Several other rocks are in its vicinity.

Between Whalehead Island and Crook Point are two prominent grassy areas in the forest near the crest of the hills about 2 miles apart and situated at an elevation of nearly 2,000 feet; the southern one is known as **Rocky Prairie**.

**Yellow Rock**, 84 feet high, lies about 4.5 miles northward of Whalehead Island, 0.5 mile offshore. The rock is yellowish in color and can be recognized from 4 miles offshore.

**Bosley Butte**, 8.5 miles northeastward of Cape Ferrelo, is 3,403 feet high, and shows above the coast ridges from the westward and northwestward as flat-topped with two summits separated by a slight depression. The northeasterly summit is rounded and somewhat larger, but is slightly lower than the eastern summit.

**Mack Arch** is a double-headed, rocky islet 0.8 mile offshore, 1.5 miles southward of Crook Point and about 8 miles northward of Cape Ferrelo. The western head is 231 feet high and the eastern a little lower; both are black to near the summits which are generally white from bird droppings. The arch, about 100 feet high, is under the eastern summit and shows prominently from southward. A rock awash lies 125 yards southward of the eastern point.

**Anchorage.**—The bight to the east-southeastward of Mack Arch has been used as a temporary anchorage during moderate northwesterly weather. The rocks and reefs break the swell. In approaching the anchorage, pass to the southward of Mack Arch about midway be-

tween it and Yellow Rock. Anchor in 11 fathoms, sand bottom, with Mack Arch bearing 296° and Yellow Rock bearing 155°. No breakers have been observed, but caution should be exercised as the place has not been closely surveyed. There is a farm near the cove northeastward of Mack Arch.

**Mack Reef** extends from Mack Arch to Crook Point and comprises many rocks, visible or sunken, varying in height from awash to 125 feet. From southward these rocks stand out conspicuously when seen against the white sand dunes northward of Crook Point. Mack Arch, on account of its size and height, is the most prominent.

**Mack Arch Cove** lies immediately eastward of the reef and affords fair shelter in northwesterly weather in 6 to 7 fathoms, sandy bottom. In entering from southward, pass eastward of Mack Arch, giving it a berth of about 150 yards, but taking care to avoid the rock 125 yards southward of its eastern point. Then bring the 125-foot rock, the highest of the northern part of the reef, to bear 352° and steer for it on that bearing until up to the anchorage abreast the group of rocks 0.5 mile northward of Mack Arch. Local small boats find smoother water by continuing the 352° course through the kelp and anchoring in 4 fathoms with the 125-foot rock bearing 333°, distant 300 yards. This latter anchorage is contracted and is not recommended.

**Crook Point** is moderately low, but terminates seaward in a rocky knoll 175 feet high, with a slight depression immediately behind it. The rocks close to the point often show up during moderately thick weather, several being of very noticeable pinnacle formation.

From the vicinity of Crook Point to the mouth of the Pistol River are sand dunes which show up prominently in clear weather and distinctly mark this section. In thick weather these dunes cannot be readily distinguished. From the mouth of the river to Cape Sebastian are numerous rocks and rocky islets extending 0.3 mile offshore, reaching in some cases a height of 150 feet. The Pistol River bar opens in the rainy season; its location varies from year to year.

**Hunter Cove** is a small, contracted anchorage under the southeastern face of Cape Sebastian. It is formed partly by the cape and partly by **Hunter Island** in the entrance. The island is 0.2 mile in extent, rocky, flat-topped, and 113 feet high. Shoal water extends from it eastward to the beach. The cove is used occasionally by launches and small craft. During strong northwesterly weather the sea at the entrance is rather lumpy for small boats. There is a small stream at the head of the cove which furnishes good clear water. With moderate southwesterly weather a heavy sea piles up across the entrance between the cape and Hunter Island. The cove is not recommended as an anchorage.

**Chart 5951.**—**Cape Sebastian** is conspicuous from either northward or southward. It is the seaward termination of a ridge transverse to the coast, and rises abruptly from seaward to a height of 694 feet, with a depression behind it and then more gradually to a height of about 2,000 feet. The seaward face is precipitous and broken, and has a

few trees; southward the lower part is grass covered. A rock with 1¾ fathoms over it that seldom breaks is 0.5 mile offshore, 0.9 mile northwestward of the western extremity of the cape.

From Cape Sebastian to the mouth of Rogue River, a distance of about 6 miles, the coast is considerably broken, quite rugged, low in the vicinity of the beach, and has a few outlying rocks.

**Hunter Creek** empties about 4 miles northward of Cape Sebastian; it is small and unimportant. Off the mouth are three exposed rocks, the outer or middle one 2 feet high, lying nearly 0.5 mile offshore.

**Rogue River** is an important sport-fishing stream. **Gold Beach**, on the southern bank of the river near the mouth, is the principal town. Opposite it, on the north bank, is **Wedderburn**, which has several float landings with depths up to 5 feet at low tide. Only a few boats are engaged in commercial fishing. The bar at the entrance has a depth of 4 to 5 feet at low water, and is crossed only at high tide during the summer months by light-draft vessels with local knowledge. Owing to the shifting character of the bar, no directions of value can be given. A concrete arch highway bridge with an overhead clearance of about 60 feet crosses the river about 0.8 mile above the mouth. The bridge is prominent from seaward when off the mouth of the river. **Special regulations** governing logging operations are given in § 207.655, Chapter 2.

The northern head at Rogue River entrance that reaches an elevation of 700 feet about a mile northward of the river mouth, the marked depression in the coast range made by the river valley, and the rocks of Rogue River Reef are prominent from seaward.

**Rogue River Reef** extends in a general northwesterly direction from the mouth of Rogue River for 4 miles, with a channel 0.5 mile wide separating it from the beach. This channel has been used occasionally, but it is not safe without local knowledge. **Northwest Rock**, 6 feet high, 4 miles northwestward of the entrance to the river, is the outermost rock of the reef. In 1925 two vessels reported striking an obstruction westward of Northwest Rock. The bottom is very broken here and, inasmuch as the area has not been swept by a wire drag, vessels are advised to give this rock a berth of at least 1.5 miles. A rock 2½ fathoms deep is 0.3 mile westward of Northwest Rock. **Needle Rock**, 106 feet high, is the most prominent of the rocks in the reef; it lies nearly in the middle of the group, 3 miles northwestward of the entrance to the river. The needle is on the southern side of the rock. **Pyramid and Double Rocks**, 46 to 53 feet high, respectively, are prominent. A rock with 2¾ fathoms over it lies 2 miles southward of Needle Rock and 2.8 miles westward of the mouth of the river, and breaks with an ordinary swell. A rocky patch 4¾ fathoms deep lies 2.5 miles southwestward of the mouth of the river and 2.5 miles southward of Needle Rock; this patch generally shows a breaker.

Northward of Rogue River the coast trends northerly for about 10 miles and then northwestward to Cape Blanco. The mountains are high, irregular, dark, and covered with chaparral. For 5 miles northward from the mouth of the river the beach is bordered by numerous

rocks, but beyond that the coast is comparatively clear with the exception of Orford and Blanco Reefs.

A group of sunken and visible rocks, 1 mile long and 0.5 mile wide, lies 5 miles northward of Rogue River and nearly 2 miles offshore; these rise abruptly from 12 fathoms. **North Rock**, 7 feet high, is the largest and is nearest the beach. A sunken rock with  $1\frac{1}{4}$  fathoms over it lies about 0.6 mile northwestward of North Rock.

The channel between Rogue River Reef and the mainland, and North Rock and the mainland, is sometimes used by coastwise freighters in clear weather. This channel should not be attempted by strangers.

**Brushy Bald Mountain**, 2,493 feet high, shows up in hazy weather as a flat rounded peak, with a gentle slope from a westerly and southerly direction.

**Sisters Rocks** are a group of three rocky islets 10.5 miles northward of the mouth of Rogue River. The northern and largest one is about 350 yards wide and 394 feet high. It is connected to a projecting rocky point, 260 feet high. The second one, 250 yards southward of the first, is 150 yards in diameter and 149 feet high. The southern and outermost is about 150 yards long and only 15 feet above water. It lies about 0.4 mile southward of the middle rock and nearly 0.8 mile offshore. There is fairly smooth water in northwesterly weather under the lee of the largest islet, which was the site of the old landing of the village of **Frankport**.

**Colebrooke Butte**, 2,050 feet high, eastward of Sisters Rocks, appears from the westward as a cone with gentle sloping sides. The upper part usually shows against the skyline and is readily recognized. From the southward, it shows as a rounded peak which resembles Brushy Bald Mountain, though it is somewhat lower. The northern part of the summit is tree-covered and dark green, and the southern part is grass- and brush-covered and light green. The slopes are timbered except for the lower part of the seaward slope which is bare and brown.

**Lookout Rock**, 2.3 miles northward of Sisters Rocks, is a prominent, projecting cliff, 560 feet high, with a marked depression behind it. The seaward face is precipitous.

**Bald Mountain**, 2,954 feet high, appears from offshore as an irregular knob at the northwesterly end of a long ridge. **Rocky Peak**, 3,187 feet high, on the southeastern end of the ridge, is a sharp conical peak. From a southwesterly direction, three peaks or knobs show; from a north-northwesterly direction, two peaks show almost in range. These peaks were used by the early navigators as a landfall for Port Orford in coming from the northward.

**Humbug Mountain**, 1,748 feet high, lies 5.3 miles northward of Sisters Rocks and 4 miles southward of Port Orford. It is conical in shape, and its seaward face is steep and rugged. It is a prominent feature from seaward.

**Chart 5952.**—**Island Rock**, 222 feet high, lies 1.3 miles off the seaward face of Humbug Mountain. It is about 350 yards in extent and flat on top. About 200 yards off its northwestern end is a needle rock 109 feet high. These islands are prominent when approaching Port Orford

from southward. Except for two small rocky patches with least depths of 10 fathoms and  $6\frac{3}{4}$  fathoms, 900 and 600 yards, respectively, northward of Island Rock, there is deep water around these islands and between them and the beach. The passage between Humbug Mountain and Island Rock has been used by northbound coast steamers in northwesterly weather.

**Redfish Rocks** are a group of islets covering an area about 0.5 mile square, lying 2 miles northward of Island Rock and nearly 1 mile offshore. They are six in number and range from 10 to 140 feet in height. Many sunken rocks lie within this area. **Rocky Point** is 1.3 miles northeastward of Redfish Rocks.

**Port Orford** is about 6.5 miles southward of Cape Blanco and 19 miles northward of Rogue River. It affords good shelter in northwesterly weather, but is exposed and dangerous in southerly weather. It is easy of access and is probably the best natural northwesterly lee northward of Point Reyes.

**The Heads**, 300 feet high, forming the western point of the cove, appear from the southward as a long ridge with three knobs. The inner two are slightly higher and covered with trees. **Tichenor Rock**, 92 feet high, lies 175 yards southward of The Heads.

**Battle Rock**, high, narrow, and black, lies in the northern part of the cove close to the shore and is detached only at extreme high tides.

A wharf is in the northern part of the cove close under **Graveyard Point**. The depths alongside are 15 feet at the inner end of the loading face; three small rocky pinnacles with depths of 17 and 18 feet are at the outer end of the wharf. Vessels moor alongside the northeastern face of the wharf to load. Inshore of this loading face the depths are shoaler; this part of the wharf is used by crab fishermen. Water, gasoline, and diesel oil are piped to the wharf. Hoists on the wharf have a capacity of 15 tons; fishing boats are hoisted to cradles on the wharf. Construction had been started in August 1957 on a new wharf about midway between Graveyard Point and Fort Point.

**Dangers.**—There is a rock with a least depth of 5 feet, 165 feet from the inner end of the wharf. It is usually marked by kelp. The remains of a former breakwater, the outer end of which is submerged and marked by kelp, extends about 100 yards southeastward of Graveyard Point to just southward of the wharf, and affords a fair lee for the wharf in southwesterly weather. Several dangerous rocky patches marked by kelp are in the area eastward of a line drawn about east-southeastward from the foot of the wharf. Other important rocky patches with  $1\frac{1}{2}$  to  $4\frac{1}{4}$  fathoms over them lie offshore southwestward 0.8 mile to northwestward 1.2 miles from Rocky Point.

Anchorage may be had slightly to the westward of the center of the cove, in 10 fathoms, sand bottom. A bell buoy is 0.5 mile southward of Tichenor Rock. Small craft may anchor closer to The Heads where better protection is afforded against the northwesterly winds which sweep with considerable force through the depression at the head of the cove. Two rocks, awash at high tide,

lie near the western side of the cove, near The Heads. In approaching Port Orford at night, a neon sign and a few other lights in the town will usually be seen.

**Port Orford** is a small town on the cove. It is noted chiefly as being the home of the famous Port Orford yellow cedar. Yellow cedar logs are shipped to Coos Bay by truck over the Oregon Coast Highway. Communication is by bus, telephone, and telegraph. Ordinary supplies can be obtained in the village. The main coastal highway passes through here and marine supplies can be ordered from larger towns.

A Coast Guard station is located inside **Nelly Cove**, 0.4 mile westward of the Port Orford wharf. The white Coast Guard lookout tower, 253 feet above the water, is prominent from the southward and is reported to be mistaken at times during daylight hours for Cape Blanco Lighthouse. The white water tank on the summit at an elevation of 362 feet and northward of the tower, shows just clear of the nearby trees. When seen from a considerable distance offshore, it also resembles Cape Blanco Lighthouse. It is visible farther to seaward than the lighthouse by reason of the dark solid timber background which brings it into prominence.

**Klooquah Rock**, 101 feet high, black, and conical, lies 0.3 mile off the northwestern face of The Heads. It is prominent, especially when coming from the northward inside Orford Reef. A rocky ledge, bare at low water, extends about 50 yards from the eastern face of this rock, and another rock, bare 2 feet at high water, lies about 330 yards eastward.

From The Heads to Cape Blanco, about 6.5 miles, the coast extends in a general north-northwesterly direction. Northward of The Heads the shore is a narrow sand ridge, rising at one point to 160 feet, covered with grass, fern, and brush, and ending abruptly nearly 3 miles from The Heads at the edge of the Elk River Valley. Northward of this point are sand dunes extending to the mouth of Elk River, a small, unimportant stream. Beyond the mouth of Elk River to Cape Blanco, the coast consists of vertical cliffs, wooded to the edges, and in some places over 150 feet high.

**Orford Reef** is composed of a group of irregular rocks and sunken ledges, about 2.5 miles long by 1.5 miles wide, extending in a northerly direction. The northernmost limit of the reef is about 2 miles southward of Cape Blanco Light, and the southernmost limits lies about 5.5 miles west-northwestward of the western extremity of The Heads. A channel 2 miles wide leads eastward of the reef, following the general trend of the coast, but at its northern end where it turns westward, it is contracted to 0.8 mile by Blanco Reef which extends southward and westward from Cape Blanco. This channel is used in clear weather, but should not be attempted in thick weather. Considerable kelp is eastward of and inside Orford Reef. A lighted whistle buoy, 1.3 miles southwestward of Fox Rock, is the guide for clearing this reef.

**Fox Rock**, 9 feet high, and **Southeast Black Rock**, 6 feet high, 1.3 miles apart, are the two southernmost rocks

of Orford Reef. There is usually a heavy break at these rocks. Two rocks awash at extreme low water are about 0.2 mile northwestward of Southeast Black Rock.

Steamboat, West Conical, and Arch Rocks are the prominent ones in the southern part of Orford Reef, and extend in a general north-northeasterly direction about 0.25 mile apart. **Steamboat Rock**, 40 feet high, is so named on account of its appearance from northward or southward. **West Conical Rock**, 112 feet high, is so named on account of its shape, the highest point being on the northwesterly side. **Arch Rock** is 149 feet high, with steep sides and a large square arch visible from southward or southwestward; it is the inshore one of the three rocks.

**Conical White Rock**, 81 feet high, is nearly in the middle of Orford Reef, and 0.3 mile northwestward of Arch Rock.

**Best Rock**, 147 feet high, is the largest of the northern group of rocks. Foul ground extends southward and eastward from it for nearly 0.4 mile, and for 0.8 mile northward in the direction of Cape Blanco. The northernmost part of this danger lies 1 mile east of Northwest Rock with the eastern edge of Seal Rock in range with Arch Rock; Klooquah Rock is also in range with Tichenor Rock off The Heads.

**Seal Rock**, 53 feet high, is large and lies 0.2 mile southward of Best Rock. **Long Brown Rock**, 70 feet high, lies nearly 0.5 mile westward of Best Rock; **Large Brown Rock** lies midway between and a little northward. **Square White Rock**, 72 feet high, lies about 0.5 mile westward of Seal Rock, with **Round Rock** midway between and a little northward of them. Between these rocks are numerous smaller ones, some sunken and some visible.

**Northwest Rock**, 15 feet high, the northernmost rock of Orford Reef, lies 3 miles southwestward of Cape Blanco Light. Keeping Northwest Rock bearing north of 072° will clear all shoals on Orford Reef of less than 10 fathoms. There is a 9-fathom spot 600 yards northwestward of Northwest Rock.

**Blanco Reef** extends about 1.5 miles southwestward from Cape Blanco, and consists of numerous rocks and sunken ledges, some of which are marked by kelp. **Pyramid Rock**, 30 feet high, lies nearly 1 mile westward of the light. There are no visible rocks outside of it, but several between it and the cape and Orford Reef. **Black Rock**, 24 feet high, black, and narrow, about 125 yards long, lies 0.6 mile southward of Pyramid Rock. The outermost rocky patches known to exist on Blanco Reef have  $\frac{1}{2}$  to  $5\frac{1}{4}$  fathoms over them and extend from 0.5 mile westward of Black Rock to 0.4 mile westward of Pyramid Rock. A rock awash at half tide is 0.4 mile northward of Pyramid Rock. A rocky patch with  $1\frac{3}{4}$  fathoms over it is 1,350 yards eastward of Black Rock.

**Cape Blanco** projects about 1.5 miles from the general trend of the coast. It is a small bare tableland, terminating seaward in a cliff 225 feet high, with low land behind it. A large high rock lies close under the southern side of the cape. From seaward the cape is not prominent,

but from northward or southward, it appears like a moderately low bluff islet. The group of buildings at Cape Blanco is very prominent.

**Cape Blanco Light** ( $42^{\circ}50.2' N.$ ,  $124^{\circ}33.8' W.$ ), 245 feet above the water and visible 22 miles, is shown from a 59-foot white conical tower near the center of the flat part of the cape; a radiobeacon is at the light. The water tank and lookout tower at The Heads should not be mistaken for this light.

Numerous sunken and visible rocks extend 0.5 mile or more northwestward from the cape.

**Gull Rock**, 108 feet high and about 1 mile northward of Cape Blanco Light, is surrounded by covered rocks. Its seaward face is black and rugged, and the summit has two knobs, the higher being to the southward. A rocky patch 3 fathoms deep lies 0.5 mile westward of Gull Rock.

**Castle Rock**, 180 feet high, is about 1.5 miles northward of Cape Blanco Light and about 300 yards off the mouth of Sixes River. The rock rises abruptly from the sea and is readily made out 10 miles to seaward. Many low rocks and sunken ledges are within 400 yards. Two rocky islets, 54 and 24 feet high, are to the west and northwest.

**Blacklock Point** is a precipitous rocky point about 2.5 miles northward of Cape Blanco. The cliff is 157 feet high. A sharp, high point, bordered by rocks, stretches out nearly 300 yards. A narrow curved line of rocks extends 0.8 mile west-southwestward from the point. **Tower Rock**, 113 feet high, is nearly 700 yards from the point. A rock that breaks in heavy weather is 1 mile northwestward of the point. Rocky patches about 4 fathoms deep are within 1.3 miles of the point in a westerly and northwesterly direction.

**Chart 5802.**—From Cape Blanco to Yaquina Head, 112 miles, the coast is remarkably straight and trends in a north by east direction. It differs considerably from the coast to the southward. The coastal mountains are much lower, the difference being more marked because of the high mountains inland. The shore consists of high yellow sand dunes and cliffs broken by bold rocky headlands of moderate height and backed by low pine-covered hills. There are few outlying dangers, the farthest offshore being Blacklock Point, Coquille River, and Cape Arago.

From Blacklock Point the shore continues rocky with cliffs gradually decreasing in height for 1.5 miles northward, thence for about 11 miles the shore is a broad sandy beach backed by dunes and long narrow lakes. The tree line is at an average distance of 0.2 mile from the sea. From the end of the sand beach to the mouth of the Coquille River, a distance of 2 miles, the shore again consists of rocky cliffs 40 to 80 feet high with several outlying rocks as much as 0.5 mile from shore. Covered dangers extend 1.6 miles westward from Coquille Point. The land directly behind this stretch of coast is comparatively flat and wooded, rising to heights of 1,000 feet in 2.5 to 3 miles.

**Chart 5971.**—The entrance to the Coquille River is about 18 miles northward of Cape Blanco. **Coquille Point**, 0.6 mile south of the entrance, is 60 feet high. Off the point are several rocky islets, the highest of which is 86 feet high. Broken rocky bottom, showing breakers in any swell, extends more than a mile seaward of the entrance. The outermost danger is **Coquille Rock**, 28 feet deep and 1.6 miles northwest of Coquille Point. All other known offshore dangers are southward of a line between Coquille Rock and **Table Rock**, which is 82 feet high and about 0.2 mile north of Coquille Point.

The entrance to the river has two jetties. The south jetty, 900 yards long, with a light and fog signal at its outer end, extends about 150 yards seaward from the shoreline. The north jetty, 1,150 yards long, extends about 425 yards seaward from the shoreline. A lighted whistle buoy is 675 yards northward of Coquille Rock and a gong buoy is 0.6 mile west-northwestward of the entrance. A lighted range marks the entrance channel, and buoys and light mark the channel inside the entrance. The channel is subject to frequent change, and the deepest water is not always on the range.

Northward of the north jetty is a long, low area of shifting dunes. The abandoned lighthouse near the jetty is a white conical tower attached to a dwelling.

A Federal project provides for a channel 13 feet deep from the entrance to 1 mile above the abandoned lighthouse. The channel is maintained at or near project depth. Above Bandon, the controlling depths reported in August 1957 were  $6\frac{1}{2}$  feet to Coquille and  $3\frac{1}{2}$  feet to Myrtle Point.

**Bandon**, on the southern bank of the Coquille River and about half a mile above the entrance, is the principal port. Waterborne traffic includes shipment of lumber, railroad ties, and logs for plywood fabrication. Depths at the wharves are 12 to 17 feet. The port dock, 375 feet long, has a depth of 14 feet along the face. Lumber steamers usually load to a draft of 14 to 15 feet at Bandon and go to Coos Bay to finish loading. In August 1957, dredging was in progress between the city and port docks for a small-boat basin to accommodate fishing and pleasure craft. The basin will be 450 by 235 feet, and float landings will be provided. The buildings and wharf of the former Coast Guard station near the western end of the Bandon waterfront are still intact. At high water and with a smooth bar, vessels drawing less than 11 feet should have no difficulty in reaching the wharves at Bandon.

**Pilotage and towage.**—The port of Bandon owns and operates a towboat, the captain of which acts as port pilot. The boat is stationed at the city dock, at the foot of Baltimore Street. Vessels desiring a pilot should notify their agents at Bandon.

Vessels drawing more than 11 feet should take a pilot, as local knowledge is essential for following the best water. When the bar is rough, local knowledge of the undertow is necessary to avoid being carried onto the jetties.

**Customs.**—The nearest port of entry is Coos Bay.

**Supplies.**—Limited amounts of provisions and ship chandlery are available at Bandon. Water is piped to the wharves. Diesel oil and gasoline are delivered by truck, and some fuel oil may be had in drums.

**Repairs.**—Ship carpenters may be had, and there is a machine shop in Bandon. Boats up to 45 feet in length can be hauled out on the marine ways at Prosper.

**Communication** is by bus and truck to Coquille and southward along the coast. There are telegraph and telephone connections. A railroad passes through Coquille.

The shipping above Bandon consists of an occasional raft of logs between the mills on the river and the railroad at Coquille. The river is crossed by a highway bridge about 3.5 miles above the entrance with a lift span having a horizontal clearance of 75 feet and an overhead clearance of 28 feet down, and 74 feet up. **Special regulations** governing logging operations on the North Fork of the Coquille River are given in § 207.660, Chapter 2.

**Prosper**, about 4 miles above the mouth of the river, is a deserted area of old piling and ruined lumber docks. The mills are in ruins, and most houses have been abandoned. A small marine railway still operates and can handle boats up to 45 feet in length.

**Riverton**, about 14 miles above the mouth of the river, has coal mines, but they were not in operation in 1957. About 4.5 miles above Riverton there is an overhead power cable with a permit clearance of 72 feet.

**Coquille**, about 21 miles above the mouth, is the distributing center for several agricultural communities of the river valley and has railway connections with the interior.

**Chart 5802.**—Northward of the entrance to the Coquille River the sand dunes extend for about 4 miles and are then succeeded by cliffs. **Fivemile Point**, about 6 miles northward of the river entrance, is a rocky cliff about 60 feet high with a cluster of rocks, 10 to 40 feet high, extending more than 0.3 mile offshore.

Northward of Fivemile Point the coast consists of cliffs, 40 to 80 feet high, which rise to heights of 100 to 250 feet 2 miles southward of Cape Arago and are cut by deep gulches, named the **Seven Devils**. Numerous rocks of varying shapes and sizes border the beach.

**South Cove**, immediately under the southern point of Cape Arago, can be used as an anchorage in summer by small vessels with local knowledge.

**Cape Arago**, about 29 miles northward of Cape Blanco, is an irregular jagged point projecting about a mile from the general trend of the coast. There are no high mountains immediately behind the cape, and it is conspicuous only when the mountains in the interior are obscured. The seaward face of the cape, 2.5 miles long in a northerly direction, is a narrow sparsely wooded tableland 50 feet high, with rugged and broken cliffs and outlying rocks of the same height as the cliff. Immediately off the cape are reefs extending northwestward for about a mile. A small

cove near the northern end, inside the reefs, is sometimes used by very small vessels with local knowledge.

**Chart 5984.**—**Cape Arago Light** ( $43^{\circ}20.5' N.$ ,  $124^{\circ}22.5' W.$ ), 100 feet above the water and visible 16 miles, is shown from a white frame octagonal tower attached to a building on a rocky, partially wooded island close inshore, 2.5 miles northward of the cape. The radiobeacon and the fog signal at the light are synchronized for distance finding. Occasional difficulty in hearing the fog signal has been reported. See Appendix for storm warning display.

**Baltimore Rock**, 11 feet deep and 0.6 mile northwestward of the light, usually breaks. It is the outermost rock of a covered ledge extending northwestward from the lighthouse island, and has 42 feet close around it. A bell buoy is about 450 yards northward of the rock.

**Coos Head**, 229 feet high, 1.8 miles east-northeastward of Cape Arago Light, is on the south side of the entrance to Coos Bay. The cliffs are about 100 feet high and terminate in several small rocky points with sand beaches between them. A Coast Guard station is on the southern point at the entrance 0.3 mile eastward of Coos Head. The buildings of the U.S. Naval Facility for oceanographic research are conspicuous on the bluffs just southwestward of Coos Head.

**Coos Bay** is about 12 miles in length by 1 mile in width and has a tidal area of about 15 square miles. The entrance is about 33 miles northward of Cape Blanco. The bay which may be used as a harbor of refuge can be entered at any time except in extreme heavy weather.

**Prominent features.**—Coos Head, Umpqua River Light, and Cape Arago Light are good guides to the entrance. The sand dunes northward toward Umpqua River are prominent. The entrance to the bay has two jetties extending about 1,200 yards seaward from the shoreline. A lighted whistle buoy is 1.8 miles west-northwestward of the entrance. The channels are marked with lighted ranges, lights, buoys, and daybeacons.

**Channels.**—A Federal project provides for an entrance channel 40 feet deep between the jetties to Guano Rock, thence 30 feet deep to Isthmus Slough, and thence 22 feet deep to Millington; for turning basins 30 feet deep at Coalbank Slough and at the city of North Bend, and anchorage basins 30 feet deep near the Jarvis Lower Range Lights and north of Pigeon Point, and for a channel 10 feet deep to a basin 10 feet deep at Charleston. The channels are maintained at or near project depths, except in Isthmus Slough. In June 1958 depths of 9 to 14 feet were reported in Isthmus Slough, however, with local knowledge a depth of 20 feet was available through this reach. It is not unusual for the bar channel to shoal 8 or 9 feet during the winter.

**Anchorage** can be had almost anywhere in the bay below the railroad bridge, depending upon the draft. Outside the bay vessels have ridden out southeasterly gales by anchoring close to Cape Arago in depths of 30 to 36 feet, but this is dangerous if the wind shifts to the southwest.

**Dangers.**—**Guano Rock**, on the southern side of the entrance channel and about 280 yards northwestward of Coos Head, shows only at extreme low water. A lighted whistle buoy is about 125 yards northwestward of the rock.

The outer end of a submerged jetty, marked by two iron poles, extends 800 yards southwestward from Fossil Point. Entering with a strong northwesterly wind, large vessels have difficulty in making the turn and may find themselves being set toward the submerged jetty. A pinnacle rock, 9 feet deep, is 75 yards westward of the outer end of the submerged jetty but clear of the channel. A lighted buoy is about 125 yards west-southwestward from the rock.

**Bridges.**—The railroad bridge over the bay westward of **North Point** has a swing span with a horizontal clearance of 197 feet and an overhead clearance of 13 feet. Between **North Point** and **Russell Point**, 0.6 mile eastward of the railroad bridge, there is a fixed highway bridge with a horizontal clearance of 515 feet and an overhead clearance of 123 feet. Special regulations for the opening of bridges in Coos Bay are given in § 203.720, Chapter 2.

**Directions.**—Vessels should make sure of the entrance range before standing close in. There is usually a current sweeping either northward or southward just off the jetties, and this current should be guarded against, especially when outward bound. The shore range should be watched carefully until clear of all dangers. The southerly current is often encountered during the summer months. With strong southerly winds during the winter, the current sometimes sets to the northward.

From the entrance, the bay extends northward for 6.5 miles, with an average width of 0.8 mile, then bends southeastward for 3.8 miles into a shallow basin, 1.5 miles in width, surrounded by marshland and intersected by several sloughs.

Vessels up to 20 feet in draft should have little difficulty in reaching the wharves at North Bend or Coos Bay through the well-marked channels.

During long runouts an ebb current of 5 knots has been found at Guano Rock, and up to 7 knots at the bell buoy. This buoy is run under at times in winter months. In 1927 a Navy destroyer reported that the best time to enter Coos Bay and go alongside a dock was to arrive off the whistle buoy about 45 minutes prior to slack before the ebb at Coos Bay entrance. By entering at this time and steaming at 12 knots a small flood current can be carried all the way up. To dock at North Bend, get into the turning basin and swing the ship to go alongside against the flood current. If it is not desired to dock heading out, it is best to wait an hour. The time of change of current at North Bend is about 45 minutes later than at the entrance.

In general, Coos Bay does not present any particular difficulties for ships drawing 15 feet or less, but care should be taken not to mistake the numerous piles used for log booms for spar buoys or daybeacons. Vessels are cautioned to be on the lookout for drifting logs, especially during times of winter freshets. From the information obtained from pilots it is always unsafe to cross the bar

if there is a medium or heavy swell running, and care should be used in steering through the jetties where whirlpools are likely to be encountered.

From either northward or southward, the course should be shaped for the lighted whistle buoy. From seaward Cape Blanco and Cape Arago are prominent features, and at night their lights furnish an excellent means for determining a vessel's position, after which a course can be laid for the lighted whistle buoy.

Approaching from any direction in thick weather, great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3½ knots have been observed at the lightships between Blunts Reef and Swiftsure Bank, and velocities considerably in excess of these amounts have been reported. The most favorable time for crossing the bar is on the last of the flood current, and on many occasions it is passable only at this time.

**Tides.**—The mean range of tide at Coos Bay is about 5½ feet. The range between mean lower low water and mean higher high water is about 7½ feet. A range of about 12 feet may occur at the time of maximum tides.

**Currents.**—A short series of current observations in the entrance taken during the month of September indicated a mean velocity of about 2 knots. The greatest observed ebb velocity was a little over 3 knots. Predictions for the entrance may be obtained from the Tidal Current Tables, Pacific Coast.

**Local magnetic disturbance** with differences of as much as 2½° less than the normal variation has been observed on land on each side of the channel from **Pony Point** to **White Point**.

See Appendix for storm warning displays.

**Pilotage.**—Pilots are available and can be called by radio.

**Quarantine.**—Quarantine regulations of the U.S. Public Health Service are enforced. Vessels with communicable diseases on board should not pass Empire until the quarantine officer has been notified and permission granted. Facilities for fumigation can be obtained. An out-patient office is in Coos Bay.

**Customs.**—Coos Bay is the port of entry for southern Oregon; marine documents are issued. Vessels subject to customs usually proceed to the dock.

**Supplies.**—Fuel oils, water, provisions, and ship chandlery can be obtained at Coos Bay and North Bend.

**Repairs.**—Machine shops are available. There are several marine ways in the area, the largest of which has a capacity of 300 tons and can haul out boats up to 125 feet in length and 10 feet in draft.

**Communication** is by rail, truck, bus, and air. No passenger vessels enter this port, although a few passengers occasionally are carried on lumber ships. There is also considerable local traffic in smaller vessels to points north and south.

**South Slough**, shoal and navigable only by small boats, extends 4 miles southward from its junction with the bay near the entrance. A small-boat basin, operated by the port of Coos Bay, is 0.3 mile northward of Charleston, across the slough from Barview. The basin is used by

commercial and sport fishermen; water and electricity are obtainable at the floats, and launching ramps for small boats are available. The slough is crossed by a highway drawbridge, 0.5 mile southward of the basin, with a swing span having horizontal clearance of 60 feet and an overhead clearance of 10 feet. An overhead power cable southward of the bridge has a permit clearance of 76 feet.

The western shore of the bay as far as the bend is formed by a sandspit covered with dunes, partly wooded, and in some places as much as 90 feet high. On the eastern shore and above the bend are low rolling hills covered with timber.

**Empire** is on the eastern shore of the bay about 4 miles above the entrance. The sawmill wharf has a 300-foot berthing space with a depth of 17 feet alongside. There are several prominent oil tanks. A private dock, westward of the tanks, has loading facilities for lumber and oil. At the pulp mill, 1.5 miles below Empire, a trestle leads to a loading wharf with a frontage of 500 feet and 20 feet alongside. The southward corner of the wharf is marked by a light. The pilot boat is usually berthed here.

**Haynes Inlet** and **North Slough**, which join the bay through a common entrance on the northern side, are navigated by small boats. A fixed highway bridge over the entrance to Haynes Inlet has a horizontal clearance of 60 feet and an overhead clearance of 29 feet.

Coos Bay and North Bend now form practically one continuous settlement extending along the shore from North Point to the mouth of Coalbank Slough. The waterfront between these two towns is called **The Strip** locally. Oil docks and lumber mills are along the waterfront.

**North Bend**, 9.5 miles above the entrance, is a prosperous town with sawmills and factories. Considerable lumber is shipped from here.

**Coos Bay**, 12 miles above the entrance, is the principal town in the bay. The town is the distributing center for a considerable section of the country devoted to lumbering, dairying and agriculture. There are ample wharfage facilities with depths of 9 to 30 feet.

Three sloughs empty into Coos Bay between the town of Coos Bay and Coos River. **Coalbank Slough** is unused. A railroad bridge with a swing span crosses it near the mouth. **Isthmus Slough** has an improved channel from the Georgia Pacific Mill landing at the junction with the Coalbank Slough to Millington. Much of the lumber from the bay is shipped from sawmills on this slough. The highway bridge across the slough has a bascule span with a horizontal clearance of 110 feet and an overhead clearance of 27 feet. **Catching Slough** is navigable for several miles by light-draft vessels and is used mainly for logging operations. The highway bridge across the mouth has a swing span with a horizontal clearance of 50 feet and an overhead clearance of 12 feet. An overhead power cable with a permit clearance of 73 feet crosses the slough just southward of the bridge. Five additional overhead cables cross the slough southward of the bridge with a least permit clearance of 12 feet.

The Coos River empties through two channels into the

bay at its head. The northern channel, unmarked, follows the eastern side of the bay and empties abreast of **North Bend**. **Marshfield Channel**, marked by a lighted range and lights, crosses the flats and empties abreast the town of Coos Bay.

The river divides at a point 3.2 miles above Graveyard Point into South Fork and Millicoma River. A highway bridge crosses the river about 0.9 miles above Graveyard Point with a lift span having a horizontal clearance of 60 feet and an overhead clearance of 28 feet, down, and 55 feet, up. Allegany, 7.5 miles above the confluence, is the head of navigation on the Millicoma River. Dellwood, 8.2 miles above the confluence, is the head of navigation on the South Fork.

A Federal project provides for a channel 5 feet deep and 50 feet wide from the mouth of the Coos River to Allegany on the Millicoma River and to Dellwood on the South Fork, thence 3 feet deep to the head of navigation. In June 1957 the controlling depth was 4 feet to the junction of Millicoma River and South Fork, thence 2 to 3 feet to the head of navigation on each waterway.

A fixed highway bridge crosses the South Fork, 0.7 mile above the confluence with a horizontal clearance of 130 feet and an overhead clearance of 41 feet. **Special regulations** for logging in the tidal section of the South Fork are given in § 207.663, Chapter 2.

**Chart 5802.**—From Coos Bay to Umpqua River, about 19.5 miles, the coast consists of sand beaches and dunes backed by moderately low hills. The mouth of **Tenmile Creek** is 13.7 miles northward of Coos Head.

**Chart 6004.**—**Umpqua River** is entered 20 miles northward of Cape Arago Light. Considerable lumber, fish, and farm and dairy produce are shipped, and general merchandise is received. The port of entry is at Coos Bay.

The southern point at the entrance to the river is marked by sand dunes, partly covered with trees, that reach elevations of 300 feet. About a mile below the entrance is a bright bare spot in the dunes that shows prominently among the trees.

**Umpqua River Light** ( $43^{\circ}39.8' N.$ ,  $124^{\circ}11.9' W.$ ), 165 feet above the water and visible 19 miles, is shown from a white conical tower on the southern entrance point. Trees surround the light, but the lantern shows over the tops.

The northern point at the entrance consists of shifting sand dunes extending northward for about 3 miles. These are bare as a rule and, on the river side, rise from 100 to 124 feet. A Coast Guard station is on the Umpqua River Light Station Reservation on the southeast bank of the river.

The entrance to the river is marked by two jetties. The South Jetty extends 1,200 yards seaward from the shoreline. About 350 yards of the outer end is submerged; a seasonal gong buoy is 325 yards off the end. The North Jetty extends 1,100 yards seaward from the shoreline. A lighted whistle buoy is 0.8 mile westward of the end of the North Jetty. The channels are marked with lighted ranges, lights and buoys. The channel over

the bar is reported to be shoalest usually during September. Later in the season the river cuts a deeper channel through the bar.

A Federal project provides for an entrance channel 26 feet deep; a river channel 22 feet deep from the mouth to Reedsport, with a turning basin at the upper end of the same depth; a side channel 12 feet deep from the main channel to the docks in Winchester Bay with a mooring and turning basin of the same depth at the inner end; a side channel 22 feet deep from the main channel near the Three Mile Directional Light to Gardiner and a turning basin of the same depth opposite Gardiner; a channel in Scholfield River 12 feet deep from its confluence with Umpqua River to a point 0.4 mile below the first railroad bridge.

In July-September 1957 the controlling depths were 26 feet in the entrance, thence 19 feet to the Three Mile Directional Light, thence 18 feet to Reedsport, and 20 feet in the side channel to Gardiner turning basin which had a depth of 8 feet.

See Appendix for storm warning displays.

**Pilotage and towage.**—Pilots can be arranged for by radio. There are several diesel tugs available for work on the bar.

**Supplies.**—Provisions, water, gasoline, and fuel oil for launches may be obtained at Reedsport.

**Repairs.**—Minor repairs to hulls or machinery can be made at Reedsport. Carpenters are available and a machine shop is at the lumber mill. There are facilities for docking launches up to 60 tons.

**Communication** is by rail to the interior or to Coos Bay, and by truck or bus to all other points. Telephone and telegraph service is available.

**Ork Reef**, a patch of rocks and sand awash at half tide, is near the northern end of Winchester Bay. Depths of 2 to 5 feet extend about 0.4 mile southwestward of the reef.

**Winchester Bay**, locally referred to as "Salmon Harbor," is a small cove on the eastern bank of the river. A breakwater on the western side of the bay makes it an excellent harbor for small craft. In 1957 the controlling depth in the entrance channel was reported to be 12 feet. A fish wharf with a cold storage and ice plant on the outer end is here. Float landings are available for commercial and sport fishing. Water, electricity, gasoline and fuel are available, as well as launching ramps for small boats. The village of Winchester Bay is a fishing resort.

**Gardiner**, on the northeastern bank of the river, 8.5 miles inside the entrance, is the site of a large lumber mill.

**Reedsport**, on the southwestern bank of the river, 10 miles inside the entrance, is a station on the railroad and the principal town on the lower river. Considerable lumber is shipped by the two sawmills. The port wharf has a depth of 23 feet alongside the loading face. Lumber steamers load to a maximum draft of 18½ feet.

The highway bridge crossing the river at the lower end of the turning basin at Reedsport has a swing span with a horizontal clearance of 195 feet through both openings and

an overhead clearance of 30 feet. About 500 yards upstream is a railroad bridge with a swing span having a horizontal clearance of 150 feet on either side of the central pier and an overhead clearance of 15 feet. Operating regulations for these bridges are given in §203.725, Chapter 2. The same railroad crosses Umpqua River north of Bolon Island over a fixed bridge with a horizontal clearance of 80 feet and an overhead clearance of 14 feet, and north of Blacks Island over a fixed bridge with a horizontal clearance of 42 feet and an overhead clearance of 12 feet.

A cutoff channel 2 to 4 feet deep marked by two lights across the flats northwesterly from Bolon Island is a nearly straight passage between Reedsport and Gardiner.

A lumber dock is on the southwest end of **Bolon Island**. A spur railroad extends from East Gardiner across Bolon Island and the flats to Gardiner. Two bridges with removable spans are on this section of the railroad, the easterly bridge having a horizontal clearance of 54 feet and the westerly bridge a horizontal clearance of 38 feet; both have an overhead clearance of 5 feet.

At high tide the Umpqua River is navigable by vessels of 6 feet draft to **Scottsburg**, 14.8 miles above Reedsport.

**Scholfield Creek** enters the Umpqua River northward of Reedsport. A fixed highway bridge crosses the creek 0.9 mile above the mouth with a horizontal clearance of 54 feet and an overhead clearance of 19 feet. A fixed railroad bridge crosses the creek 2 miles above the mouth with a horizontal clearance of 30 feet and an overhead clearance of 14 feet.

**Smith River** enters the Umpqua River from the north-eastward at Reedsport. A Federal project provides for a channel 6 feet deep from the mouth to the mouth of the North Fork, then 4 feet deep to **Sulphur Springs Landing**, 18 miles above the mouth. Corps of Engineers project maps show that the project depths were available in June 1958. The river is crossed by a retractile bridge near its junction with Hudson Slough having a horizontal clearance of 55 feet and an overhead clearance of 22 feet.

**Chart 5802.**—From Umpqua River to Siuslaw River, about 21 miles, the coast is straight and consists of sand dunes broken only by the mouth of **Threemile Creek**, **Tahkenitch Creek**, **Siltcoos River**, and the stream from **Cleawox Lake**.

**Chart 6023.**—Siuslaw River empties into the ocean about 42 miles northward of Cape Arago Light and 7.5 miles southward of Heceta Head Light. The port of entry is at Coos Bay.

The southern entrance point is a narrow spit of high shifting sand dunes. The northern point consists of a low flat sand beach, backed by rocky wooded cliffs 50 to 100 feet high.

**Cannery Hill**, 145 feet high and wooded, on the eastern shore about 1 mile above the entrance, is prominent from seaward.

The entrance to the river is marked by two jetties. In August 1957 construction was in progress on extending the north jetty. A lighted whistle buoy is 1 mile westward of

the entrance. The channel is marked with a lighted range, lights, buoys and daybeacons.

A Federal project provides for a channel 12 feet deep from the entrance to Cushman, 6.3 miles above the mouth. The bar is narrow and the depths vary greatly because of storms and freshets. In March-June 1955, the project depth was obtained.

Light-draft vessels can ascend the river to Mapleton, but the channel is narrow and crooked.

**Florence** is a small town on the northern bank of the river 4 miles inside the entrance. A port dock and a fish dock with an iceplant are here. Fish are shipped by truck. The river has some logging operations and finished lumber is barged to Pacific ports. See Appendix for storm warning displays.

Just east of the port dock is a small boat moorage locally known as "Holiday Harbor." Launching ramps and moorage are available for pleasure craft. Electricity, water, gasoline, and fuel oil can be obtained.

**Glenada** is a small town on the southern bank of the river opposite Florence. The river is crossed here by a double-leaf bascule highway bridge having a horizontal clearance of 110 feet and an overhead clearance of 27 feet. An overhead power cable with a permit clearance of 88 feet crosses the river 1 mile above the bridge.

**Cushman**, on the northern bank of the river 2.5 miles above Florence, has lumber and shingle mills. The products from these mills are shipped by rail and barge. The marine ways here can handle craft up to 60 feet in length.

About 1 mile above Cushman the river is crossed by a railway drawbridge with a horizontal clearance of 100 feet on either side of the central drawspan, and an overhead clearance of 15 feet. Operating regulations for bridges on the Siuslaw River are given in § 203.730, Chapter 2.

Pilots and towboats are available.

Gasoline, oil, water, and limited amounts of provision are obtainable. Minor repairs can be made. Carpenters are available and machine work can be done locally.

Communication is by rail to the interior and by the Oregon Coast Highway along the coast. There are telegraph and telephone connections.

**Chart 5802.**—From Siuslaw River to Heceta Head, about 7.5 miles, the coast is composed of sand dunes that are quite conspicuous in contrast with the dark trees partly covering them.

**Heceta Bank** is 70 miles north by west of Cape Blanco and about 30 miles offshore west of Heceta Head. The bank covers an irregular area about 30 miles long and 10 miles wide. The least water found on the bank is 25 fathoms, but the soundings are irregular. Northward and southward of the bank the depths are considerably greater.

**Heceta Head** lies 28.5 miles northward of Umpqua River Light. The seaward face is 2.5 miles long with nearly vertical cliffs 100 to 200 feet high. The summit of the head, which reaches an elevation of 1,000 feet in 0.5 mile from the cliffs, is covered with grass and a few pines. A sharp black conical rock, 180 feet high, marks the extreme western and northern part of the head and is easily made out from either northward or southward.

**Heceta Head Light** (44°08.3' N., 124°07.6' W.), 205 feet above the water and visible 21 miles, is shown from a white conical tower on a bench cut in the high bluff near the western extremity. Because of the high bluff northward of the light, vessels from northward will not make out the tower or buildings until abreast the station.

**Cox Rock**, 100 feet high, conical in shape and usually white on top with bird droppings, is close to the southern part of the head.

For 9 miles from Heceta Head to Cape Perpetua the coast consists of high broken rocky cliffs, except for the first 2 miles which are composed of much lower sloping sandy cliffs, backed by a strip of clear land. The hills behind reach an elevation of over 800 feet in less than 0.5 mile from the beach, and are heavily wooded.

**Tenmile Creek**, 5 miles northward of Heceta Head, is marked by a sand beach about 0.3 mile long at its mouth.

**Cape Perpetua**, 9 miles northward of Heceta Head, consists of two projecting points, the northerly of which is the bolder. It reaches a height of 800 feet a short distance from the beach and 1,000 feet at a distance of 0.8 mile. The rocky cliff forming the face of the northern point is reddish. A few rocks awash at low water are close to its face.

**Yachats River**, navigable only for canoes, breaks through the coast hills immediately northward from Cape Perpetua.

The coast northward of Cape Perpetua for 2.5 miles consists of cliffs, 15 to 30 feet high, with a narrow strip of grassy land 0.2 to 1 mile wide behind them. Thence for 5.5 miles there are low bluffs with a broad sand beach in front and comparatively low wooded country behind them to Alsea Bay.

**Table Mountain**, 2,804 feet high, is about 11 miles northeastward of the mouth of Alsea Bay. It is flat-topped, covered with dead trees, and looks whitish. There is another summit, 2,752 feet high, about 0.6 mile southwestward of Table Mountain.

**Marys Peak**, a prominent mountain 4,097 feet high about 24 miles eastward of the entrance to Yaquina Bay, is wooded on its sides but its summit is covered with grass.

**Chart 6056.**—**Alsea Bay** is about 8.5 miles northward of Cape Perpetua. The northern point is low, broad, and sandy, but the southern point is an abrupt sandstone cliff about 100 feet high, covered with trees. The entrance has a shifting bar with a depth of about 6 feet. A buoy is about a mile off the bar. With a floodtide, the bar fills in with sand and the full effect of the tide cannot be counted on. There is considerable fishing and crabbing in the bay and river, but boats rarely cross the bar. **Waldport** is the principal settlement. A small-boat landing, where gasoline, other light fuels, and limited supplies are available, is at the northern tip of the village. The fixed bridge of the Oregon Coast Highway crosses the bay with a horizontal clearance of 200 feet and an overhead clearance of 60 feet.

From Alsea Bay to Yaquina Bay the coast is nearly straight for 11.5 miles. For 1.5 miles northward of Alsea Bay the shore is a low sand beach backed by dunes, but

then changes to bluffs which, 2.5 miles farther north, rise to heights of 70 and 100 feet.

**Seal Rocks**, abreast the highest part of the bluff, are low and extend parallel with the coast for 2.5 miles at a distance of 0.5 mile from the beach. The highest rock stands 20 feet above water.

**Stonewall Bank**, about 17 miles southwestward of Yaquina Head Light, is about 9 miles long in a northerly direction and 2.5 miles wide. There is a least depth of 13 fathoms on the bank.

Beyond Seal Rocks the bluffs are low, with a broad sand beach, until within 1.5 miles of Yaquina Bay where sand dunes extend to its entrance. The land behind is comparatively low and wooded, with areas of burnt timber.

An area of sunken rocks is reported to exist 2 to 4 miles northwestward of Seal Rocks and about 1.5 miles offshore. There is a 2½-fathom patch 1.6 miles northward of Seal Rocks and 1.4 miles from the beach.

**Yaquina Head**, 32.5 miles northward of Heceta Head, is distinguished by two conical hills covered with grass. The outer one is 355 feet high and the inner 390 feet high, with a low saddle between them. The extremity to the point, which projects about a mile from the general trend of the coast, is broken and rocky, but comparatively low. One mile inland from the point, the grass-covered land changes to a dense forest and the hills rise rapidly. Two sunken ledges lie northward of the point not over 0.5 mile from the beach. There is a sunken rock and considerable kelp about a mile southward of the point. Southward to Yaquina Bay, the coast consists of broken yellow cliffs, bordered on the southern part by broad, low water, sand beaches.

**Yaquina Head Light** (44°40.6' N., 124°04.7' W.), 162 feet above the water and visible 19 miles, is shown from a white conical tower on the flat bench projecting at the western extremity of the head; a radiobeacon is at the light. See Appendix for storm warning display. A patch of rocks, awash at high water, is about 1 mile northward from the light.

**Yaquina Reef**, a ridge of hard sand and rock, with depths of 5 to 13 feet, lies 0.5 mile off the entrance, extending parallel with the shore for a distance of 1.5 miles. The wreck of the concrete ship JOHN ASPIN bares 5½ feet at low water on the reef about 0.5 mile north-northwestward from the outer end of the north jetty. **South Reef** is a southerly continuation of Yaquina Reef, the two being separated by the entrance channel.

**Chart 6055.**—**Yaquina Bay** entrance is 4 miles southward of Yaquina Head Light. The bay is a tidal estuary, the harbor itself being merely the widening of the Yaquina River just inside the entrance.

The northern point at the entrance is a rounding sandy bluff, 120 feet high. The old abandoned lighthouse and Coast Guard lookout towers at the extremity, and the hotels and cottages northward of it are prominent landmarks. The tower consists of a house on a skeleton tower, and the old lighthouse is a circular tower on the roof of a two-story frame dwelling. They are close together and, when viewed from the northwest, the light tower obscures

all but the upper portion of the lookout tower. The southern point is a low sand beach backed by sand dunes rising to 150 feet.

The entrance to the bay is marked by two jetties 330 yards apart at the outer end. A lighted whistle buoy is 1.9 miles southwestward of the entrance. The channels are marked with a lighted range, lights and buoys.

During the summer when the swell is roughly parallel with the coast, the bar is comparatively smooth, being partially sheltered by Yaquina Head. In winter, however, the heavy westerly swell makes the bar very rough. The maximum draft to which vessels are loaded in Yaquina Bay is 16½ feet. A smooth bar and favorable tide are necessary for this draft.

A Federal project provides for a channel 26 feet deep over the bar, thence 20 feet deep to McLean Point, with a turning basin 22 feet deep at the upstream end, thence 18 feet deep to Yaquina; and a small-boat mooring basin at Newport protected by a breakwater and having a depth of 10 feet. In June 1958 the controlling depth was 19 feet from the entrance to the turning basin at McLean Point.

**Anchorage.**—No anchorage regulations are prescribed. Vessels anchor in the channel at points according to draft.

A fixed highway bridge across the channel 1 mile above the entrance has a horizontal clearance of 395 feet and an overhead clearance of 130 feet. A Coast Guard station is at Newport 400 yards northward of the bridge.

**Newport**, just inside the northern entrance point, is the principal town on the river. It is principally a summer resort, although the town has considerable fishing and several small canneries. Lumber, either brought down from upper river mills or brought by truck, is shipped from the wharves at Newport. The principal wharf for loading lumber is at McLean Point, 1 mile upstream from the highway bridge. A 30-foot channel has been dredged to the lumber terminal. Occasionally lumber is loaded at the wharf along the south side of the channel just inside the highway bridge. Both wharves have ample water alongside for any vessel that can cross the bar.

**Directions.**—Strangers desiring to enter or to ascend the river should employ a pilot or a man with local knowledge. At the entrance the buoys cannot be relied upon as indicating the best water, and in the river the depths are subject to frequent change.

**Currents.**—The average current on both flood and ebb in Yaquina Bay entrance is about 2 knots. Near Newport docks the current averages ½ knot. Off Yaquina and 1 mile south of Toledo the mean velocities are about 1 knot and 1½ knots, respectively. For predictions see the Tidal Current Tables, Pacific Coast.

See Appendix for storm warning displays.

**Pilotage and towage.**—Licensed pilots are available and can be obtained by prior arrangement by radio. Privately owned towboats are berthed in Newport.

**Quarantine.**—A U.S. Public Health Service outpatient office is in Newport.

**Customs.**—Newport is a port of entry.

**Supplies.**—Fresh water, gasoline, distillate, and provisions can be obtained.

**Repairs.**—Boats up to 60 feet in length and 7 feet in

draft can be hauled out on the marine ways at Yaquina. Toledo also has a small marine ways.

**Communication** is by bus and air. The municipal airport is about 4 miles south of Newport. A good highway extends north and south along the coast and another highway leads to the interior. There is communication by telegraph and telephone.

A Federal project for Yaquina River provides for a channel 10 feet deep from Yaquina to Toledo. Corps of Engineers project maps show that the project depth was available in 1956.

**Yaquina**, a small settlement, is about 3.5 miles above the entrance.

An overhead power cable with a permit clearance of 77 feet crosses the river about 0.5 mile above Yaquina.

**Toledo**, 11 miles above the entrance, has large lumber mills. Lumber is shipped by both water and rail. The depths alongside the wharves are 5 to 6 feet. The fixed highway bridge, 0.5 mile above Toledo, has a horizontal clearance of 150 feet and an overhead clearance of 30 feet. An overhead pipeline with a permit clearance of 62 feet crosses the mouth of **Depoe Creek**. The overhead pipeline at the wharves has a permit clearance of 22 feet; and the fixed bridge 300 yards northwestward has a horizontal clearance of 37 feet and an overhead clearance of 5 feet.

**Chart 5902.**—From Yaquina Head to the mouth of the Columbia River, the coast is fairly straight. The headlands are Cape Foulweather, Cascade Head, Cape Lookout, Cape Meares, Cape Falcon, and Tillamook Head. The 30-fathom curve follows the general trend of the coast about 3.5 miles offshore, without indicating the several headlands. When about opposite Tillamook Head, the curve swings west and is about 7.5 miles off the end of Clatsop Split.

**Chart 6056.**—From Yaquina Head for 5.5 miles to Cape Foulweather, the coast consists of yellow and white sandstone cliffs, low and broken.

**Iron Mountain**, about 1.5 miles northeastward of Yaquina Head Light, is a hill about 654 feet high. The highest third of the hill is bare and is composed of a red rock formation; the lower part is thickly wooded.

A low flat rock, 2 feet high, is 0.4 mile offshore about 2.8 miles northward of Yaquina Head.

**Otter Rock**, 11 feet high, is 3.2 miles northward of Yaquina Head and 0.6 mile offshore. **Gull Rock**, 56 feet high, is about 1.2 miles from Otter Rock and 750 yards offshore. In line between the two rocks is a kelp field with several rocks, covered or awash. Covered rocks that break are northward of Gull Rock, 0.5 mile and 1 mile distant.

**Cape Foulweather** is a prominent headland with about 6 miles of seaward face consisting of rocky cliffs over 60 feet high. The cape is formed by several grass-covered headlands separated by densely wooded gulches. Near the middle of the cape is a strip of flat land, 0.5 mile long and 0.2 mile wide, bare of trees. The highest point of the cape is near the southern part. A grassy patch is conspicuous on the southwestern slope. About 0.9 mile southeast-

ward of the extreme western point of the cape is a rocky point 445 feet high, and eastward of the point the hills rise to 1,100 feet in 0.6 mile. Dangers extend for nearly 2 miles northward of the northern point of Cape Foulweather and about 600 yards offshore.

The coast highway follows the shoreline closely at Cape Foulweather.

**Depoe Bay**, 8 miles north of Yaquina Head, has one of the best small-boat shelters along this part of the coast. The bay proper has foul ground on both north and south sides but the channel to the improved inner basin, though narrow, is deep and well marked. The foul areas break in moderate seas and are marked by kelp. Prominent from seaward are the concrete arch bridge over the entrance to the basin and the standpipe on the shoulder of a 500-foot hill 0.2 mile to the northward. A lighted whistle buoy is 1.1 miles westward of the entrance to the bay, and a bell buoy is farther inshore.

A Federal project provides for a channel 8 feet deep and 30 feet wide to an inner basin 390 feet wide, 750 feet long, and 8 feet deep. In February 1957 the controlling depth was 8 feet in the channel and 7 feet in most of the inner basin.

The fixed bridge over the entrance to Depoe Bay inner basin has a horizontal clearance of 50 feet and an overhead clearance of 50 feet at midarch. The lighted range at the south end of the bridge marks the entrance to the bay on bearing  $086^{\circ}40'$ ; a fog signal is about 50 yards southwest of the front light. Floodlights about 50 yards seaward of the bridge illuminate the entrance to the inner basin; the overhead power cable has a permit clearance of 50 feet. The navigator is cautioned against the dangerous surge in the narrow entrance.

A Coast Guard vessel is stationed in the inner basin; no lookout is maintained but a siren and telephone are available at the north end of the bridge to summon aid. See Appendix for storm warning display.

The town of **Depoe Bay** has a post office, bus station, fire department, and telephone exchange. The basin has a concrete bulkhead, mooring floats, and a grid that can accommodate any vessel able to enter. Hull and minor repairs can be made; fuel, water, hardware, and other supplies are available in small quantities.

**Chart 5902.**—From Cape Foulweather for 5.5 miles to the entrance of Siletz Bay, the coast continues as yellow broken bluffs, 40 to 100 feet high, bordered by about 3 miles of sandy beaches. From the northern point of the bluffs to the bay entrance there are sand dunes covered with low brush.

The entrance to **Siletz Bay**, 15 miles northward of Yaquina Head, is marked by a whistle buoy 0.8 mile off the bar. The entrance channel changes frequently; 7 feet is considered the deepest draft that can be taken over the bar at high water. In August 1957 there was a reported depth of 2 to 3 feet on the bar.

The northern point at the entrance is a low bluff with a narrow sand beach. The southern point is a low sandspit about 2.5 miles long and 250 yards wide. The dunes on the spit are thinly wooded near the shore but

become thickly wooded inland. The bay inside the entrance is shoal. **Siletz River** enters the bay at the south-east end.

**Taft**, the principal village in the bay, is on the coast highway. Regular bus and freight services are maintained the entire length of the Oregon coast. Gasoline and other light fuel oils are available by truck delivery. Several stores handle general merchandise. About 3 miles above the entrance to the river is a small-boat works where craft up to 60 feet long are built. Immediately southward of Taft, a white covered bridge is prominent from seaward. At night the lights at Taft and at the town of **Delake**, about 2.5 miles northward, are very prominent.

From the northern point of Siletz Bay the coast extends 7 miles northward to the Salmon River. For 2.5 miles of this stretch to the outlet of **Devils Lake**, the yellow sandstone cliffs are 80 to 100 feet high. The lake is a large body of fresh water 10 feet above sea level that empties through a narrow stream. At 0.5 mile west by south of the mouth of the stream is a covered rock that generally breaks. For 3 miles northward from the outlet of the lake, the bluffs are 20 to 60 feet high, rising to grassy hills. A broad low-water beach and ledges of rocks are along the low-water line.

**Salmon River** empties at the southern extremity of Cascade Head. The river is of no commercial importance, as the entrance is nearly closed by sand bars.

Immediately southward of Salmon River is a rocky cliff whose seaward face is 0.6 mile long. The summit is a dome-shaped butte 510 feet high. From here a rolling grassy plateau with a few trees extends southward and eastward to the river. A rock, 46 feet high, is 700 yards westward of this cliff, and about a mile southward is a covered rock 630 yards off the beach. Immediately southward of, and in line with Cascade Head, opposite the mouth of the river, three grayish rocks about 765 yards offshore have heights of 56 feet on the north, 25 feet in the center, and 47 feet on the south.

**Cascade Head** lies 16.8 miles northward of Cape Foulweather. Very jagged and heavily wooded, it is prominent to vessels close inshore. The face of the cliff is 3 miles long, in places is over 700 feet high, and is cut by several deep gorges through which the waters of three creeks are discharged in cascades 60 to 80 feet high. Several rocks are about 0.1 mile offshore.

**Two Arches Rock**, 30 feet high, is 0.9 mile northward of the southern point of Cascade Head. The arches are visible from northward, the inner being the larger.

From Cascade Head to Cape Kiwanda, a distance of 9.5 miles, the coast is a low sand beach with a narrow marsh behind the southern part. Rolling hilltops, occasionally wooded, rise to an elevation of 500 feet behind the beach.

**Neskowin Rock**, at the high-water line about 0.3 mile northward of the northern extremity of the cliffs marking Cascade Head, rises abruptly from sand beach to 113 feet in height. The rock is dark brown and wooded on top.

**Neskowin** is a small resort with a post office and a general store.

North of Neskowin the Oregon Coast Highway is about 0.5 mile inland. At night the headlights of automobiles traveling this road cause intermittent flashes as they make the turns and might be mistaken for lights of vessels or of marine lights.

**Nestucca River** empties into **Nestucca Bay** about 5.5 miles northward of Cascade Head. The channel over the bar changes frequently in position and depth, and only light-draft vessels having local knowledge are able to cross. A fixed highway bridge at Pacific City has a horizontal clearance of 96 feet and an overhead clearance of 9 feet. The river has many snags which change the depths and shift the channel. A buoy is about 0.7 mile westward of the entrance. Even in a moderate sea, the bar is extremely dangerous. The point on the south side of the entrance consists of several low rolling grassy hillocks, about 400 to 500 feet high, which approach very close to the beach. The northern point is the southern extremity of the sandspit and dunes that extend to Cape Kiwanda.

**Pacific City**, a summer resort a mile southward of Cape Kiwanda, has a post office and a general store. Small quantities of oil and gasoline can be had. There is a hotel and telephone communication. A bus operates each day to Tillamook.

**Haystack Rock**, 327 feet high, 0.5 mile southwestward of Cape Kiwanda and 0.5 mile offshore, is a prominent landmark. The rock is conical in shape and dark for about half its height, and in summer the top is whitened by bird droppings.

**Cape Kiwanda** is a low yellow rocky point, much broken and eroded, that projects about 0.5 mile from the general trend of the coast. Behind the cape are bright sand dunes, 500 feet high, which are prominent from seaward.

From Cape Kiwanda the coast extends 7.5 miles in a general northerly direction to Cape Lookout. It is broken about halfway by the entrance to **Sand Lake**, which is shallow and not navigable. The coast consists of sand beaches and dunes until about a mile northward of Sand Lake where it changes to vertical sandstone cliffs, 50 to 100 feet high. These continue to Cape Lookout. The hills and country back of the beach as far as the ridge of Cape Lookout have been burned over except in the gulches, and numerous trunks of whitened trees are still standing.

**Cape Lookout** is about 17.5 miles northward of Cascade Head and nearly 40 miles northward of Yaquina Head Light. It projects westward for about 1.5 miles, forming a narrow rocky promontory 432 feet in height at its seaward extremity. The southern face is nearly straight, and its precipitous cliffs have numerous caves. The northern face is sloping and covered with a thick growth of timber. The ridge that forms the cape runs at about right angles to the coast, reaching an elevation of some 2,000 feet, 3.8 miles inland. The northern face of the cape is smooth and bold for the first mile, and then is much broken and marked by caves and several

cascades. Fair shelter in northwesterly winds may be had under the southern side of the cape in depths of 6 to 8 fathoms, sandy bottom. A lighted whistle buoy is about 0.5 mile off the cape.

Northward of Cape Lookout for 4.5 miles, the land falls to a low narrow sandy peninsula, separating Netarts Bay from the ocean. The sand dunes on the peninsula are visible for 10 or 12 miles.

Netarts Bay is a shallow lagoon about 4 miles long, with an average width of 1 mile. The greater portion is bare at low tide except the channel, which has depths of 6 or 7 feet. The village of Netarts, on the northern shore about a mile inside the entrance, has a post office, a general store, and telephone and bus connections. Small quantities of oil and gasoline can be obtained, but the village is of no commercial importance. Only light-draft vessels with local knowledge can enter; midchannel buoys mark the best water.

Northward of the entrance to Netarts Bay, for 1.5 miles to the rocks forming the southern part of Cape Meares, the coast is a sandy beach, backed by cliffs 50 to 120 feet high. These cliffs, topped by sand dunes varying in height from 150 to 200 feet, are good landmarks.

**Chart 6112.**—Cape Meares is high and rocky, with a seaward face about 2 miles long. The northern part is the higher, with nearly vertical cliffs 460 feet high. The western point is narrow, covered with fern and brush, and terminates seaward in a cliff about 200 feet high.

Three Arch Rocks are the largest of a cluster extending about 350 yards off the southern point of the cape. They range in height from 204 to 275 feet. The largest arch is in the middle of the lowest rock, and is about half the height of the rock above water. These rocks are the favorite resort of sea lions, whose barking can be heard a considerable distance with a favorable wind.

Cape Meares Light (45°29.2' N., 123°58.6' W.), 217 feet above the water and visible 21 miles, is shown from a white octagonal pyramidal tower on the summit of the cliff.

Pillar Rock, 102 feet high, is 0.2 mile northwestward of the point, and 0.4 mile farther northwestward is Pyramid Rock, 109 feet high, which leans seaward.

From Cape Meares to Kincheloe Point, the coast is low, partly wooded sandspit, with dunes 40 to 50 feet high. It forms the western shore of Tillamook Bay. A sand dike, 1.4 miles long has been constructed between Pitcher Point and Bayocean to stop further breakthrough in that vicinity.

Tillamook Bay entrance is about 42 miles southward of the Columbia River, 22.5 miles southward of Tillamook Rock Light, and 5 miles northward of Cape Meares Light. The bay is about 6 miles long and 3 miles wide, with a tidal area of about 13 square miles, most of which, at low tide, presents a succession of sand and mud flats. These are traversed by three principal channels which, although of fair depth near the entrance, gradually shoal toward the head of the bay.

Shipments from the bay are farm and dairy products, lumber, and fish. General merchandise is received by

rail and truck. Local products usually are shipped by rail or truck, but logs are towed on barges to the Columbia River.

Kincheloe Point is low and sandy. The north side of the entrance is the termination of a high wooded ridge extending between the bay and Nehalem River. Green Hill, opposite Kincheloe Point, is a spur 421 feet high that terminates in a bluff rounded point. It is covered by ferns, grass, and dense brush with trees on top, and is prominent. Several rocks are close inshore northwestward of the point, including a rock 7 feet deep about 360 yards west of Green Hill.

A jetty extends 800 yards seaward from the shoreline on the north side of the entrance, but the outer 500 feet has been beaten down by the sea. A lighted whistle buoy is 0.7 mile westward of the end of the jetty. The channels are marked by a lighted range, lights and buoys. The bar sometimes makes out across the range from the northward during the summer months or whenever there have been any long periods of northwesterly winds.

A Federal project provides for a channel 18 feet deep from the entrance to a turning basin of the same depth in Miami Cove; and an approach channel and a small-boat basin 12 feet deep at Garibaldi. In June 1958 the controlling depth was 12 feet to Garibaldi Light, thence 9 feet to the turning basin and 2 feet in the turning basin. No work has been done on the approach channel and small-boat basin (June 1957).

A Coast Guard station is on the northern shore at Garibaldi. The lookout station, on the jetty about 200 yards from its inner end at the foot of a steep knoll about 100 feet high, is not manned.

**Currents.**—In the entrance to the bay, the average central surface velocity of the flood or ebb stream at strength is about 3 knots.

See Appendix for storm warning display.

Sow and Pigs, a small ledge bare at half tide, lies in the entrance 0.3 mile eastward of the extremity of Kincheloe Point and about 400 yards off the northern shore. This ledge is dangerous when entering with a flood current, as the current sets toward it. The rocks of the ledge are marked by a buoy.

The three principal channels in the bay are Bay City Channel, Main Channel, and South Channel. Of the three, Bay City Channel is the only one of any commercial importance.

Houquarten Slough, a continuation of Bay City Channel, is a narrow crooked waterway leading from the head of the bay to the town of Tillamook. It has ample depths for any vessel which can pass through the bay channels, but it is so tortuous that vessels over 100 feet long have difficulty rounding the bends.

Main Channel has been abandoned below the crossover at Bay City. A depth of 6 feet is available in Bay City Channel to the crossover, which is marked by a light.

Above the limits of this dredged area, Main Channel and Houquarten Slough have been improved as far as Tillamook by the construction of dikes, the removal of snags, and by dredging in places. The resultant channel has a least width of 60 feet and a least depth of about

2½ feet. Vessels drawing 7 feet can reach Tillamook at high tide. An overhead power cable crossing at Tillamook has a permit clearance of 58 feet.

During freshets snags are carried into the upper part of the bay where they form a menace to navigation.

**Garibaldi**, a lumber and fishing town, is on the northern shore 0.5 mile inside the entrance. A black concrete stack 229 feet high and a silver elevated tank 138 feet high are conspicuous. There are two small canneries and a wharf at Garibaldi. An excellent boat basin for commercial and sport fishing is located just west of the plywood mill. Gasoline, distillate, water, provisions, and a limited amount of ship chandlery can be obtained.

**Pilotage and towage.**—A pilot, or a fisherman having local knowledge, can be obtained. Two commercial towboats take logs out of the bay.

**Miami Cove** is at the eastern end of the town of Garibaldi. The two lumber mills in the cove ship by rail.

**Hobsonville**, on the point that forms the southerly side of Miami Cove, has been abandoned.

**Bay City**, about midway along the eastern shore of the bay, has a small cannery located on the wharf which is rapidly deteriorating. The wharf bays at low water. Fishing and crabbing are carried on in this vicinity, but all shipments are made by truck or rail.

**Tillamook**, on Hoquarten Slough, is the principal town in the bay, and is noted for the production of cheese. It is the distributing center for a rich farming and dairying section, and has communication by rail to Portland. There is little waterborne commerce. The town is on the coast highway. Some logs are towed to Garibaldi or Miami Cove to make rafts for towing to Aberdeen. The tall concrete stack of a powerplant is prominent.

Gasoline, distillate, water, provisions, and a limited amount of ship chandlery can be obtained at Tillamook. Repair facilities are limited to carpentry work and minor repairs to launch engines. Communication is by rail and bus to Portland, and by truck and bus over the coast highway to the Columbia River or San Francisco.

**Chart 5902.**—From Tillamook Bay to Nehalem River, the coast is nearly straight for about 5.5 miles. Several lakes in this stretch are separated from the beach by wooded sand dunes. The heavily wooded hills begin to rise 0.5 mile to 0.8 mile from the beach and in 1 mile reach elevations of 1,000 to 1,600 feet.

**Twin Rocks** are 700 yards offshore and 2 miles northward of the entrance to Tillamook Bay. Their bases are so close together that they usually look like one rock. The southerly and larger is 88 feet high and has an arch in it; the other is 73 feet high.

**Chart 6122.**—Nehalem River is a small stream that empties about 19.5 miles northward of Cape Lookout and 17 miles southward of Tillamook Rock Light. The tidal reach extends to a point about 10 miles from the entrance, above which the river is a mountain stream full of riffles and obstructed by boulders. The river consti-

tutes a natural outlet for an extensive area of heavily timbered country. Lumbering and fishing are the principal industries. Sawmills are located along the lower river.

**Nehalem Beach**, the northern point at the entrance, is a narrow sandspit, bare of trees, and with dunes of moderate elevation over the northern part. The southern side of the entrance is a low broad sand beach, backed by wooded country rising to elevations of 400 feet.

The entrance is marked by two jetties extending about 600 yards from the shoreline. A whistle buoy is 0.7 mile southwestward of the entrance. The channel is marked by ranges and daybeacons.

The depths on the bar and within the bay are not sufficient for coastwise shipping; all lumber is now shipped out by rail. The controlling depth is about 8 feet on the bar, and 7 to 8 feet to Wheeler. In winter, the river cuts a channel, usually about 12 feet deep, straight out, but in summer there is only about 8 feet. The channel is very changeable.

**Brighton** is a small settlement on the eastern shore, a mile inside the entrance to the river. The sawmill and wharf are in ruins.

**Hoebet and Wheeler** form practically one continuous town on the southern bank of the river, 2.8 miles above Brighton. The old sawmill at Hoebet is in ruins and the wharf is dangerous. Wheeler has a shingle mill. All traffic is by rail and truck.

**Nehalem** is a small settlement on the western shore of the river about 1.5 miles above Wheeler. A highway bridge over the river just below Nehalem, and about 0.6 mile northward of Deans Point, has a swing span with a horizontal clearance of 92 feet and an overhead clearance of 20 feet; close south of this bridge is an overhead power cable with a clearance of 48 feet. A highway bridge with an overhead clearance of 9 feet is about 2 miles above the town on the north fork of the river.

**Chart 5902.**—Northward of the entrance to Nehalem River the coast is low and sandy for about 3 miles. It then increases in height and is covered with dense forest, except in the vicinity of the beach where there are grassy hillocks, 40 to 100 feet high, which rise gradually to the southern slope of Neahkahnne Mountain.

**Cape Falcon**, about 17 miles northward of Cape Meares and 10 miles southward of Tillamook Rock, projects about 2 miles from the general trend of the coast. The seaward face, less than 0.5 mile in extent, is very jagged with numerous rocks under the cliffs. The southwestern point of the cape is composed of nearly vertical cliffs, 200 feet high, and is partially timbered.

**Falcon Rock**, 15 feet high, small in extent, and not very conspicuous, is 0.7 mile westward of the cape.

**Smugglers Cove**, the local name of a small bight just southward of Cape Falcon, is an excellent anchorage for small boats. The best anchorage is close to the northern shore in 4 to 5 fathoms, protected from all except southwesterly winds. Care should be taken to avoid two rocks, bare at extreme low water, that are about 150 yards

from the north shore of the cove and rise abruptly from deep water. A supply of fresh water empties into the cove at the sand beach at the head.

**Neahkahnie Mountain**, 2.8 miles eastward of Cape Falcon, is a prominent landmark. It is double-headed. The western summit is rounded and 1,900 feet high, but the eastern summit is serrated and divided into three peaks of nearly equal height. The entire southeastern slope is bare of timber but is covered with grass and fern. The seaward face terminates in rocky broken cliffs over 500 feet high, and there are a few rocks about 100 feet from the beach. The two summits are visible from southward; from northward, the western summit hides the eastern and is very conspicuous.

The coast northward from Cape Falcon consists of high cliffs until 1.5 miles southward of Arch Cape, where they change to low bluffs.

**Arch Cape**, rocky and precipitous, projects slightly from the general trend of the coast. It is the termination of a mountain ridge rising to 2,775 feet about 3 miles eastward. The cape is bare of timber on the southern slope for a short distance from the point. A rock 120 feet high is close to the cape and connected with it at low water. A smaller rock, 25 feet high, is about 100 yards seaward of the larger. There are several other high rocks in the vicinity of the cape.

**Castle Rock** derives its name from its remarkable resemblance to a medieval castle with two towers, the taller of which 157 feet high, is on the seaward end. It is a little over 0.8 mile westward of the highest part of the cape, and is the outermost bare rock. The upper part of the rock is covered with bird droppings and shows up very distinctly in sunlight. A rock awash is about 0.9 mile off the cape and 0.4 mile southwest of Castle Rock; another rock, bare at lowest tides, is 0.5 mile offshore and 1 mile south of Castle Rock.

A narrow but deep passage between Falcon Rock and the shore has depths of at least 10 fathoms. Falcon Rock should be passed close by; care should be taken to avoid the reef, bare at extreme low water, the seaward end of which is 0.4 mile northeastward of the rock.

Northeastward of Cape Falcon, and 2 to 3 miles back from the shoreline, is a group of peaks, among which is **Angora Peak**, the highest and most prominent, which is 3,095 feet high. The peak has a rounded summit, with a very gentle slope to the southward and a more marked and abrupt drop to the northward. It is very conspicuous from westward in clear weather.

**Hug Point** is a small cliff close to the beach, 1.8 miles northward of Arch Cape; the cliffs in its vicinity are about 180 feet high.

**Double Peak**, halfway between Cape Falcon and Tillamook Head, is the seaward end of a ridge extending eastward, which reaches a height of 1,050 feet in less than 0.7

mile from the shore. It is heavily wooded and pitches abruptly to the sea, ending in a rocky broken cliff 100 feet high and 0.2 mile long. A rock 107 feet high, is close to and abreast of the southern end of the cliff; another, 76 feet high, is close to and abreast the northern end. A ledge, with two rocks that bare at half tide, is about a mile west-southwestward of the highest part of the cliff.

From Double Peak, the coast extends northward for 2.7 miles to the mouth of **Elk Creek**, and then turns sharply northwestward for the same distance to the western point of Tillamook Head. The coast is high and wooded with broken cliffs bordered by numerous rocks, except at **Cannon Beach** at the mouth of Elk Creek.

**Haystack Rock**, 235 feet high, is 1.5 miles northward of Double Peak and is the largest of a cluster of rocks stretching out from the low water line to depths of 10 fathoms. A rock awash at low water, and surrounded by a depth of about 9 fathoms, is 0.8 mile southwestward of Haystack Rock.

**Tillamook Head** ends in two points which are 0.5 mile apart. The cliffs are 560 feet high at the southern point and 1,000 feet high at the northern point. A pinnacle rock is at the foot of the northern cliffs, and extending offshore from it for 300 yards is a cluster of rocks, 45 to 150 feet high, the outer one being the lowest. The summit of the head is 1,300 feet high, flat, and densely wooded, with slightly lower land behind it.

**Tillamook Rock**, nearly 1.2 miles west of the southern point of Tillamook Head, is about 100 feet high. The abandoned lighthouse and buildings are prominent. The western face leans a little seaward. A rock awash is between Tillamook Rock and the nearest part of Tillamook Head. A lighted whistle buoy is 0.5 mile westward of the outer rock.

North of Tillamook Head the coast is a broad sand beach extending for 17 miles to Clatsop Spit, on the south side of the entrance to Columbia River. Low sandy ridges, covered with grass, fern, and brush, extend parallel with and back of the beach. **Necanicum River**, a small stream, empties at Seaside, about 2.5 miles from the north side of Tillamook Head. Several hotels and summer resorts are along this stretch, and a sawmill, generally showing smoke, is near the southern end.

**Seaside**, an important summer resort in the bight 4 miles to the northward of Tillamook Head, has rail connections to Astoria.

**Saddle Mountain**, double-headed and 3,283 feet high, is the landfall for the approach to the Columbia River. The mountain is 14 miles east of Tillamook Rock and is visible 50 miles offshore. From northwestward, the mountain appears to be triple-headed; the northeastern peak appears cone-shaped, sharp, and lowest; the middle peak is irregularly cone-shaped; and the southern and highest peak is a flat-topped cone.

## 10. COLUMBIA RIVER, OREGON AND WASHINGTON

**Charts 6151 to 6157.**—The Columbia River rises in British Columbia, through which it flows for 370 miles. It enters the United States in northeastern Washington, flows southerly to the mouth of Snake River, thence westerly between Oregon and Washington, and empties into the Pacific Ocean 548 miles north of the entrance to San Francisco Bay and 145 miles south of the entrance to the Strait of Juan de Fuca. The total length of the river is 1,050 miles. The river with its tributaries drains a large and productive territory. Below the Cascade Mountains the river flows through a canyon averaging about 5 miles in width between high cliffs on each side; of this width, the river occupies about 1 mile, the rest being marsh, low islands, and lowlands. Near the mouth, the river becomes wider, and in some places is 5 miles across.

The Columbia River and its tributaries are navigable by deep-draft ocean steamers to Portland, Vancouver, and The Dalles, 97, 92, and 164 miles, respectively, above the mouth; and by light-draft steamers to Priest Rapids, Wash., and Lewiston, Idaho, 355 and 406 miles, respectively, above the mouth.

The commerce, both foreign and domestic, is extensive. The exports are principally lumber, grain, flour, fruit, fish, and general merchandise; the imports are coal, fuel oil, cement, manufactures, and general merchandise. There are numerous settlements and landings, but Astoria, on the south bank, 12 miles inside the entrance, and Portland, on the Willamette River, 9 miles from its junction with Columbia, are the principal shipping points.

The deep channels for ocean vessels are shown on a set of seven, overlapping, large-scale charts, covering the area from the entrance to The Dalles at the head of this type of navigation. They are numbered 6151 to 6157, inclusive.

The various places and features along both banks of the river are described as the river is ascended. When two features are abreast of each other on opposite sides of the river, the one on the southern bank is described first.

Distances shown in the text as Mile 0.9, Mile 12, etc., are the nautical miles above the mouth of the Columbia River. Mile 0.0 is at the junction of the Main Channel Range and a line joining the outer ends of the north and south jetties. The distance to the mouth of the river from a position 0.5 mile west of the Columbia River Lightship is 5.6 miles.

**Prominent features.**—Columbia River Lightship ( $46^{\circ} 11.1' N.$ ,  $124^{\circ} 11.0' W.$ ), is in 198 feet on the Main Channel Range 5.3 miles southwestward of the entrance to the Columbia River. The vessel has a red hull, with the word COLUMBIA on each side, and two masts. The light, shown from the foremast, is 57 feet above the water and

is visible 13 miles; the radiobeacon and the fog signal are synchronized for distance finding. The code flag signal and radio call is NNCR. Storm warnings are displayed daytime only.

**Mount Saint Helens**, nearly 10,000 feet high, cone-shaped and snow-capped, is about 75 miles eastward of the entrance to the river. On a clear day it is visible when looking up the valley from seaward. **Mount Hood** and **Mount Adams** are also lofty, snow-covered peaks, visible from parts of the Columbia River on a clear day.

**Clatsop Spit**, on the southern side of the entrance, is a low sand beach, extending about 2.5 miles northwestward from Point Adams. There is a tendency for the shoal northward of the spit to build up to the northwestward due to spring freshets and northwest storms. Vessels are cautioned to keep informed as to the conditions in this vicinity. **Point Adams**, just inside Clatsop Spit, is a low, sandy point, covered with fir and undergrowth to the edge of the sand beach and low dunes. The point usually shows well from seaward, particularly if it is hazy inside. A Coast Guard station is on the eastern side of the point at Hammond. The red storm warning lights at the station are obscured from  $015^{\circ}$  to  $180^{\circ}$  to prevent possible confusion with aids to navigation by inbound vessels.

**Cape Disappointment**, the northern point at the entrance to the Columbia River, is the only headland on the low sand beach that extends from Tillamook Head to Point Grenville, a distance of over 80 miles. It comprises a group of rounding hills covering an area 2.5 miles long and 1 mile wide, divided by a narrow valley extending north-northwestward. The seaward faces of these hills are precipitous cliffs with jagged, rocky points and small strips of sand beach. **Cape Disappointment Light** ( $46^{\circ} 16.6' N.$ ,  $124^{\circ} 03.1' W.$ ), 220 feet above the water and visible 21 miles, is shown from a white conical tower on the extreme southeastern point of the cape; a radiobeacon is at the light. A Coast Guard station is at Fort Canby on the eastern side of the cape.

From the southward, Cape Disappointment shows as three low knobs, separated by low flat ridges. North Head Light shows on the western slope of the western knob and Cape Disappointment Light shows on the western slope of the eastern knob. From the westward, the cape is not prominent, but in fog, haze, or smoke inside the cape, it stands out clearly. From northwestward, the cape appears as a flat island with a slight depression in the center and a timbered knob at each end. From this direction, a low, flat hill with gently sloping sides between the cape and high ridges eastward appears as an island from a distance.

**McKenzie Head**, 0.8 mile northwestward of Cape Disappointment Light, is 190 feet high and nearly round. It is covered with grass and fern but is bare of trees.

**North Head**, the extreme western point of the cape, is 270 feet high, with a very jagged, precipitous cliff, backed by a narrow grassy strip; the higher ground behind it is covered with trees. **North Head Light** ( $46^{\circ}18.0' N.$ ,  $124^{\circ}04.6' W.$ ), 194 feet above the water and visible 20 miles, is shown from a white conical tower on the western point.

The entrance to the Columbia River is marked by two jetties. The south jetty extends 2.7 miles seaward from the northwest end of Clatsop Spit. The north jetty extends 300 yards seaward from the shoreline on the north side of the entrance. Lighted ranges, lights, buoys and daybeacons mark the channels.

**Boundary lines of Inland Waters.**—The line established for the Columbia River is described in §82.125, Chapter 2.

**Channels.**—A Federal project provides for an entrance channel 48 feet deep over the ocean bar, thence 35 feet to the Broadway Bridge at Portland, Oreg., and 30 feet deep from the mouth of the Willamette River to Vancouver, Wash., thence 27 feet to Bonneville, thence 27 feet to The Dalles.

The largest vessels on the Pacific can enter and leave the Columbia River at any normal stage of the tide, and in any weather except during the most severe storms.

The channel depths are maintained by dredging on the bars, and by the construction of stone and pile dikes and revetments. It is impossible to maintain project depths on the bars throughout the year because of the excessive shoaling which occurs in the months of May, June, and July. The channels are restored to project depths as soon as possible after the shoaling takes place.

**Depths.**—Minimum depths are given at mean lower low water from the entrance to Harrington Point, thence at Columbia River Datum to Bonneville Dam on the Columbia River and Willamette Falls Dam near Oregon City on the Willamette River. **Columbia River Datum** is the mean lower low water during lowest river stages. The staff gage at the Columbia River Pilots' Office, at the foot of 14th Street at Astoria, Oreg., is set with zero at mean lower low water. The staff gages located on the bars from Harrington Point to Portland, Oreg., are set with zero at Columbia River Datum.

The controlling depths are published monthly in the Local Notice to Mariners, issued by the Commander, 13th Coast Guard District, Seattle, Wash., and the Notice to Mariners published by the Navy Hydrographic Office, Washington, D.C. Additional information may be obtained from the Corps of Engineers, U.S. Army, Portland, Oreg.

**Anchorage.**—Limits and regulations of the anchorage areas in the Columbia River are given in §202.228, Chapter 2.

**Bridges and cables.**—Overhead clearances of bridges and cables over the Columbia River and its tributaries are at mean lower low water below Harrington Point and at Columbia River Datum above that point. The clearances are referred to normal pool level above the

dams on the Columbia River and above the low water slope on the Willamette River above the locks at Oregon City.

**Caution regarding aids to navigation.**—During the period of high water conditions, aids to navigation in the Columbia River are subject to being destroyed, temporarily discontinued, or otherwise rendered unreliable. Mariners are warned to exercise caution in navigating the river and to obtain the latest information regarding the status of aids to navigation by local inquiry and through local Notices to Mariners, available upon request to the Commander, 13th Coast Guard District, Seattle, Wash. Every effort is being made to maintain the aids in operating condition and restoration of aids to normal operation will be accomplished at the earliest practicable date that conditions will permit.

**Directions, Columbia River approach.** The lights at the entrance and at Willapa Bay, 28 miles northward, are distinguishing marks for determining a vessel's position and the subsequent shaping of the course.

Approaching from any direction in thick weather, great caution is essential. The currents are variable and uncertain. Velocities of 3 to  $3\frac{1}{2}$  knots have been observed at the lightships between Blunts Reefs and Swiftsure Bank, and velocities considerably in excess of those amounts have been reported. Under such conditions, vessels should keep outside the 30-fathom curve until the lightship has been made. Care should be taken not to mistake the low sand beach northward of Cape Disappointment for that southward of Point Adams. Nearly all the vessels which have gone ashore while endeavoring to make the entrance have been wrecked northward of the mouth of the river in the vicinity of Peacock Spit.

Sailing vessels should endeavor to make the land to windward of the entrance in the summer months, in the latitude of Cape Disappointment; and in winter, well southward of the cape; and when compelled to heave-to while waiting for favorable conditions for entering, particularly during the heavy weather of the winter season, should make ample allowance for current. Vessels have been known to heave-to on making Columbia River Lightship and 24 hours later find themselves off Grays Harbor.

In clear weather, vessels should have no difficulty in entering the river as the aids to navigation are numerous. The chart is the guide, and no detailed directions are necessary. In thick weather, however, when the aids cannot be seen, strangers should not attempt to enter without a pilot.

Local vessels entering in thick weather and with a floodtide, as a rule, do not attempt to pass beyond Desdemona Sands Light, because of the difficulty under such circumstances of avoiding vessels anchored in the narrow channel above the light.

**River channels.**—Because of the changes made from time to time in the alinement of the dredged channels, no directions for the river can be given which would be of permanent value. The channels are well marked by ranges, daybeacons, and buoys; by following the chart, vessels of less than 30-foot draft should have little dif-

faculty in reaching Portland, providing the trip can be made in daylight. Darkness greatly increases the difficulty of navigation, not only because the unlighted aids cannot be seen, but more particularly because the lighted aids are in some cases difficult to distinguish from the numerous other lights surrounding them. Strangers should not attempt to run the river at night.

Dredges will usually be found at work in the channels of the Columbia and Willamette Rivers. These dredges should be passed with caution and reduced speed; regulations are given in § 207.670, Chapter 2.

**Weather.**—An estimate of bar conditions, visibility, wind, etc., may be obtained by radio from the Coast Guard Cutter at Astoria, or the Point Adams Coast Guard station at Hammond.

**Currents.**—The currents at the Columbia River Lightship are described in the Tidal Current Tables, Pacific Coast.

**Caution.**—The Columbia River Bar is reported to be very dangerous because of sudden and unpredictable changes in the currents often accompanied by breakers. It is reported that ebb currents on the northern side of the bar attain velocities of 6 to 8 knots, and that strong northwesterly winds sometimes cause currents that set northward or against the wind in the area outside the jetties.

In the entrance the currents are variable, and at times, reach a velocity of over 5 knots on the ebb; on the flood they seldom exceed a velocity of 4 knots. The mean velocity of the tidal current is about  $3\frac{1}{2}$  knots at strength of either flood or ebb, but this tidal current is always modified both as to velocity and time of slack water by the river discharge. On the flood, there is a dangerous set toward Clatsop Spit, its direction being approximately east by south; on the ebb the current sets along the line of buoys. Heavy breakers have been reported as far inside the entrance as buoy 12, southward of Sand Island.

For predicted times and velocities, the Tidal Current Tables, Pacific Coast should be consulted.

**Freshets** occur annually, the highwater stage being reached about June. The heights above normal range about 20 feet at Portland to practically nothing at Astoria. These freshets cause shoaling in the dredged cuts through the various bars, but redredging is begun as soon as the waters have partly subsided, and normal conditions are restored shortly after the end of the flood season.

Since logging is one of the main industries of the region, free floating logs and submerged deadheads or sinkers are a constant source of danger in the Columbia and Willamette Rivers. The danger is increased during spring freshets. **Deadheads** or **sinkers** are logs which have become adrift from rafts or booms. One end of the sinker settles to the bottom while the other floats just awash, rising and falling with the tide.

**Ice** forms occasionally in both the Willamette and Columbia Rivers, but it is seldom heavy enough to seriously affect navigation.

**Salinity of river water.**—The river water in the vicinity of Portland and as far downstream as Brookfield, Wash.,

is fresh and is used for boilers of steamers at all seasons of the year. From Brookfield to the sea the salinity increases. In the vicinity of Astoria it is brackish.

**Pilotage.**—Pilotage across the Columbia River Bar and up or down the river is not compulsory, but pilots are always available and a pilot boat will usually be found cruising off the bar. Vessels requiring a pilot should radio (Code Word) Bar Pilots Astoria, 12 hours prior to arrival, stating expected time of arrival at the Columbia River Lightship in order to be assured of a bar pilot being available.

The Bar Pilots maintain two pilot boats, one a power schooner named COLUMBIA, radiotelephone call WA-3810, operating on 2738 kc., and the other a converted mine sweeper named PEACOCK, radiotelephone call WA-9403, operating on 2738 kc. One of these boats is on station at the lightship when a ship requiring a pilot is due.

Pilots are transferred from the pilot boat by means of a pulling boat and the ship should have a boat rope for the small boat to hang onto, this boat rope to be made fast on deck about 75 feet on each side of the ladder with the bight down to the water's edge.

The bar pilotage ground extends from the uppermost dock or wharf at the port of Astoria to the open sea, at least 10 miles beyond the outermost buoy, and the river pilotage ground extends from the lowermost dock or wharf at the port of Astoria to the head of navigation on the Columbia or Willamette Rivers and their tributaries. The transfer of a bar pilot to a river pilot is made off Astoria. The radio code word for Columbia River Pilots is COLRIP. The whistle signal is one long and three short blasts. They also may be reached by calling the Elliott Hotel, Astoria 1052.

An occulting amber light is maintained by the Columbia Bar Pilots, in cooperation with the Coast Guard, on the outer end of the pier on the west side of Tongue Point. When this light is exhibited it will inform outward bound vessels that desire a bar pilot that the bar is not passable and that the vessel should anchor.

**Chart 6151.—Columbia River Entrance to Harrington Point.**—Reaches of the channel within the limits of this chart are Entrance Main Channel Range, Sand Island Range, Desdemona Channel, Flavel Range, Tansy Point Range, Astoria Range, Tongue Point Channel, Harrington Point Range, and Miller Sands Channel.

**Baker Bay** is a shoal open bight, eastward of Cape Disappointment, formed by the cape and the recession of the land northward. Sand Island, low and flat, is in front of the bay. A Federal project provides for a channel 10 feet deep and 200 feet wide eastward and northward of the island to a mooring basin of the same depth at Ilwaco, a small town on the northern shore. In July 1958 the controlling depth was 2 feet in the channel and 10 feet in the basin. A Federal project provides for another channel 10 feet deep and from 150 to 200 feet wide westward of Sand Island extending from deep water in the river to the main channel at Ilwaco. In July 1958 the controlling depth was 7 feet; however, the entrance is subject to con-

tinual change. As there is usually a swell here, the channel should be navigated only at high water with local knowledge. Ilwaco is the base for a large fishing fleet. Fuel oil, gasoline, and water are available; there are facilities for hoisting out 8- to 10-ton fish boats on small marine railways and for making some repairs. The remainder of the bay is covered with shoals and old abandoned fish traps; at low tide, it is not navigable even for light-draft river steamers.

**Desdemona Sands**, a shoal area extending from just inside the entrance of the Columbia River southeastward for about 6 miles, divides the river into the main channel to the south and a secondary channel to the north. **Desdemona Sands Light** (46°13.5' N., 123°57.2' W.), 17 feet above the water and visible 7 miles, is shown from a white platform on a pile structure on the western side of the shoal; a fog signal is at the light.

**Fort Stevens wharf**, at Mile 7.3 on the Oregon side, is marked by a light and fog signal on a dolphin off the end. A narrow catwalk connects the light structure with the wharf which is falling to ruins. The Fort Stevens Boat Haven is at **Hammond**, 0.2 mile southeastward of the wharf. Its entrance is marked by lights on the end of the jetties and an unlighted range bearing 215½°. In July 1958 the controlling depth was 7 feet from the entrance to inside the basin.

**Warrenton**, on the Skipanon River at Mile 9.5, has several sawmills, canneries, and fertilizer works. There are two marine ways located in the town where boats up to 50 feet long can be hauled out for repair. A Federal project provides for a channel 30 feet deep and 200 feet wide from the Columbia River to the railroad bridge, a distance of 1.7 miles, including a turning basin of the same depth and a mooring basin 12 feet deep at Warrenton; and a channel 6 feet deep for a distance of 1,500 yards above the railroad bridge. In June 1953 the controlling depth was 22 feet in the entrance channel, 12 feet in the turning basin, and 6 feet in the channel above the railroad bridge. Additional shoaling has been reported since that time. Ocean vessels no longer call here. Warrenton has rail and highway connections with Astoria.

Three bridges cross the Skipanon River. The overhead clearances are at mean lower low water. A railroad bridge, about 0.7 mile above the mouth, has a swing span with a horizontal clearance of 16 feet in the east draw and 33 feet in the west draw, and an overhead clearance of 10 feet. A highway bridge, about 0.8 mile above the mouth, has a bascule span with a horizontal clearance of 33 feet and an overhead clearance of 15 feet; an overhead power cable at the bridge has a permit clearance of 68 feet. A highway bridge about 2.1 miles above the mouth, has a bascule span with a horizontal clearance of 84 feet and an overhead clearance of 10 feet. Operating regulations for these bridges are given in § 203.740, Chapter 2.

**Scarboro Hill**, 820 feet high, is on the Washington side about 7 miles eastward of Cape Disappointment. It is a long, gradually rising ridge, covered with grass and fern. Formerly it was prominent, being the only grass-

covered hill visible on the northern bank of the river. In recent years, however, many scattered trees have grown up on the hill, and the slopes eastward to Point Ellice have been largely denuded of their dark timber. A number of conspicuous light-colored buildings of the historical State park at **Fort Columbia**, may be seen near the base of the hill, and alongshore to the westward lies the town of Chinook.

A Federal project provides for a channel 10 feet deep and 150 feet wide from the Columbia River to a turning and mooring basin of the same depth at **Chinook**. In May 1956 the controlling depth was 9 feet in the entrance channel and 4½ feet near the dock at Chinook. The turning and mooring basin was scheduled for completion in 1958. At the town is a pile and timber bulkhead. The only wharf is owned by a packing company, a portion of which is used as a public landing.

**Smith Point**, at Mile 11.3 on the Oregon side, is the western termination of a high, wooded ridge; it is the first prominent point on the southern bank southeastward of Point Adams. The ridge culminates in **Coxcomb Hill**, 595 feet high, behind Astoria. The Astor Column on the top of the hill is prominent.

**Youngs Bay** is a shoal body of water just westward of Smith Point. It receives the waters of **Youngs River** and **Lewis and Clark River**. Traffic on the two rivers is confined chiefly to towboats handling log rafts just above the two highway bridges. Small towboats operate to the town of **Olney** on Youngs River at high tide. The shipyards of Youngs Bay are no longer in operation. A powerhouse with a prominent white concrete stack is on the northern shore of the bay, just westward of the highway bridge.

A Federal project for Youngs Bay and Youngs River provides for a channel 10 feet deep and 150 feet wide from the Columbia River to the foot of Haven Island. In October 1956 the controlling depth in Youngs Bay was 7 feet to the highway bridge. In January 1957 the controlling depth in Youngs River from the highway bridge to Fry Island was 10 feet, thence 5 feet to Haven Island. Shoaling has been reported at the mouth of Youngs Bay on an extension of the pierhead line of the Astoria waterfront.

Two bridges cross Youngs Bay. A railroad bridge, about 0.4 mile above the mouth, has a swing span with a horizontal clearance of 130 feet and an overhead clearance of 18 feet. A highway bridge, about 2.1 miles above the mouth, has a bascule span with a horizontal clearance of 120 feet and an overhead clearance of 27 feet in the center of the span. About 0.7 mile above this bridge on the Youngs River is the first of several overhead cables; its permit clearance is 103 feet.

The highway bridge about 0.9 mile above the mouth of the Lewis and Clark River, westward of Youngs River, has a bascule span with a horizontal clearance of 92 feet and an overhead clearance of 25 feet. A highway bridge 4.3 miles above the mouth has a swing span with a horizontal clearance of 50 feet and an overhead clearance of 11 feet. A highway bridge, about 6.1 miles above the mouth, has a fixed span with a horizontal clearance of 80

feet and an overhead clearance of 18 feet. The overhead clearances are at mean lower low water. Operating regulations for these bridges are given in § 203.740, Chapter 2.

Astoria, at Mile 12 on the Oregon side, extends from Youngs Bay to Tongue Point. It is the principal city on the lower portion of the river. It has connections with the interior by both rail and river steamers; large quantities of grain, lumber and general merchandise are shipped to both foreign and domestic ports. Oil products are received. There are ample wharfage facilities, both municipal and private, with depths of 20 to 35 feet.

A mooring basin for trolling boats and others is maintained by the port of Astoria just eastward of its piers at Smith Point. The basin is about 600 feet by 900 feet, with capacity for about 400 boats. The northeast corner of this mooring basin is marked by a lighted sign in the shape of a letter "A". It is reported to be the most prominent light of the waterfront. A second mooring known as the East Basin is maintained at the eastern extremity of the waterfront. It accommodates about 100 boats. A 200-foot salvage tug is moored here.

**Anchorage.**—The anchorage areas off Astoria are given in § 202.228, Chapter 2. There is a harbor regulation that no vessel shall anchor for more than 1 hour within an area bounded on the south by the Astoria waterfront and on the north by the main channel buoys. Temporary anchorage may be had by vessels of suitable draft just east of buoy 19 northwest of Desdemona Sands Light.

**Tides.**—The mean range of tide at Astoria is about 6 feet. The range between mean lower low water and mean higher high water is about 8 feet. A range of about 12 feet may occur at the time of maximum tides. Daily tide predictions for Astoria (Tongue Point) are given in the Tide Tables.

**Currents.**—Above Astoria the current averages 1 to 3 knots at strength except during the freshet period when the ebb is considerably increased although not enough to seriously affect navigation.

**Towage.**—Towboats are always available. Barges of various sizes are available at all times.

**Quarantine.**—Quarantine regulations of the U.S. Public Health Service are enforced. The quarantine officer is stationed in Portland. He may be requested at Astoria or other ports of call by previous arrangement. An outpatient office of the Public Health Service, in charge of a contract physician, is at Astoria.

**Customs.**—Astoria is a port of entry; marine documents are issued.

**Immigration.**—There is no office here. Arrangements can be made through the Portland office if required.

**Harbor regulations** are prescribed by the Port of Astoria Commission and enforced by the harbor master. Copies of the complete regulations may be obtained from him.

**Terminal facilities.**—The port of Astoria, a municipal corporation embracing all of Clatsop County, owns 8,840 feet of the waterfront at Smith Point, and operates a well-equipped modern terminal of three piers. The offices are on Pier 1.

**Supplies.**—Fuel oils, provisions, and ship chandlery are available.

**Repairs.**—Marine ways having a capacity of 400 tons are available in Astoria. Vessels up to 200 feet long and 12 feet draft can be hauled out for repair. There are machine shops and foundries. Complete salvage equipment is available. The Tongue Point naval dock is available in emergencies.

**Communication** between Astoria and Portland and intermediate points is by railroad, truck, and bus. Transportation is also available to points directly north and south of Astoria by bus. Astoria is on the Columbia River Highway which extends from Seaside, Oreg., to Astoria, thence along the southern bank of the Columbia to The Dalles.

A Coast Guard cutter is stationed at the port during the greater part of the year and is available to render assistance to vessels off the Oregon and Washington coasts.

**Point Ellice**, on the Washington side, 9.5 miles inside the entrance, is the termination of a spur from the mountain ridge back of Scarboro Hill. The point is rounding and rocky but not high. Two hillocks lie behind the point; one is 240 feet high and the other behind it is much higher. The shore in this vicinity is closely built up with abandoned fish traps and pile structures which extend out into the river.

**Megler**, a ferry landing on the northern shore 1 mile northeastward of Point Ellice, is connected by ferry with Astoria as part of the coastal highway route. The ferry is operated by the Oregon State Highway Department. It operates on a ½-hour schedule from June 1 to Labor Day and at 1½-hour intervals the remainder of the year.

**Tongue Point**, at Mile 16 on the Oregon side, is a bold, rocky peninsula, 308 feet high, covered with trees and connected with the southern bank by a low, narrow neck; it projects into the river for 0.8 mile. A buoy depot of the Coast Guard is on the western side of the peninsula near its inner end. On the eastern side opposite the buoy depot is a naval base which has eight concrete piers, each about 435 yards long. The area adjacent to the piers has a general depth of 20 feet.

**Cathlamet Bay** lies eastward of Tongue Point and southward of the Main Ship Channel. There are many islands which are covered with tule in the summer, while in the winter they are almost indiscernible. The **John Day Channel** lies between Tongue Point and **John Day Point**. At the junction with the **John Day River**, just northward of the point, the name changes to **South Channel**, and it follows the shore closely to and around **Settler Point** to **Svensen**. These channels are marked with buoys. The westerly portions of **Prairie** and **Woody Island** channels cross the bay. The Maritime berthing area is on the west shore of Cathlamet Bay southward of Tongue Point; regulations are given in § 207.900, Chapter 2. **John Day River** is crossed by five overhead power cables with a least permit clearance of 38 feet at mean lower low water.

**Grays Bay** extends from **Grays Point** to **Harrington Point** northward of the Main Ship Channel. In the northeastern section of the bay are extensive mud flats. **Deep River** flows into the northern part of the bay. The channel is marked and follows the shore from Grays Point around **Portugese Point** and **Rocky Point**. A Federal project provides for a channel 8 feet deep and 100 feet wide through the bars at the mouth of the river and the entrance, and 60 feet wide in the river up to the town of **Deep River**. In June 1946 the controlling depth was  $2\frac{1}{2}$  feet.

Deep River is crossed by two highway bridges. The first, about 3 miles above the mouth, has a swing span with a horizontal clearance of 60 feet in the east draw, 56 feet in the west draw, and an overhead clearance of 20 feet. The second, about 3.7 miles above the mouth, has a bascule span with a horizontal clearance of 38 feet and an overhead clearance of 18 feet. The river is crossed by an overhead power cable having a permit clearance of 87 feet. **Overhead clearances are at mean lower low water.** At the town of Deep River is one wharf for general freight. The river is used mostly by fishing vessels and log rafts.

**Grays River** enters the northern section of Grays Bay. The river is navigable to the town of **Grays River** about 7 miles above the mouth. The channel is in fair condition but shoal with an accumulation of snags and sunken logs. No recent surveys have been made. The controlling depth is reported by local interests to be 2 feet for 5 miles above the mouth; above that point to the town of Grays River the river is practically dry in two places at low water.

Two highway bridges cross Grays River at **Rosburg** about 4 miles above the mouth. The first has a fixed span with a horizontal clearance of 60 feet and an overhead clearance of 33 feet. The second has a swing span with a horizontal clearance of 48 feet and an overhead clearance of 18 feet. **Overhead clearances are at mean lower low water.** Along the river are small privately owned wharves. The river is used mostly by fishing vessels and log rafts. Above the town of Grays River the river is used only for logs.

**Chart 6152.—Harrington Point to Crims Island.**—Reaches of the main channel within the limits of this chart are **Miller Sands Channel**, **Pillar Rock Lower Range**, **Pillar Rock Upper Range**, **Skamokawa Channel**, **Puget Island Range**, **Wauna Range**, **Driscoll Range**, **Westport Channel**, **Eureka Channel**, and **Gull Island Channel**. **Overhead clearances are at Columbia River Datum.**

In this section of the river the main channel follows the northern bank to **Three Tree Point**; thence swings around the bend, holding to the northeastern shore to **Hunting Island**; thence swings southward and follows the southerly shore until off the southeastern end of **Puget Island**; thence follows the northerly bank from **Cape Horn** past **Abernathy Point** and northward of **Crims** and **Gull Islands**.

**Currents.**—In this section of the river the tidal current at strength has an average velocity of about 1 knot. Because of the river flow which combines with tidal current,

the upstream flow is weak or nonexistent and the downstream flow attains velocities of 2 to 3 knots at strength. Much greater velocities occur under freshet conditions. Tidal current predictions may be obtained from the Tidal Current Tables, Pacific Coast.

**Local magnetic disturbance.**—Differences of as much as  $2^\circ$  from the normal variation have been observed along this section of the river.

The easterly end of **Woody Island Channel** enters the main channel northward of **Woody Island**. **Prairie Channel** follows the northern spore of **Long Island** to **Woody Island**. **Blind Slough** and its tributary, **Grizzly Slough**, on the southern side of Long Island, are used for log raft storage. Across **Blind Slough** are two bridges. A railroad bridge, about 1 mile above the mouth, has a swing span with a horizontal clearance of 45 feet and an overhead clearance of 11 feet. A highway bridge, about 1.4 miles above the mouth, has a removable span with a horizontal clearance of 70 feet and an overhead clearance of 16 feet; an overhead power cable at the bridge has a permit clearance of 60 feet. Operating regulations for the railroad bridge are given in § 203.740, Chapter 2.

**Steamboat Slough**, northeastward of Price Island at Mile 29.3 on the Washington side, is used by fishing boats, tugs, and for log storage. **Skamokawa** is a small village at the western entrance to the slough.

A Federal project provides for a channel  $6\frac{1}{2}$  feet deep and 75 feet wide at the entrance to **Skamokawa Creek** between **Steamboat** and **Brooks Sloughs**. In June 1957 the channel was at project depth. A highway bridge, 0.2 mile above the mouth, has a swing span with a horizontal clearance of 65 feet and an overhead clearance of 20 feet; operating regulations are given in § 203.758, Chapter 2. The overhead power cable at the bridge has a permit clearance of 77 feet. About 0.4 mile above the mouth is a highway bridge that has a swing span with a horizontal clearance of 61 feet and an overhead clearance of 15 feet.

**Brooks Slough** is just northward of the mouth of **Steamboat Slough**. A highway bridge across the slough about 0.2 mile above the mouth has a swing span with a horizontal clearance of 60 feet and an overhead clearance of 20 feet; and an overhead power cable at the bridge has a permit clearance of 77 feet. About 0.3 mile east of the bridge the slough is crossed by an overhead power cable with a permit clearance of 80 feet.

**Elokomin Slough**, on the eastern side of **Hunting Island** at Mile 31.4, is used for log storage and by towboats. A Federal project provides for a channel 10 feet deep and 100 feet wide extending from the Columbia River near the southerly end of the slough to terminals near the mouth of **Elokomin River**, with a turning basin of the same depth at the inner end. In 1950 the slough had a controlling depth of 5 feet in a narrow channel close to the wharf on the eastern side of the southeast entrance. The western entrance to the slough has natural depths of 1 foot near the mouth. There is a fixed highway bridge about 0.5 mile from the junction of the slough and the river with a horizontal clearance of 100 feet and an overhead clearance of 16 feet.

**Clifton Channel** separates **Tenasillahe Island** from the

western bank of the river. There is a log pond at **Bradwood**, at Mile 33.8 on the Oregon side, where this channel joins the main channel. About 1 mile upstream from Bradwood, Columbia River main channel is crossed by an overhead power cable with a permit clearance of 221 feet.

**Cathlamet Channel** joins the main channel at Mile 32.3 on the Washington side. It is used by fishing boats, tugs, log rafts, and barges; and for some log storage above the city of **Cathlamet**; 10 feet can be carried. A fixed span highway bridge crosses the channel from Cathlamet to Puget Island; the central section has a horizontal clearance of 400 feet; a width of 180 feet has an overhead clearance of 72 feet. An overhead power cable 0.5 mile above the bridge has a permit clearance of 99 feet.

**Westport Slough**, at Mile 37.8 on the Oregon side, is used by oceangoing steamers to **Westport**. A Federal project provides for a channel 32 feet deep and 250 to 300 feet wide to the ferry dolphin at the downstream end of the lumber wharf. In August 1957 the controlling depth was 28 feet over a width of 200 feet. An overhead power cable a mile above the mouth of the slough has a permit clearance of 75 feet. East of Westport, the slough is used for log storage, and about 8 feet can be carried to **Kerry**, 1.5 miles above Westport. A ferry operates between Westport and **Pancake Point** on Puget Island.

**Wallace Slough**, at Mile 41 southward of **Wallace Island**, is used by cannery tenders, fishing boats, and house floats. A depth of 4 or 5 feet can be carried through the slough. **Beaver Slough** enters Wallace Slough at the mouth of the canal and is used by fishing boats and float houses. **Clatskanie Creek** is a tributary of Beaver Slough. A railroad bridge crosses the creek about 0.6 mile above the mouth, having a swing span with a horizontal clearance of 61 feet and an overhead clearance of 16 feet. Operating regulations for this bridge are given in § 203.740, Chapter 2. A Federal project provides for a channel 6 feet deep and 40 feet wide from the town of Clatskanie to the Columbia River about 3.5 miles. In July 1950 the controlling depth was 6 feet. At **Clatskanie** is a wharf and warehouse. Five private wharves are on Beaver Slough.

**Bradbury Slough**, at Mile 47.1 southwestward of Crims Island, carries the deepest water in a narrow channel along the Oregon shore with a minimum depth of 9 feet to the upper end where it shoals to 3 feet. There is extensive log storage along Crims Island shore.

**Chart 6153.—Crims Island to Saint Helens.**—Reaches of the main channel within the limits of this chart are **Stella Range**, **Fisher Island Channel**, **Walker Island Channel**, **Barlow Point Channel**, **Slaughters Channel**, **Cottonwood Island Lower Range**, **Cottonwood Island Turn**, **Cottonwood Island Upper Range**, **Kalama Lower Range**, **Kalama Upper Range**, **Martin Island Channel**, **Martin Island Range**, and **Saint Helens Range**. Overhead clearances are at Columbia River Datum.

The main channel swings southeastward, passing southward of **Fisher Island** and northward of **Walker Island**; thence, under the Longview Bridge, which has an over-

head clearance of 185 feet; thence westward of **Cottonwood Island**, eastward of **Sandy Island**, and westward of **Martin** and **Burke Islands**. Numerous jetties are along this section of the river. Lights or daybeacons are at the outer end of most of them.

**Currents.**—Between Crims Island and Saint Helens the tidal current at strength has an average velocity of  $\frac{1}{2}$  knot. During 6 days of observations taken in June and July there was a continuous downstream flow varying from  $\frac{1}{2}$  knot to 2 knots. Much greater velocities doubtless occur during freshets. Tidal current predictions may be obtained from the Tidal Current Tables, Pacific Coast.

**Local magnetic disturbance.**—Differences of as much as 8° from the normal variation have been observed along this section of the Columbia River.

**Coal Creek Slough**, at Mile 49.2 on the Washington side, empties into the Columbia River at Stella. It is used exclusively for log-raft storage. Depths over the bar are only 3 to 4 feet, but much deeper water extends nearly 3 miles above the entrance. Four power cables over the deeper part of the slough have a least permit clearance of 65 feet.

**Fisher Island Slough**, northward of Fisher Island, is used as Longview Yacht Basin, and by small fishing vessels and as log storage grounds. A depth of 7 feet may be carried through the channel.

An overhead cable crossing the river at Mile 54.5, near Slaughters Range has a permit clearance of 216 feet.

The channel between Walker Island and the Oregon shore is used for log-raft storage. The shoal area, northward of **Dibblee Point**, limits the maximum depth which may be carried through the entire channel to about 7 feet. This channel is used as a short cut by river boats during freshets. The overhead power cable south of Lord Island has a permit clearance of 115 feet.

**Mount Coffin**, at one time 248 feet high, has been quarried away until no part of the mound remains. A large chemical plant is just westward of Mount Coffin Light. There is a wharf with a 500-foot face and reported depths of 32 feet alongside. There are dolphins 125 feet from either end of this wharf.

**The Longview Bridge**, at Mile 57.3 between Longview and Rainier, has a fixed span with a horizontal clearance of 1,085 feet and an overhead clearance of 185 feet. Fog signals are on the two piers of the bridge.

**Rainier**, at Mile 59 on the Oregon side, has some commerce in lumber and other wood products. A Federal project provides for a channel 24 feet deep and 200 feet wide along the city waterfront. In March 1949 the controlling depth was 24 feet. Two small boatyards have marine railways capable of hauling vessels 75 feet long and 150 tons. Gasoline is available at a marine station. Diesel oil may be obtained from a tank truck.

**Longview**, just westward of the Cowlitz River and opposite Rainier, is built around the activities of an extensive lumber development. A turning basin 2,500 feet wide, 15,000 feet long, and 35 feet deep, fronts the dock at the port of Longview. The dock, parallel to the Columbia

River, has 1,675 feet of berthing space. It is well equipped to handle general cargo. Oceangoing vessels load lumber and grain for export and intercoastal trade.

Complete tug and lighter services are available. Longview is a customs port of entry but marine documents are not issued. Cranes at the port have a maximum capacity of 100 tons. Diesel and fuel oils, gasoline, and water are available in any quantity. Complete facilities are maintained for the repair of vessels except for drydocking. The port is served by four transcontinental railroads and several intercoastal steamship lines. The grain elevator and the stacks and tanks of the mills are conspicuous.

A Naval Reserve pier is at the west end of the port of Longview wharf and just east of the Longview Bridge.

The Cowlitz River flows into the Columbia River at Mile 59 just eastward of Longview. A Federal project provides for a channel 4 feet deep and 50 feet wide from the mouth to Ostrander, 7.8 miles; thence 2½ feet deep and 50 feet wide to Castle Rock, 15.2 miles; thence 2½ feet deep and not less than 40 feet wide to Toledo, 29.5 miles. A controlling depth of 4 feet is maintained to Kelso, but no work is being done above that point. The tide varies from 4 feet at the mouth to zero at Ostrander. During ordinary freshets a stage of 20 feet and at extreme floods a stage of 25 feet is reached at Kelso.

Between the mouth of the Cowlitz River and Ostrander are five bridges. A railroad bridge, about 1.3 miles above the mouth, has a bascule span with a horizontal clearance of 107 feet and an overhead clearance of 25 feet; overhead power cables near the bridge have a permit clearance of 75 feet. A fixed highway bridge 1.6 miles above the mouth has a horizontal clearance of 215 feet and an overhead clearance of 75 feet. An overhead power cable 1.7 miles above the bridge has a permit clearance of 77 feet. The highway bridge 4.8 miles above the mouth at Kelso has a lift span with a horizontal clearance of 100 feet and an overhead clearance of 70 feet up. A fixed highway bridge 4.9 miles above the mouth has a horizontal clearance of 240 feet and an overhead clearance of 64 feet. An overhead power cable crosses the river at Kelso 0.1 mile north of the fixed highway bridge. The fixed railway bridge 6.1 miles above the mouth has a horizontal clearance of 227 feet and an overhead clearance of 65 feet. Two overhead power cables cross near Buena Vista with a least permit clearance of 88 feet. Two overhead power cables cross near Ostrander with a least permit clearance of 48 feet.

At Kelso are several private wharves and one public landing. North of Kelso are log dumps.

Carroll Channel, between Cottonwood Island and the Washington shore, is used for log storage and fishing boats. About 13 feet can be carried through the channel.

The main channel westward of the southern part of Cottonwood Island is subject to shoaling and must be dredged to maintain the project depth of 35 feet. There may be periods between dredging operations when the controlling depth will be about 30 feet.

A State fish hatchery is on Kalama River at Mile 63.4. Kalama, on the eastern bank about 3 miles above Cottonwood Island, has a fish wharf with an iceplant. Shingle

and plywood mills are in operation. Small boats may obtain water and petroleum products by tank truck; there are no boatyards.

The channel circling the westerly side of Sandy Island is used by towboats hauling log rafts and barges; the controlling depth is about 8 feet.

Martin Slough, between Martin Island and Burke Island and the Washington shore, is used in log rafting operations. Burke Slough between Burke Island and the Washington shore is also used for that purpose.

Columbia City is a municipality at Mile 73 on the Oregon side. The main channel of the Columbia River follows along the waterfront.

Saint Helens is at Mile 75 opposite the mouth of the Lewis River. There are paper and lumber mills, the products of which are shipped in considerable quantities.

During high water large vessels require the assistance of tugs to be turned in the narrow basin off the dock. Municipal water is available on the dock in any quantity. Fuel for small boats is available at floating marine stations. There are no commercial boatyards. The main wharf has a face of 1,350 feet with a reported depth of 30 feet alongside.

Lewis River enters the Columbia River at Austin Point at Mile 75.7 on the Washington side. A Federal project provides for a channel 6 feet deep and 50 feet wide to the mouth of the East Fork; thence 4 feet deep on the North Fork to Woodland, 5.7 miles above the mouth; and 4 feet deep on the East Fork to La Center, 5.8 miles above the mouth. The tide ranges from 3 feet at the mouth to 1½ feet at La Center and zero at Woodland. During ordinary freshets a stage of 14 feet and at extreme flood a stage of about 24 feet is reached in the main river at Woodland. In June 1951 the controlling depths were 3 feet at the mouth, 1½ feet to Woodland, and 1 foot to La Center.

Lewis River is crossed by three bridges. The first, a railroad bridge about 1.8 miles above the mouth, has a swing span with a horizontal clearance of 100 feet and an overhead clearance of 28 feet. An overhead cable crosses the river 0.8 mile above the bridge with a permit clearance of 84 feet. A fixed highway bridge, 4.8 miles above the mouth, has a horizontal clearance of 215 feet and an overhead clearance of 35 feet. The overhead power cable 0.5 mile northward of the bridge has a permit clearance of 58 feet. The fixed highway bridge, 6.3 miles above the mouth, has a horizontal clearance of 156 feet and an overhead clearance of 55 feet. The overhead cable just northward of the bridge has a permit clearance of 48 feet.

Across the east fork of the Lewis River are two bridges. A highway bridge, about 0.4 mile above the mouth, has a fixed span with a horizontal clearance of 145 feet and an overhead clearance of 41 feet. A highway bridge, about 2.6 miles above the mouth, has a fixed span with a horizontal clearance of 140 feet and an overhead clearance of 34 feet at the center of the arch.

Chart 6154.—Saint Helens to Vancouver.—Reaches of the main channel within the limits of this chart are Warrior Rock Range, Henrici Range, Willow Lower

**Range, Willow Upper Range, Morgan Lower Range, Morgan Upper Range, Vancouver Lower Range, and Vancouver Upper Range. Overhead clearances are at Columbia River Datum.**

The main channel follows a southerly course. **Sauvie Island**, on the west bank, separates Multnomah Channel from the main channel. **Bachelor Island** is on the eastern side opposite Sauvie Island. Vessels seldom attempt to pass Warrior Rock Light in a thick fog, anchoring either above or below this point until the weather clears.

**Local magnetic disturbance.**—Differences of as much as  $6^{\circ}$  from the normal variation have been reported between Warrior Rock and the light off **Duck Club**.

**Warrior Rock Light (45°50.9' N., 122°47.2' W.)** 28 feet above the water, is shown from a white pyramidal structure on a stone pier near the northern end of Sauvie Island; a fog signal is at the light.

**Multnomah Channel**, on the western side of Sauvie Island, is about 19 miles long connecting the Columbia River near Saint Helens with the Willamette River at the north boundary of the city of Portland. It is an important waterway, used by tows, and also by small river steamers during the winter months when the main channel is discharging floe ice. The channel is also an important log-raft storage grounds.

A Federal project provides for a channel 25 feet deep and 300 feet wide extending for a distance of 5,000 feet at the Columbia River end, and a channel 25 feet deep and 250 feet wide extending for a distance of 9,500 feet from the Willamette River end. Controlling depths were 20 feet in the north end in January 1954, and 19 feet in the south end in January 1956. In the remainder of the channel, depths vary from 8 to 50 feet where snags and sunken logs have accumulated.

An overhead power cable with a permit clearance of 100 feet crosses the Multnomah Channel, 9.6 miles above the north end. A fixed highway bridge crosses the channel 1.1 miles from the south end with a horizontal clearance of 175 feet and an overhead clearance of 78 feet.

**Lake River** is the outlet of **Vancouver Lake**. The stream flows northward for about 9.5 miles and enters the Columbia River at the northern end of Bachelor Island at Mile 76. A Federal project provides for a channel 6 feet deep and 100 feet wide to **Ridgefield**, about 2.5 miles above the mouth. In May 1956 the controlling depth was 6 feet. There are four wharves at Ridgefield. The principal traffic is floated logs, which are placed in the river from a log dump connected with the railroad at **Felida**. Overhead power cables across the river have permit clearances as follows: at Ridgefield, 94 feet; 0.7 mile north of Knapp, 85 feet; and 0.8 mile south of Felida, 58 feet.

**Bachelor Island Slough**, which enters Lake River on the east side of Bachelor Island, is a little-used channel with a depth of only 1 foot in places. It is used by boats operating between the farms on Bachelor Island and Ridgefield. The slough is crossed by two overhead cables with a least permit clearance of 38 feet.

**Chart 6155.—Willamette River** empties into the Columbia River at Mile 88. It is the largest tributary of the Columbia River below the Cascade Mountains. **Overhead clearances are at Columbia River Datum.**

A Federal project provides for a channel 35 feet deep and 500 feet wide from the mouth to Broadway Bridge at Portland, 10.4 miles; thence 30 feet deep and 300 feet wide to Ross Island to be maintained by the port of Portland; thence 8 feet deep and 200 feet wide to Cedar Island; thence 8 feet deep and 150 feet wide to Oregon City, 22 miles above the mouth; thence 6 feet deep to the mouth of Santiam River, 94.2 miles above the mouth; thence 5 feet deep to Albany, 104.2 miles above the mouth; and thence  $2\frac{1}{2}$  to  $3\frac{1}{2}$  feet deep to Corvallis, 114.6 miles above the mouth.

The controlling depths to Portland are given monthly in the Notices to Mariners. The controlling depth to Oregon City is about 8 feet and to Corvallis about  $3\frac{1}{2}$  feet.

**Navigation regulations** for the Willamette River are given in § 207.670, Chapter 2.

**Willamette River Light 44 (45°39.2' N., 122°45.7' W.)**, 20 feet above the water, is shown from a pile structure with white daymarks on the end of the dike extending from **Kelley Point** on the eastern side of the entrance to the river; a fog signal is at the light.

**Columbia Slough**, a narrow back channel roughly parallel to the Columbia River, empties into the Willamette River about 0.4 mile above its mouth. A dam has been constructed across the slough about 7.3 miles above the mouth and a cross channel, **Peninsula Drainage Canal**, dredged to the Columbia River. Navigation consists principally of movements of log rafts to several shingle and lumber mills located on the slough.

A Federal project provides for a channel 10 feet deep and generally 100 feet wide, between the mouth and Union Avenue, a distance of 6.7 miles, with two turning basins 10 feet deep, 200 feet wide, including the width of the 100-foot channel, and 1,000 feet long; one basin to be located below Union Avenue, the other below Denver Avenue.

In June 1958 no work had been done on the project. In February 1947 the controlling depth was 4 feet.

Seven fixed bridges cross the project channel with a least horizontal clearance of 60 feet and an overhead clearance of 27 feet. The least permit clearance of three overhead power cables is 68 feet at East St. Johns.

There are no wharves or docks on the slough. There are, however, several booms, dolphins, and slips used for storage and handling of logs near the shingle and lumber mills.

In the vicinity of the **Post Office Bar** range, 2 miles above the mouth of the Willamette River, deep draft vessels favor the west side of the river, while smaller vessels and tows usually hug the eastern side because of lesser current. An overhead power cable with a permit clearance of 230 feet crosses the river 0.3 mile below the

junction with the Multnomah Channel. The twin towers supporting the cable are the most conspicuous feature in this area.

**Portland**, on the Willamette River about 9 miles from its mouth, is the principal city of the Columbia River valley. It has extensive commerce, both foreign and domestic, and is the port of call for many lines of coastwise, intercoastal, and trans-Pacific steamships. The port is served by four transcontinental railroads. There are 70 docks within the 25 miles of the deep water frontage on the banks of the river. The docks are well equipped to handle general cargo. Many of the docks have shipside tracks providing a direct interchange between the rail and the water carriers.

The administration of the port of Portland is vested primarily in the municipal corporation known as the **Port of Portland**, which has general jurisdiction over the physical development of the harbor and its channels, between the Broadway and Ross Island Bridges; and, in the **Commission of Public Docks**, with jurisdiction over the construction and operation of municipal water terminals. The Portland District of United States Engineers has jurisdiction over channel maintenance and improvement below the Broadway Bridge and above the Ross Island Bridge. The Port of Portland has jurisdiction, through the city, of a strip along each side of the river extending to 50 feet outside the harbor lines. The Port of Portland was established by the State legislature, while the Commission of Public Docks is a department of the city.

**Anchorage**.—The generally used anchorage is from the Broadway Bridge downstream to the northern limits of the city, a short distance below municipal terminal No. 4, with depths of 30 to 35 feet.

**Bridges and cables**.—Nine bridges cross the Willamette River in the vicinity of Portland. **The overhead clearances are given at Columbia River Datum.** The St. Johns suspension highway bridge, 5.2 miles above the mouth, has horizontal clearance of 1,068 feet and an overhead clearance of 205 feet. The St. Johns railroad bridge, 6 miles above the mouth, has a swing span with a horizontal clearance of 230 feet and an overhead clearance of 44 feet. The Broadway highway bridge, 10.2 miles above the mouth, has a bascule span with a horizontal clearance of 251 feet and an overhead clearance of 90 feet. The Glisan Street railway and highway bridge, 10.5 miles above the mouth, has a lift with two spans; the horizontal clearance is 205 feet and the overhead clearance of the lower level is 26 feet, down, and 72 feet, up, and 164 feet with both levels raised. The Burnside Street highway bridge, 10.8 miles above the mouth, has a bascule span with a horizontal clearance of 209 feet and an overhead clearance of 65 feet. The Morrison Street highway bridge has a bascule span with a permit horizontal clearance of 220 feet and an overhead clearance of 68 feet at the center. The Hawthorne Avenue highway bridge, 11.3 miles above the mouth, has a lift span with a horizontal clearance of 200 feet and an overhead clearance of 49 feet, down, and 159 feet, up. The Ross Island fixed highway bridge, 12.1 miles above the mouth, has a horizontal

clearance of 490 feet and an overhead clearance of 123 feet. The Sellwood fixed bridge, 14.3 miles above the mouth, has a horizontal clearance of 270 feet and an overhead clearance of 74 feet. Operating regulations for these bridges are given in § 203.750, Chapter 2.

Willamette River is crossed by a power cable at the north end of Ross Island. The permit clearances are 83 feet for the east channel and 123 feet for the west channel. An overhead conveyor belt with a permit clearance of 75 feet and a power cable with a permit clearance of 76 feet extend across the east channel at the north end of Hardtack Island. Another power cable crosses the river 0.7 mile south of the south end of Ross Island with a permit clearance of 75 feet.

**Weather**.—During the months from November to February, inclusive, the prevailing winds in the vicinity of Portland are from the southward or southeastward; for the remainder of the year, northwesterly winds prevail.

**Ice**.—Ice forms occasionally, but it is seldom heavy enough to seriously affect navigation, although navigation by small vessels and river boats may be rendered difficult.

**Towage**.—Towboats are always available. There is practically no lighterage service performed at this port. In view of the practice which prevails of moving vessels to various berths as required to load or discharge, the necessity for lighterage transfers has been minimized. There is, however, a transfer of lumber in barges from mills to vessels for oversize loading.

**Quarantine**.—Quarantine regulations of the U.S. Public Health Service are enforced. Vessels subject to quarantine usually proceed to their docks where they are boarded by the quarantine officer for inspection. A quarantine station is maintained below municipal terminal No. 4 at Portland. Vessels may be deratized at either Astoria or Portland. An outpatient clinic of the Public Health Service is in the city.

**Customs**.—Portland is the headquarters of the customs collection district and a port of entry; marine documents are issued.

**Immigration** officials are stationed at Portland.

Other local offices of the following **Federal agencies** are in Portland; see Appendix for addresses: Coast and Geodetic Survey, Coast Guard, Federal Communication Commission, Weather Bureau, and Corps of Engineers, U.S. Army.

**Harbor regulations**.—The regulations are enforced by the harbor master; complete copies of the regulations may be obtained from his office.

**Terminal facilities**.—There are wharves capable of handling the largest ships plying the river with storage facilities of all types available. Cranes of 2- to 150-ton capacities and two barge cranes of 2- to 125-ton capacities are available. Grain elevators for the storage of grain and steel tanks for the storage of bulk liquids other than petroleum products are available.

**Supplies**.—Fuel oil, coal, water, provisions, and ship chandlery may be had in any quantity.

**Repairs**.—Repairs of all kinds can be made. The

principal marine repair plant, maintained by the Port of Portland, a municipal authority distinct from the city, is on the east bank of the Willamette River. It is equipped with modern machinery and is served by two floating drydocks. The navy dock is on the lower end of Swan Island. It has a lifting capacity of 16,000 deadweight tons, is 520 feet over the keel blocks and 598 feet overall. The width between the wings is 84 feet with a depth of water over the keel blocks of 30 feet. The second dock, known as No. 2, has a lifting capacity of 15,000 deadweight tons, a length of 458 feet over the keel blocks, and 518 feet overall. The width between the wings is 92 feet with a depth of water over the keel blocks of 27 feet.

One well-equipped firm specializes in marine salvage in Portland. It has a 203-foot 3,600 horsepower converted LSM, equipped with 50-ton winches and other necessary gear. Several firms undertake minor salvage work but none of these specialize in such activities.

**Communications.**—All commercial methods of communication are available out of Portland, including several transcontinental railroads. Ship-to-shore radiotelephone service is handled through both Portland and Astoria.

**Chart 6171.**—Navigation of the Willamette River above Portland is hazardous due to the rocks, shoaling bars, and strong currents. Local knowledge and steering a mid-channel course is recommended in these waters. Freshets occur annually during the months of May, June, and July; they cause some shoaling. Below the falls at Oregon City ordinary fluctuation of stage of water is 15 feet and extreme fluctuation due to flood conditions 30 to 50 feet. Above Oregon City the ordinary fluctuation is 12 to 20 feet and the extreme is 20 to 27 feet. **Overhead clearances are at Columbia River Datum below the Willamette Falls locks and at the low water slope above the locks.**

The river is marked with lights, buoys, and unlighted ranges.

Between Portland and Willamette Falls the terminals are privately owned mill wharves and oil-receiving stations. Above the falls are small privately owned wharves or natural landings.

Above Sellwood Bridge the river flows northwestward passing westward of **Milwaukie**, 16 miles above the mouth. A boatyard with a marine railway capable of hauling out boats of 25 tons weight and 50 feet in length is on the bank at Milwaukie. The channel passes westward of **Elk Rock Island**. **Milwaukie Heights**, on the eastern bank, is about 0.5 mile south of the island. The overhead power cable crossing the river at Elk Rock Island has a permit clearance of 89 feet. The Southern Pacific Railroad fixed bridge crosses the river 17.8 miles above the mouth and just northward of **Tryon Creek**; it has a horizontal clearance of 280 feet and an overhead clearance of 74 feet.

**Oswego** is on the west bank of the river between Tryon and **Oswego Creeks**. A prominent stack is southeast-

ward from the center of the town. **Oswego Rock**, 250 yards northeastward of Oswego Creek entrance, is 2 feet high.

The channel passes to the eastward of **Rocky Island**, 1.1 miles above Oswego. **Copeleys Rock**, 150 yards east of the southern extremity of the island, has a depth of 10 feet over it and should be avoided. The channel continues eastward of Cedar Island, 1 mile above Rocky Island.

The river is divided by a low island 1 mile above Cedar Island; the channel is on the northern side. **Clackamas Rapids** is on the southern side of the island. The rapids should be avoided because of bar shoaling and cross currents. **Clackamas River** enters from the east across the river from Clackamas Rapids; it is not navigable.

**Oregon City**, 22 miles from the mouth, is on the east bank of the river. The city is connected with **West Linn** and **Sunset** by a fixed highway bridge which has a horizontal clearance of 181 feet and an overhead clearance of 74 feet. An overhead power cable just below the bridge has a permit clearance of 77 feet. Gasoline and oil are available at the northern limits of the city.

The **Willamette Falls Canal** is on the west bank of the river. The canal consists of five locks, and has a total lift of 50 feet. The usable lock dimensions are 175 feet in length, 37 feet in width, and 6 feet deep over the miter sills at low water. Upbound vessels may expect a delay through the locks during the week days because of the downbound traffic. **Regulations** regarding the use, administration, and navigation of the canal and locks are given in § 207.680, Chapter 2.

**Overhead clearances above the locks are at the low water slope.**

A warehouse and several buildings are on the west bank alongside the canal locks. A timber wharf about 850 feet in length is on the east of the canal lock. Several overhead power cables cross the canal and locks; the least permit clearance is 75 feet.

A channel 0.2 mile southeastward of Willamette Falls Light, with a depth of 7 feet, extends northeastward along the east bank to the dock at the Hawley Pulp and Paper Company buildings.

The town of **Willamette**, about 1.4 miles southwestward of **Sunset**, is on the west bank of the river and on the north bank of the **Tualatin River** which is not navigable.

The channel westward of **Rock Island** is narrow and marked by buoys. An overhead power cable, crossing near the northern part of the island, has a permit clearance of 123 feet. The **Sevcik Pond** entrance is about 200 yards north of **New Era Bar Island**. The channel between that island and Willow Island, runs northeastward through **Fish Eddy**. **Shanks Landing** is on the west bank about 4 miles above Willamette.

**Chart 6172.**—**Walnut Eddy** is on the east bank, 29.4 miles above the mouth. Three overhead cables with a least permit clearance of 50 feet cross the river at **Buchmans Landing**. 0.4 mile above Walnut Eddy. An

overhead cable with a permit clearance of 75 feet crosses the river 32.5 miles above the mouth. A half mile below Wilsonville, a fixed highway bridge has a horizontal clearance of 240 feet and an overhead clearance of 72 feet. At Wilsonville, 33.7 miles above the mouth, a fixed railroad bridge has a horizontal clearance of 187 feet and an overhead clearance of 72 feet. The overhead power cable 0.5 mile upstream from the bridge has a permit clearance of 99 feet. At Butteville, 37.3 miles above the mouth, the river is crossed by an overhead power cable with a permit clearance of 79 feet. A fixed bridge, 42.1 miles above the mouth at Dog Ridge, has permit clearances of 240 feet horizontally and 68 feet overhead at the main span. A highway bridge at Newberg, 43.4 miles above the mouth, has a fixed span with a horizontal clearance of 105 feet and an overhead clearance of 87 feet.

A railroad bridge at Salem, 73.6 miles above the mouth, has a lift span with a horizontal clearance of 118 feet and an overhead clearance of 42 feet, down, and 87 feet, up. A fixed highway bridge, 73.7 miles above the mouth, has a horizontal clearance of 240 feet and an overhead clearance of 69 feet. A fixed highway bridge, 73.8 miles above the mouth, has a horizontal clearance of 120 feet and an overhead clearance of 69 feet. The overhead power cable across the river at the north city limits of Salem has a permit clearance of 86 feet. A railroad bridge at Albany, 103.8 miles above the mouth, has a swing span with a horizontal clearance of 110 feet and an overhead clearance of 40 feet. A fixed highway bridge, 104.2 miles above the mouth, has a horizontal clearance of 195 feet and an overhead clearance of 55 feet. A highway bridge at Corvallis, 114.4 miles above the mouth, has a swing span with a horizontal clearance of 102 feet and an overhead clearance of 35 feet. Operating regulations for these bridges are given in § 203.755, Chapter 2.

Between Corvallis and the head of navigation, 149.0 miles above the mouth, are three bridges. The fixed highway bridge at Harrisburg, 141.4 miles above the mouth, has a horizontal clearance of 172 feet and an overhead clearance of 24 feet. The railroad bridge, 142.6 miles above the mouth, has a lift span with a horizontal clearance of 190 feet and an overhead clearance of 25 feet, down, and 85 feet, up. The railroad bridge, 142.7 miles above the mouth, has a swing span with a horizontal clearance of 103 feet and an overhead clearance of 25 feet.

The Yamhill River empties into the Willamette River 47 miles above the mouth. A Federal project provides for a channel 4 feet deep and 60 feet wide from its mouth to McMinnville, 15.6 miles upriver. Operation of Yamhill Lock, 6.5 miles above the mouth, was discontinued officially in 1954 because of lack of use. In 1956 the controlling depth to the dock was 4 feet. For the Yamhill River the ordinary fluctuation of the stage of water is 35 feet and the extreme fluctuation due to floods is 48 feet.

Three fixed highway bridges cross the river. The bridge at Dayton, 4 miles above the mouth, has a horizontal clearance of 193 feet and an overhead clearance of 60 feet. The bridge at Lafayette, 8 miles above the mouth,

has a horizontal clearance of 148 feet and an overhead clearance of 54 feet. The bridge at McMinnville has a horizontal clearance of 80 feet and an overhead clearance of 53 feet.

**Chart 6155.—Willamette River to Vancouver.**—The main channel of the Columbia River is between Hayden and Tomahawk Islands and the Washington shore. Overhead clearances are at Columbia River Datum. Three bridges cross the main channel between Vancouver and Hayden Island. The railroad bridge at Mile 91.8 has a swing span with a horizontal clearance of 200 feet and an overhead clearance of 39 feet. The two Interstate Highway Bridges at Mile 92.5 have lift spans with a horizontal clearance of 250 feet and an overhead clearance of 39 feet, down, and 175 feet, up. The overhead power cable between Hayden Island and Vancouver has a permit clearance of 220 feet. Operating regulations for these bridges are given in § 203.750, Chapter 2.

**North Portland Harbor (Oregon Slough)** is that portion of the river channel between the Oregon shore and Hayden Island, the west end being at Mile 89.2. A Federal project provides for a channel 20 feet deep and 200 feet wide from its western junction with the main stream of the Columbia River to a point 500 yards above the railroad bridge. In October 1956 the controlling depth was 5 feet.

Two bridges are between Hayden Island and the Oregon shore. The railroad bridge, 2.6 miles above the mouth, has a swing span with a horizontal clearance of 125 feet and an overhead clearance of 39 feet; operating regulations are given in § 203.750, Chapter 2. A fixed highway bridge, 3.5 miles above the mouth, has a horizontal clearance of 100 feet and an overhead clearance of 35 feet. The bridge formerly connecting the Oregon shore with Tomahawk Island has been removed, except the approach structures on shore. It is reported that some of the stub piling exists below water. The former center span horizontal clearance of 60 feet is presumably clear.

**Vancouver** is on the Washington side of the Columbia River at Mile 92. The port is a water outlet for a large lumber producing section in southwestern Washington, as well as a distributing point for a fair share of the wheat produced in the interior of Washington and Oregon. Aluminum, paper products, and canned goods are also shipped.

**Channels.**—A Federal project provides for a channel 30 feet deep as far as the Interstate Highway Bridge with two turning basins of the same depth. The channel is maintained at or near project depth, except when shoaling occurs after freshets.

**Anchorage.**—No defined areas have been specially designated as anchorage ground. Anchorage may be had near the outer part of the channel providing the center of the fairway is not obstructed.

For quarantine, customs, and immigration, see Portland.

**Harbor regulations.**—No regulations have been pre-

scribed by official authorities of the city of Vancouver, or the State of Washington, to govern the movement of vessels or similar harbor activities within the port.

**Terminal facilities.**—The port has two public terminals with 30-foot depths which are maintained by the port of Vancouver and three privately owned docks. The docks are well equipped for handling general cargo in the foreign and domestic trade. The total berthing space at the public terminals is 2,185 feet and outside storage space of 500,000 sq. ft. The covered storage space is 150,000 sq. ft. A large bulk grain elevator is at the foot of West Thirteenth Street. Rail service to the waterfront is served by the Spokane, Portland, and Seattle Railroad which connects with four transcontinental lines.

**Supplies.**—Fresh water and supplies are available. There are no fueling facilities for large vessels, but gasoline and diesel oil may be obtained.

**Repairs.**—A small general boat repair yard is about 1 mile above the Interstate Bridge on the north bank.

**Chart 6156.—Vancouver to the Bonneville Dam.**—Overhead clearances are at Columbia River Datum. A Federal project provides for a channel 27 feet deep at low water between Vancouver and Bonneville. The channel is maintained at a depth of 15 feet at low water. During the average summer freshet the controlling depths are increased to a range of 33 to 38 feet. There are over 35 dike dolphins along this section of the river; some of them are marked with lights at the ends. All of the dikes are completely submerged at the higher stages of the river but are exposed approximately 6 feet at datum level.

A measured nautical mile, on course 107°, is at Leiser Point, 3.6 miles above the Interstate Bridge at Vancouver. Each range is painted yellow with black stripes.

**Local magnetic disturbance.**—Differences of as much as 8° from the normal variation have been observed between Tunnel Point and Point Vancouver eastward of Reed Island.

The secondary channel south of Government Island at Mile 100 is used extensively by pleasure boats and some commercial shipping.

A special small-vessel anchorage area is between Sand Island and Government Island; limits and regulations are given in § 202.1 and § 202.128, Chapter 2.

Camas on the Washington side at Mile 104.5 has a large paper mill which maintains a private wharf on Camas Slough. Camas Slough, north of Lady Island, is used extensively for bringing supplies to, and taking away the products of the paper mill at Camas. The paper is shipped to Portland by barge for reshipment. The eastern entrance to Camas Slough is foul and bares at low water. At high flood stages of the river a current of as much as five knots prevails in the slough.

Washougal is on the Washington side just eastward of Camas. The port of Camas-Washougal has a wharf 528 feet in length at Washougal, which will be available for ocean vessels when an adequate channel is provided. Nothing has been done to this channel to date (March 1957).

There are four power cables crossing at Ione Reef. The least permit clearance is 130 feet north of the reef and 142 feet south of it.

The entrance to Sandy River, opposite Camas, bares at low water. The projecting shoal, Sandy River bar, is dangerous to vessels making the turn south of Ione Reef. At higher flood stages of the Columbia River, passage up Sandy River as far as Troutdale is possible.

**Dangers.**—The principal difficulties and hazards to ship navigation are due to strong currents, rocky banks, rocks, winds and accumulation of ice.

**Currents.**—In general, currents run fair with the main channels with considerable intensity, increasing in regions upstream toward Bonneville. Exceptions are the turn in the channel at Washougal Light, where a north-westerly set prevails; southwestward of Cape Horn, where a westward set is experienced; and the region between Fashion Reef Light and Multnomah Falls, where a southward set is experienced.

Between Dodson and Warrendale at Mile 122 the river becomes restricted; the restriction continues to the entrance of the channel leading to the locks, at the lower end of Bradford Island. Along this reach of the river, the upper part of which is called Garrison Rapids, the currents are so strong that constant piloting is necessary. See description of Bonneville Dam.

**Weather.**—Above Corbett, Mile 108, the river emerges from the Columbia River Gorge and for the greater part of the distance to The Dalles, flows between high, bold mountains of the Cascade Range. In this stretch, winds of considerable force prevail during much of the time; generally upstream in summer months and downstream in winter. The daily peak velocities vary from 7 to 48 miles per hour.

Bonneville, on the Oregon side of the river at Mile 126, is the headquarters of the U.S. Engineers in charge of the operation of the Bonneville Dam and lock. Fresh water supplied through a small pipe may be obtained here.

Bonneville Dam, 126.3 miles above the mouth of the Columbia River, is in two parts. The spillway is between the Washington shore and Bradford Island. The powerhouse and lock are between Bradford Island and the Oregon shore. The usable dimensions of the lock are: 500 feet long, 76 feet wide, 24 feet over the lower miter sill, and a vertical lift of 59 feet. The normal pool level is 72 feet above mean sea level. Operating regulations are given in § 207.700, Chapter 2.

The highway bridge just west of the lock has a swing span with a horizontal clearance of 87 feet and an overhead clearance of 29 feet. The power cables here have permit clearances of 142 feet south of Bradford Island and 74 feet north of it.

Radio communication with the superintendent of the lock is possible on 2738 kc. when within a few miles of the lock.

Approaching Bonneville Lock from downstream, difficulties are presented to vessels in turning out of the swift water into the channel leading to the lock, as the current from the powerhouse spillway sets in strongly across the western entrance to the lock approach.

Approaching Bonneville Lock from upstream, due to the strong current toward the powerhouse from the upstream lock approach, it is difficult to approach the lock at an angle and execute a turn in time to avoid an accident. Therefore, all craft approaching the lock from the east and pushing one or more barges should steer as close to the Oregon mainland shore as safety will permit, should be in line with the lock upon reaching the east end of the guide wall, and should continue at a steady but reduced speed if the lock is prepared for entrance and the signal for entrance has been given.

**Chart 6157.—Bonneville to The Dalles.**—The channel from the Bonneville Dam to The Dalles is provided by the pool which extends 40 miles to The Dalles Dam. Overhead clearances are at normal pool level.

A Federal project provides for a channel 27 feet deep between Bonneville and The Dalles. Depths of 20 feet or more are available for barge traffic. The channels are marked by lights, lighted ranges, and unlighted buoys.

Tugboats make use of the eddy in the mouth of Eagle Creek, 0.6 mile above the lock, for mooring and shifting barges and log rafts. Small boats may find refuge in the mouth of Eagle Creek, Rock Creek, Government Cove, Wind River, Drano Lake, Ruthton, White Salmon River, and Hood River. Entrance to these places should be made with caution. Access to all but two is under railroad and highway bridges. At present log rafts are made up or stored in all of these places except the moorage at Hood River. Alertness to movement of rafts is necessary.

**Currents.**—From the lock at Bonneville, through Cascade Rapids, constant piloting is necessary because of the strong currents. From Cascade Rapids eastward, a set of one to three degrees may be experienced depending on the angle that the course makes with the general direction of the river, the strength of the current, and the direction and strength of the wind.

**Local magnetic disturbance.**—Differences of as much as 6° from the normal variation have been observed along this section of the Columbia River.

At the mouth of Eagle Creek, on the Oregon side 0.7 mile above the Bonneville Dam, small boats may find refuge on either side of the bridge if the creek is not in flood. The overhead clearances of the bridges are: railroad, 18 feet; highway, approximately 30 feet.

The **Bridge of the Gods**, 2.6 miles above the Bonneville Dam, has a fixed span with a horizontal clearance of 656 feet and an overhead clearance of 135 feet over a middle width of 284 feet.

The **Cascade Locks**, 3 miles above the Bonneville Dam, have been drowned out. At normal stages of pool level the sides of the old chamber of the lock bare about 3 feet. This section of the lock makes a good moorage, except for small boats in easterly weather. A strong current flows through the lock.

**Rock Creek at Stevenson**, Washington, 4.2 miles above the Bonneville Dam, affords refuge for small boats between the railroad and highway bridges or in the pool north of the highway bridge. The bridge clearances are:

railroad, horizontal 139 feet, overhead 25 feet; highway, horizontal 67 feet, overhead 20½ feet.

**Government Cove**, on the Oregon side 5.6 miles above the Bonneville Dam, is a refuge for small boats. There are no bridges but log rafts may block the entrance. An overhead cable has a permit clearance of 18 feet.

**Wind River at Home Valley**, Wash., 7.8 miles above the Bonneville Dam, is a refuge for small boats either north or south of the fixed bridges. The bridge clearances are: railroad, horizontal 192 feet, overhead 26 feet; highway, horizontal 275 feet, overhead west pier, 24 feet, east pier, 21 feet.

**Drano Lake** is at the mouth of Little White Salmon River near Cook, Wash., 14.5 miles above the Bonneville Dam. The least clearances of the railroad and highway fixed bridges are: horizontal 139 feet, overhead 25 feet.

Small boats may find refuge at **Ruthton**, Ore., 17.8 miles above the Bonneville Dam. There are no bridges.

**White Salmon River at Underwood**, Wash., 20.4 miles above the Bonneville Dam, is a small boat refuge. The bridge clearances are: railroad, horizontal 145 feet, overhead 28 feet; highway, horizontal 184 feet, overhead 26 feet.

**Hood River**, Oregon, 21.7 miles above the Bonneville Dam, has a small-boat moorage situated west of the fill to the highway bridge across the Columbia River. A small marine railway with 2 feet of water over the carriage at normal pool level is here. Fishing boats weighing 5 tons and 28 feet in length have been hauled out. Gasoline is available and diesel oil can be procured by arrangement. No fresh water is available. Emergency repairs can be made by various shops in town. The highway bridge over the Columbia River has a lift span with a horizontal clearance in the center span of 246 feet and an overhead clearance of 69 feet, down, and 149 feet, up. Operating regulations are given in § 203.759, Chapter 2.

The overhead power cable at **Stanley Rock**, 22.9 miles above the Bonneville Dam, has a permit clearance of 118 feet. A ferry crosses the Columbia River between **Rowena**, Ore., and **Lyle**, Wash., 8.5 miles above Stanley Rock. The overhead power cable at **Crates Point**, 13 miles above Stanley Rock, has a permit clearance of 153 feet.

**The Dalles** is on the Oregon side of the Columbia River 39 miles above the Bonneville Dam. River traffic between the town and Vancouver consists mainly of petroleum products and general freight bound upstream, and wheat, wool, and rafted logs bound downstream.

A small-boat mooring basin with a breakwater and sheer boom protection is just eastward of the city wharf. A small seaplane base is maintained between the wharf and the boat basin.

The municipal wharf used by ocean vessels and river boats is 125 feet by 1,100 feet with warehouse facilities. The municipal oil wharf is 27 feet by 193 feet. There are also privately owned facilities for handling petroleum products and bulk grain from river boats.

A privately maintained machine shop and drydock are capable of taking vessels of 1,000 tons, 10 feet in draft, and 220 feet in length. The facilities are available to the gen-

eral public. Gasoline and fuel oil may be obtained by tank wagon. Fresh water is available at the basin.

**Columbia River above The Dalles Dam.**—Above The Dalles Dam, some navigation is carried on by boats, tugs, and barges. Traffic is mostly by vessels carrying wheat and petroleum products. High power light-draft vessels navigate the Columbia River to Priest Rapids, 353 miles above the mouth. Ice occasionally prevents navigation for two weeks or more, usually in January or February.

Between The Dalles Dam and McNary Dam, there are no wharves. Grain elevators are at Blalock, Arlington, Roosevelt, and Umatilla, 36, 43.5, 44, and 84 miles above The Dalles Dam, respectively. Umatilla also has storage facilities for petroleum products.

**The Dalles Dam**, 166.4 miles above the mouth of the Columbia River, provides slack water to the site of the authorized John Day Dam, 22 miles upstream, and raises the water level approximately 88 feet to a normal pool level of 160 feet above mean sea level. The dam is 8,700 feet long. The navigation lock on the Washington side of the river has usable dimensions of: 675 feet long, 86 feet wide, a depth of 20 feet over the upper sill, a depth of 18 feet over the lower sill, and a vertical lift of 87½ feet. Operating regulations are given in § 207.705, Chapter 2.

The pool created by the dam provides a navigable channel with depths of 12 feet and over to the John Day Dam site, 21.7 miles above The Dalles Dam. The channels are marked by lighted and unlighted ranges, lights, and oil drum buoys.

A fixed highway bridge across the downstream approach to the lock at The Dalles Dam has a horizontal clearance of 250 feet and an overhead clearance of 100 feet. The overhead power cables at the upstream approach to the lock have a least permit clearance of 125 feet.

A railroad bridge, 7 miles above The Dalles Dam, has a lift span with a horizontal clearance of 308 feet and an overhead clearance of 19, feet, down, and 75 feet, up.

A ferry crosses the Columbia River between Biggs, Oreg. and Maryhill, Wash., 14 miles above The Dalles Dam.

A channel with a project depth of 6 feet extends from the navigational channel in the Columbia River to the site of the port development at Arlington, Oreg., 43.5 miles above The Dalles Dam. A ferry crosses the river from Arlington to Roosevelt, Wash.

At Umatilla Harbor, 84 miles above The Dalles Dam, a project provides for the improvement of the existing harbor and entrance channel by removal of boulders, rocky reefs, and gravel bars to provide a project depth of 7 feet. No work has been done on the project.

The fixed highway bridge across the Columbia River at Umatilla, 85 miles above The Dalles Dam, has two navigational spans. Each span has a horizontal clearance of 335 feet and an overhead clearance of 90 feet. The north span is usually used during high water as there is less current, but during low water it is unsafe. The overhead power cables eastward of the bridge have a least permit clearance of 82 feet.

**McNary Dam**, 253.5 miles above the mouth of the Columbia River near Umatilla, Oreg., creates a pool extending about 55.6 miles upstream to a point about 23.4 miles above Pasco, Wash. The dam raises the water level approximately 85 feet to a normal pool level of 340 feet above mean sea level. It is approximately 7,600 feet long and consists of an earth dam at the Oregon (south) abutment, a powerhouse, a spillway dam, a navigation lock, and an earth dam at the Washington (north) abutment. The navigation lock on the Washington side of the river has usable dimensions of: 675 feet long, 86 feet wide, and a vertical lift of 92 feet. The depth over the miter sill at low water is 12 feet and over the upper sill at normal pool is 20 feet. Operating regulations are given in § 207.715, Chapter 2.

The pool created by the dam will provide a navigable channel with depths of 12 feet and over between McNary Dam and the confluence of the Yakima River, a distance of about 37 miles. The channels to Richland, 40 miles above the McNary Dam, are marked by lighted and unlighted ranges, lights, oil drum buoys, a lighted buoy, and a few daybeacons.

**Port Kelly**, on the east side of the Columbia River 16 miles above the McNary Dam, has a large grain elevator and facilities for handling bulk grain by truck, rail, or water.

**Walla Walla River** enters the Columbia River on the east side 20 miles above the McNary Dam. There is a small boat moorage on the south side of the river just upstream from the abandoned highway bridge near the mouth.

**Port of Walla Walla**, on the east side of the Columbia River 22 miles above the McNary Dam, is an industrial port with no service facilities.

The railroad bridge crossing the Columbia River 27 miles above the McNary Dam has a swing span with a horizontal clearance of 113 feet and a reported overhead clearance of 11 feet. Operating regulations are given in § 203.760, Chapter 2.

The Snake River, which is the largest tributary of the Columbia River, rises in Yellowstone National Park, in the western part of Wyoming, flows in a general westerly direction for about 868 miles and empties into the Columbia River near Pasco, Washington, 281 miles from the Pacific Ocean and 28 miles above the McNary Dam.

A Federal project provides for the construction of such dams as are necessary and open channel improvement for purposes of providing slack water navigation between the mouth of the Snake River and Lewiston, Idaho, 121 miles upstream. In 1956 the controlling depth was less than 1 foot.

A channel of 9 feet is provided from the Columbia River to about 8.8 miles above the mouth of the Snake River by the pool of the McNary Dam.

The railroad bridge at Burbank, 0.4 mile above the mouth of the Snake River, has a swing span with a horizontal clearance of 150 feet and a reported overhead clearance of 13 feet.

**East Pasco**, on the north side of the Snake River a mile above the mouth, has extensive storage for grain, petroleum products, cement, and ammonia; the wharves are privately owned. From East Pasco to Lewiston there are no usable wharves.

The fixed highway bridge 2 miles above the mouth of the Snake River has a horizontal clearance of 400 feet and a reported overhead clearance of 60 feet.

A dam is being constructed at **Ice Harbor**, 10 miles above the mouth of the Snake River. The lock is scheduled for completion in December 1961, and will have a clear width of 86 feet and a length of 540 feet. Until it is completed, navigation past the damsite will not be possible.

**Pasco**, on the north side of the Columbia River 285 miles above the mouth, is 31 miles above the McNary Dam. A public wharf is located here which is leased to private interests. There are extensive grain and petroleum storage facilities.

**Kennewick** is on the south side of the Columbia River opposite Pasco. A Federal project provides for an approach channel 6 feet deep from the Columbia River channel to the site of the terminal development at Kennewick. The completion of the McNary Dam provides project depths or greater in this area.

Kennewick has facilities for grain storage, a public wharf where dry cargo is handled, and a well protected small-boat moorage. There are repair facilities for craft up to 35 feet in length and 20 tons in weight. Gasoline, lubricants, and some small-boat chandlery are available.

The railroad bridge between Pasco and Kennewick has a lift span with a horizontal clearance of 280 feet and a reported overhead clearance of 70 feet, up. The fixed highway bridge 0.3 mile upstream has a horizontal clearance of 420 feet and a reported overhead clearance of 50 feet. Operating regulations are given in § 203.760, Chapter 2.

The fixed highway bridge 33 miles above the McNary Dam has a horizontal clearance of 500 feet and a reported overhead clearance of 61 feet.

**Richland**, on the west side of the Columbia River 40 miles above the McNary Dam, has a small boat moorage but there are no service facilities.

**Priest Rapids Dam**, 68 miles above the McNary Dam and 353 miles above the mouth of the Columbia River, is being constructed. It is being built primarily for power purposes; although foundations for a navigational lock are included, project plans do not include a lock. Priest Rapids is the theoretical head of through navigation, but for practical purposes Richland is considered the head of navigation.

**Charts 6168, 6169.**—**Franklin D. Roosevelt Lake** is in the north central part of the State of Washington. The longest artificial lake in the world, it is formed by the waters impounded by **Grand Coulee Dam**. The lake extends about 125 miles along the Columbia River Canyon upstream from the dam to the International Boundary. In addition, the reservoir extends 26 miles up **Spokane River**,

8 miles up **Sanpoil River**, and 6 miles up **Kettle River**, all of which are now known as arms of the lake.

The normal lake level is 1,288.6 feet above mean sea level, and all depths and overhead clearances are given according to this datum. The lake is subject to draw-downs which vary considerably from year to year. The maximum contemplated drawdown during seasons of extremely low natural flow conditions is 82 feet below normal lake level.

**Bridges and overhead cables.**—Sanpoil River, which flows into the lake 15.6 miles above the dam, is crossed by an overhead power cable near the mouth of Silver Creek with a permit clearance of 73 feet. Spokane River Arm, near the entrance, is crossed by a fixed bridge with a horizontal clearance of 420 feet and an overhead clearance of 35 feet; the overhead cable about 0.3 mile above the bridge has a permit clearance of 55 feet. An overhead power cable 64.4 miles above the dam and about 1 mile above **Bissell** has a permit clearance of 86 feet. At **Kettle Falls**, 88.9 miles above the dam, are two overhead power cables and two fixed bridges. The limiting clearances of the bridges are 300 feet horizontally and 47 feet overhead; the least permit clearance of the cables is 56 feet. An overhead power cable 101.4 miles above the dam and 1.8 miles above **Bossburg** has a permit clearance of 70 feet. About 111.6 miles above the dam and 0.3 mile below **Island Rock** is an overhead power cable with a permit clearance of 71 feet. Near **Northport**, 116 miles above the dam, are two fixed bridges and two overhead cables. The old highway bridge has a horizontal clearance of 238 feet and an overhead clearance of 38 feet, and the new structure has a horizontal clearance of 224 feet and an overhead clearance of 75 feet. The least permit cable clearance, 43 feet, is that of the telephone cable; the power cable permit clearance is 80 feet. Two overhead guy wires for bucket ferries, 124.3 miles above the dam and 1 mile below the Canadian boundary, have a limiting clearance of 66 feet.

In river navigation, shoal areas, sand bars, submerged rocks, and other dangers are known or suspected. They are particularly noticed upstream from Northport to the Canadian line, as well as in the Little Dalles area. Extreme caution should be exercised in navigating the Little Dalles area and upstream from Northport. The lake is well marked by lights and daybeacons.

Very little traffic is encountered on the lake. It consists chiefly of lumber, barges, and log rafts towed by tugboats. Pleasure craft are seen occasionally. Daily passenger service is maintained during the summer season on the lake between Miles, Washington, and Coulee Dam. There is a ferry between **Gifford** and **Inchelium**, 6.8 miles above the dam. Its scheduled operation is during daylight hours throughout the year except when ice interferes.

Minor repairs and limited marine supplies may be obtained by prior arrangement at the Bureau of Reclamation's Anchorage at Coulee Dam. Fuel oil, gasoline, fresh water, and provisions are available at Coulee Dam, Grand Coulee, Wilbur, Lincoln, Miles, Hunters, Gifford, Kettle Falls, and Northport.

Hospital facilities are available at Coulee Dam, Wilbur, and Colville. Northport is a port of entry.

## 11. COLUMBIA RIVER TO STRAIT OF JUAN DE FUCA, WASH.

**Chart 6002.**—From Cape Disappointment, the coast extends northward for 22 miles to Willapa Bay, as a low, sandy beach, with sandy ridges about 20 feet high parallel with the shore. Back of the beach, the country is heavily wooded. Numerous summer resorts and cottages are along the beach.

**Chart 6185.**—**Willapa Bay**, formerly known as **Shoalwater Bay**, has its entrance 40 miles northward of the Columbia River entrance. The bay, with its various tributaries, furnishes an outlet to an extensive area of valuable timber. Oyster beds cover much of the shoaler areas of the bay. Lumber and lumber products are the principal exports; fish and other sea foods are also shipped. The imports consist of general merchandise, mill machinery, and farming implements.

**Prominent features.**—**Leadbetter Point**, the southern point at the entrance to Willapa Bay, is low and sandy, with no distinctive feature to mark its extremity nearer than the limit of the trees, 2.2 miles southward.

**Cape Shoalwater**, the northern point at the entrance, terminates in a low bluff about 50 feet high. It is sandy, and the northern portion is covered with trees to within 300 yards of the point.

**Willapa Bay Light** ( $46^{\circ}44.1' N.$ ,  $124^{\circ}04.6' W.$ ), 118 feet above the water and visible 16 miles, is shown from a white skeleton tower on the north side of the entrance; a radiobeacon is at the light.

**Willapa Bay entrance.**—The northern shore of the entrance to the bay is distinctive in appearance with respect to the southern shore, being marked by timbered bluffs and ridges, several hundred feet high. In the daytime, scars on the cliffs can often be seen before the light is visible. The termination of the tree line on Leadbetter Point is sharply defined.

The entrance is in the northern part of the bay, which consists of two arms; the southern, 16 miles long, and the eastern, 10 miles long. Both arms are filled with extensive shoals, large areas of which bare at low water. The southern arm is separated from the ocean by a strip of low sand and sand dunes, averaging 1.5 miles in width and covered with trees until within 2.2 miles of Leadbetter Point. Numerous cottages and summer resorts are along the seaward face of the narrow peninsula. The shores of the bay elsewhere are composed of low, rolling hills, 100 to 200 feet high, covered with a dense growth of timber.

**Willapa Bar** extends about 3 miles outside of a line joining Willapa Bay Light and Leadbetter Point. The bar channel is continually shifting and depths over it

vary from season to season. Experience shows that every 20 to 30 years the channel works to the southward until it is parallel with the shore, then breaks out to the westward. The buoys marking the channel through the bar are moved from time to time because of the shifting sands and changing channel. Dredging range lights are temporarily established at the entrance at times during dredging operations. They do not necessarily mark the best water.

Due to the changeable character of the entrance, vessels should always employ a pilot.

**Channels.**—A Federal project provides for a channel 26 feet deep with a minimum width of 500 feet over the bar, thence a channel 24 feet deep from deep water in Willapa Bay with varying widths of 200 to 300 feet to the forks of Willapa River at Raymond; a channel 24 feet deep and 150 feet wide in the South Fork as far as the deep basin at Cram Lumber Company; and a channel 24 feet deep and 150 feet wide in the North Fork to a turning basin of the same depth opposite Twelfth Street at Raymond.

A controlling depth of 20 to 32 feet is maintained over the bar, thence at or near project depths to the forks at Raymond. In May 1957 the controlling depth was 19 feet in the North Fork to 700 feet below the highway bridge and 18 feet in the South Fork to the highway bridge.

**Willapa River** enters at the head of the eastern arm of Willapa Bay. Ranges, buoys, daybeacons, and lights mark the channel through the eastern arm of the bay and the Willapa River to South Bend and Raymond.

A Coast Guard station is at Toke Point, 4.2 miles eastward of Willapa Bay Light.

**South Bend** is on the southern bank of Willapa River, 3 miles above the mouth. The principal industries are lumbering, oystering, and fishing. It has a large sawmill, shingle mills, and three canneries. The depths at the wharves vary from 15 to 20 feet. Willapa Harbor Airport is on the north bank of the river about 2.5 miles northwestward of South Bend. Two power cables over the river at the easterly edge of the city have a least permit clearance of 165 feet.

**Raymond**, the principal town, is on the southern bank of the Willapa River, at the junction of the south fork, 3 miles above South Bend. It has sawmills and shingle mills, and ships large quantities of lumber. The depths at the wharves range from 20 to 28 feet.

**Anchorage** may be had at almost any point inside the bay; the holding ground is good. The anchorage generally used is off Toke Point in 30 to 55 feet.

The main turning basin at the junction of the North and South Forks is used by ships up to 500 feet long and 24-foot draft. Ships turning usually head up the South Fork, back with the aid of a small tug into the North Fork, then straighten out down the main river.

**Bridges.**—The South Fork of the Willapa River is crossed by two drawbridges at Raymond. A railroad swing bridge, 0.3 mile above the junction of the forks, has a horizontal clearance of 125 feet and an overhead clearance of 7 feet. A highway swing bridge, 0.7 mile above the junction, has a horizontal clearance of 125 feet in the north draw and an overhead clearance of 5 feet. The highway fixed bridge about 3 miles above the junction has a horizontal clearance of 80 feet and an overhead clearance of 7 feet. Two power cable crossings over the South Fork have a least permit clearance of 60 feet.

At Raymond the North Fork is crossed by a highway swing bridge with a horizontal clearance of 125 feet and an overhead clearance of 11 feet. A fixed railroad bridge crosses the mouth of Ellis Slough with a horizontal clearance of 90 feet and an overhead clearance of 20 feet. Operating regulations for these bridges are given in § 203.770, Chapter 2.

**Directions.**—From northward or southward, the course should be shaped to make the outermost lighted whistle buoy. From seaward in clear weather, the lights at the entrance at Grays Harbor, 14 miles northward and at North Head, 22 miles southward, are distinguishing marks for fixing a vessel's position and the subsequent shaping of the course.

Approaching from any direction in thick weather great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3½ knots have been observed at the lightships between Blunts Reef and the Swiftsure Bank, and velocities considerably in excess of these amounts have been reported. Under such conditions vessels should not shoal the water to less than 20 fathoms until the lighted whistle buoy off the entrance has been made.

Strangers should not attempt to navigate the bay in thick weather. At any time, however, when the aids to navigation can be seen, vessels of 20 feet or less draft should have little difficulty in reaching the wharves at Raymond or South Bend, as the channel throughout is well marked by ranges, lights, daybeacons, and buoys. Vessels of a deeper draft should secure the services of a pilot.

**Tides.**—The mean range of tide at South Bend is 8 feet. The range between mean lower low water and mean higher high water is 10 feet. A range of about 14 feet may occur at the time of maximum tides.

**Currents.**—In the entrance the average velocity of the flood or ebb stream is about 2½ knots at strength. Currents of 4 to 6 knots occur at times, the velocity being greatest on the ebb, particularly with a southerly wind.

In the channel at South Bend, Willapa River, the average velocity at strength of flood is about 1 knot and at strength of ebb 1½ knots. Daily current predictions

for both the entrance and South Bend may be obtained from the Tidal Current Tables, Pacific Coast.

See Appendix for storm warning displays.

**Pilotage.**—Pilots may be obtained by calling the Grays Harbor-Willapa Harbor Pilots Association, Hoquiam, through Olympic Radio Company, KJQ, and stating time of arrival off the bar. Deep-draft vessels should not attempt to enter without a pilot.

**Towage.**—Vessels desiring a tugboat may notify Radio Station KJQ. Small power boats are also available.

**Quarantine.**—Quarantine regulations are enforced by an officer stationed at South Bend. Vessels subject to quarantine usually proceed to their dock where they are boarded for inspection. Only sulphur fumigation is available. A medical relief station in charge of a contract medical officer is in the Werley Building, Water and Memorial Streets, South Bend.

**Customs.**—South Bend is a port of entry. There is a part time customs officer stationed at Raymond.

**Immigration.**—Immigration is handled through the Aberdeen office of the U.S. Immigration Service.

Regulations relative to logging on Willapa Bay and tributaries are given in § 207.720, Chapter 2.

**Terminal facilities.**—The port of Willapa Harbor maintains a terminal with a 600-foot wharf on the southern bank of the river between South Bend and Raymond; the depth along the face of the wharf is 24 feet. There is covered warehouse space of 7,200 square feet. Two lift trucks and a 30-ton crane are available. The office of the port manager is on the wharf.

**Supplies.**—Provisions and water may be obtained at South Bend, Raymond, and the Port of Willapa Bay Terminal. Fuel oil may be had at South Bend or Raymond, or at the port dock, Willapa Harbor. Coal may be obtained by prior arrangement.

**Repairs.**—Marine ways in South Bend can haul out boats up to 65 feet long and 7-foot draft. There are machine shops and foundries.

Communication may be had by rail and bus; there is regular bus service to the north, south, and east; telegraph and telephone facilities are available.

**Tokeland, on Toke Point, about 2 miles eastward of Cape Shoalwater, is a summer resort. There is a wharf at the point maintained by the port of Willapa Harbor; it has 6½ feet alongside and is used mostly by crab and oyster men.**

**Cedar River winds across the flats from Toke Point for 2 miles to the head of the flats. Small towboats can ascend the river at half tide to a log raft 0.3 mile northward of the mouth of the river.**

**North River enters the eastern arm of the bay 3 miles westward of the mouth of Willapa River; it is navigated by small logging launches. The river has been improved by the removal of snags and log jams. The channel is marked by privately maintained daybeacons, and is navigable at high tide to Eaton's Ranch, a distance of about 3 miles above the last daybeacon.**

**Mailboat Slough**, one of the interconnecting waterways of the Willapa River, is closed off by a dike at the south-east end.

The southern part of Willapa Bay is used only by local light-draft craft.

The channel to Bay Center is marked by lights and buoys. The directional light off Goose Point should be used only with local knowledge as the channel is subject to change and the white center beam may not always mark the best water.

**Bay Center** is a small village on Goose Point on the eastern shore of the southern arm near its entrance; oyster culture is the main industry, but fish and crabs are also important products. A Federal project provides for a channel 10 feet deep and 40 feet wide leading from deep water in the Palix River to the wharves at Bay Center. In June 1958 the controlling depth was 10 feet. Gasoline and diesel oil are available.

**Bone River** enters the bay about 2 miles northeastward of Goose Point. The entrance channel across the flats is tortuous and shoal; passage only at high tide is possible for very small boats. A fixed highway bridge, crossing the river at its mouth, has a horizontal clearance of 30 feet and an overhead clearance of 14 feet.

**Niawiakum River** enters the bay about a mile eastward of Goose Point. It is shoal and cannot be navigated except at high tide. A fixed highway bridge, crossing the river about 0.5 mile above its mouth, has a horizontal clearance of 57 feet and an overhead clearance of 9 feet. An oyster plant is in operation at the north end of the bridge.

**Palix River** is the second largest river on the eastern side of the bay. It is navigable for small logging tow-boats and fishboats for about a mile up each of the three forks above their junction. A fixed highway bridge about a mile below the forks has a horizontal clearance of 57 feet and an overhead clearance of 12 feet.

**Nemah River Channel** leading to **South Nemah River** is marked by privately maintained daybeacons. In 1957 the controlling depth was about 5 feet in the seaward half of the channel and about 3 feet in the inner half. The **Middle Nemah River** joins the South Nemah River 0.5 mile above its mouth. The channel to **North Nemah River** is practically dry at low water. These rivers are used almost exclusively for towing logs. All three branches are crossed by fixed highway bridges about 0.5 mile above their mouths. They are considered not navigable beyond these bridges.

**Nahcotta** is a small village about 9 miles southward of Leadbetter Point. Oyster culture and processing are the principal industries; several large oyster packing plants operate at the village. The channel leading to the village is well marked by lights and buoys, and has sufficient depth for any vessel that can cross the bar. The long pier has a 70 foot face with depths and 28 feet alongside.

**Stanley Channel** leads from **Nahcotta Channel**, at Long Island Shoal Light, eastward of Long Island and **Stanley Peninsula** to the mouth of the Naselle River. Shallow-draft boats with local knowledge can cross **Long Island Shoal**.

**Long Island**, 5.5 miles long in a northwesterly direction and of irregular width, wooded, and rising to over 100 feet in elevation, lies in the southern arm of the bay near the head and nearly fills it.

**Naselle River** is the largest of the rivers entering on the eastern side of the bay. It is navigable by boats of 5 feet or less draft to the bridge at the village of **Naselle**, 10 miles above the mouth. This bridge marks the head of tide water at ordinary high tides. A highway bridge crosses the river about 2.2 miles above the mouth, having a swing span with a horizontal clearance of 107 feet in its north opening and 104 feet in its south opening, and an overhead clearance of 4 feet. The signal for opening the drawspan is 4 long blasts of the whistle. Between the bridges the river has numerous snags and submerged logs, and overhead power cables with a least permit clearance of 35 feet; passage should not be attempted without local knowledge. Small logging and fishing boats operate on the river.

**Bear River** enters at the southeastern corner at the head of the bay. A long tortuous, unmarked channel across the flats makes entrance to the river difficult. Vessels of 5-foot draft or less can make the fixed bridge about 1.5 miles above the mouth at half tide. The bridge has a horizontal clearance of 50 feet and an overhead clearance of 2 feet.

**Chart 6002.**—From Cape Shoalwater to Point Chehalis, the southern point at the entrance to Grays Harbor, the coast extends for 12 miles as a low sand beach, backed by a heavy growth of timber.

**Chart 6195.**—**Grays Harbor** has its entrance about 40 miles northward of Cape Disappointment and 93 miles southward of Cape Flattery. The bay and its tributaries furnish an outlet to an extensive area of valuable timber. Grays Harbor is one of the leading lumber ports in the United States and its shipments include both coastwise and foreign. Oil is brought in by large tankers.

The bay at the entrance is about 2 miles in width, but shoals extending southward from Point Brown contract the navigable channel to a width of 0.4 mile. From the entrance the bay extends eastward for 15 miles to the mouth of the Chehalis River. The bay is filled by shoals and flats. They are bare at low water and cut by numerous channels.

**Point Chehalis** is low and sandy, and for 1.5 miles southward of the extremity is bare of trees. A jetty extends seaward from the end of the point.

**Grays Harbor Light** ( $46^{\circ}53.3' N.$ ,  $124^{\circ}06.9' W.$ ), 123 feet above the water and visible 17 miles, is shown from a white octagonal pyramidal tower on the seaward side of Point Chehalis. The radiobeacon and the fog signal, synchronized for distance finding, are 1.1 miles northward of the light.

**Point Brown**, the northern point at the entrance to Grays Harbor, is 2.5 miles northward of Point Chehalis; it is low, rounding, and sandy, with shoals extending southward and westward, which together with those extending westward from Point Chehalis form the bar at

the entrance. The point is wooded to within 0.5 mile of the extremity near which is a lone tree. A jetty extends southwestward from the point.

**Prominent features.**—The country about Grays Harbor is flat and featureless, with few conspicuous objects. **Saddle Hill**, about 310 feet high, 8 miles northward of the entrance and 2 miles inshore, is the most conspicuous feature.

Grays Harbor Light shows prominently on a closer approach to the entrance. In clear weather, **Brackenridge Bluff**, on the northern shore of the bay, 6 miles inside the entrance, is quite prominent. It is a reddish cliff about a mile long, rising in two places to a height of 80 feet; from seaward it is visible only through the entrance.

In clear weather **Neds Rock** shows prominently from inside the entrance; it is reddish in color.

**Grays Harbor entrance.**—The entrance is between two jetties extending outward from Point Chehalis and Point Brown. About 400 yards of the outer end of the south jetty is submerged at high water. The entrance is marked by lighted ranges and by buoys which are shifted to mark the best water as determined by frequent surveys of the bar. Due to the changeable conditions, vessels should not attempt the entrance without a pilot or local knowledge.

Experience has been that the bar shoals considerably during the winter months. However, it is dredged sufficiently deep every summer so that it seldom shoals to less than 25 feet. Deep-draft vessels must wait for favorable bar conditions before leaving the harbor, and are subject to delay on this account.

**Channels.**—A Federal project provides for an entrance channel 30 feet deep over the bar, thence 30 feet deep to a turning basin of the same depth near Cosmopolis, thence 16 feet deep to a turning basin of the same depth at Montesano. The channels are maintained at or near project depth as far as Cosmopolis. There has been no deep draft navigation above Cosmopolis and no soundings have been taken since 1943. At that time the controlling depth to Montesano was 9 feet.

**Chehalis River** enters at the eastern end of Grays Harbor and is marked by lights and lighted ranges. It is navigable by small boats to **Elma**, 24 miles above the mouth. The upper portion of the river, for a distance of approximately 45 miles above Elma, is used for floating saw logs.

**Hoquiam** is on the northern shore at the mouth of Hoquiam River, 2.5 miles from the entrance to the harbor. There are large lumber and shingle mills, and wharves with from 10 to 30 feet alongside.

**Aberdeen** is the largest city on the bay. It adjoins Hoquiam on the east and includes South Aberdeen on the southern side of the Chehalis River. The depth alongside the wharves varies from 10 to 30 feet.

Aberdeen and Hoquiam are both served by the Northern Pacific, Union Pacific, and Chicago, Milwaukee, St. Paul and Pacific Railroads.

**Cosmopolis** is a small town on the southern side of the Chehalis River a short distance above South Aberdeen. There is a large pulp mill here.

**Montesano** is on the northern bank, about 14 miles above Aberdeen. Shingle mills are located here. Shipments are generally by barge to Aberdeen for loading, although coastwise vessels drawing up to 18 feet can reach Montesano at high tide. In 1957 there was no commercial shipping to Montesano. This stretch of the river is used only by log tows.

**Anchorage.**—The best anchorage is southward of **Sand Island Shoal**, in depths of 35 to 40 feet. The holding ground is good, and there is more swinging room here than elsewhere in the harbor. Outbound vessels waiting to cross the bar may anchor in the channel abreast Westport.

**Bridges.**—Seven bridges cross Chehalis River between the mouth and South Elma. The Union Pacific bridge at Aberdeen has a swing span with a horizontal clearance of 125 feet and an overhead clearance of 10 feet. About 100 yards upstream is a highway bridge having a double bascule span with a horizontal clearance of 150 feet and an overhead clearance of 35 feet. The former swing-bridge just upstream from the Wishkah River has been removed. The center pier has been removed to the low water line but the bottom part still remains. The dolphins guarding the former false work on which the former swing span rested when open are still in place (March 1957). Extreme caution should be exercised in this vicinity. An overhead power cable with a permit clearance of 103 feet crosses the river at Cosmopolis, about 5.5 miles above the mouth. At South Montesano, 13 miles above the mouth, there are overhead power cables with a least permit clearance of 50 feet, and a swing bridge of the Union Pacific Railroad with a horizontal clearance of 100 feet and an overhead clearance of 8 feet. A swing highway bridge 0.2 mile above has the same clearances. Operating regulations for these bridges are given in § 203.775, Chapter 2. At **Fuller**, 20.4 miles above the mouth, is a fixed highway bridge with a horizontal clearance of 194 feet and an overhead clearance of 8 feet. The fixed highway bridge at South Elma has a horizontal clearance of 260 feet and an overhead clearance of 17 feet. The fixed railway bridge at South Elma has a horizontal clearance of 80 feet and an overhead clearance of 10 feet.

**Directions.**—From northward or southward, the course should be shaped to make the entrance buoy. From seaward in clear weather, Saddle Hill, 8 miles northward of the entrance, and Grays Harbor Light on Point Chehalis, will be seen.

Approaching from any direction in thick weather great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3½ knots have been observed at the lightships between Blunts Reef and Swiftsure Bank, and velocities considerably in excess of these amounts have been reported. Under such conditions vessels should not shoal the depths to less than 20 fathoms unless sure of the position.

Strangers are advised to take a pilot, and they should in no case attempt to cross the bar when it is breaking.

At any time when the aids to navigation can be seen, vessels of 20 feet or less draft, having crossed the bar, should have no difficulty in reaching the wharves at

Hoquiam or Aberdeen. The channels should not be attempted in thick weather. Due to the changeable character of the channels and the necessary shifting of the aids to navigation, no directions of a permanent value can be given.

**Tides.**—The mean range of tide at Aberdeen is 8 feet. The range between mean lower low water and mean higher high water is 10 feet. A range of about 14 feet may occur at the time of maximum tides. Daily tide predictions for Aberdeen are given in the Tide Tables.

**Currents.**—In the entrance the average surface velocity of the flood or ebb streams at strength is about 2½ knots, but velocities up to 5 knots may occur. In the channels through the bay the velocities seldom exceed 3 knots. The master of the dredge working on the bar states that the currents are very erratic. He usually experienced a northerly set close inshore and a southerly set offshore. The Tidal Current Tables, Pacific Coast, contain daily current predictions for a location in Grays Harbor Entrance, together with information for obtaining similar predictions for a number of other locations in the vicinity. See Appendix for storm warning displays.

**Pilotage.**—Pilots may be obtained by calling the Grays Harbor-Willapa Harbor Pilots Association, Hoquiam, through Olympic Radio Company, KJQ, and stating the time of arrival off the bar. Pilots also may be obtained off the entrance by signals which are relayed by the Coast Guard lookout station on Point Chehalis. The office of the Grays Harbor-Willapa Harbor Pilots Association is at the foot of Myrtle Street, Hoquiam.

Vessels proceeding to Grays Harbor from the Columbia River, Willapa Bay, or Puget Sound ports can usually make arrangements with the pilot association to send a pilot to the port of departure, thereby avoiding delay at the entrance due to fog or stormy weather. Information relative to conditions on the bar can be obtained by radio from the pilot association. It is advisable to notify the stevedoring companies as far in advance as possible as to the time of arrival off the bar and the nature of the cargo to be handled.

**Towage.**—Towboats are available for use inside the harbor. Open barges are available.

**Quarantine.**—Regulations of the U.S. Public Health Service are enforced. Vessels subject to quarantine inspection are boarded at their first berth. Fumigation, when necessary, is done by one of the stevedoring companies under the supervision of the Public Health Service. Only sulphur fumigation is available. Vessels may be shifted to a designated anchorage if necessary. An outpatient office of the Public Health Service is in Aberdeen.

**Customs.**—Aberdeen is a port of entry; marine documents are issued.

**Immigration.**—The Immigration Service maintains an office at Aberdeen.

The Coast Guard office is at Hoquiam.

**Harbor regulations.**—A commission, Port of Grays Harbor, directs the affairs of the port district, which is coextensive with Grays Harbor County, and of the port facilities under its control. All rates of wharfage, dockage, warehousing, and other port and terminal charges in

connection with improvements owned and operated directly by the port district, are fixed by the commission. The office of the Port of Grays Harbor is at the foot of Myrtle Street, Aberdeen.

5 **Regulations** relative to logging in Grays Harbor and tributaries are given in § 207.730, Chapter 2.

**Terminal facilities.**—Midway between Hoquiam and Aberdeen, the Port of Grays Harbor operates a modern freight terminal with two slips, one of which is maintained to a depth of 30 feet. The terminal has rail connections and is equipped with modern improvements for handling lumber and other cargo. Fuel oil may be obtained from pipeline connections on the dock. Storage space for lumber and lumber products is available. There is covered warehouse space of 30,000 square feet. There is 1,760 feet of berthing space at the port dock and private berths with a total of 2,920 feet of space at other points in the harbor. Floating cranes are available which can handle maximum lifts of 50 tons. There are 2 fueling berths with 500 feet each.

10 **Supplies.**—Fuel oils, water, provisions, and ship chandlery can be obtained. A limited amount of coal is kept on hand and any amount can be obtained on short notice.

15 **Repairs.**—There are marine railways, the largest of which can haul out vessels 100 feet in length, 9 feet in draft, and 250 tons in weight. Machine shops and foundries can make ordinary repairs.

20 **Communications.**—Grays Harbor is served by three lines of transcontinental railroads, and a large number of ships operating in foreign and intercoastal trade. There are good highways to Olympia.

25 **Bowerman Airport** is on the extensive filled area just westward of Hoquiam.

**North Bay**, on the northern shore immediately eastward of Point Brown, is a shallow bight about 4 miles long at the entrance and 4 miles wide. It is filled with shoals and flats, bare at low water. The **Humptulips River** enters in the northern part of the bight, and several narrow channels wind through the flats to the main channel of the bay. There is some oyster culture in the bay which is used considerably by small oyster boats.

30 **Hoquiam River** empties into Grays Harbor about 2 miles westward of the mouth of the Chehalis River. It is practically a tidal slough 11 miles long. It has been improved for a distance of 2 miles above the entrance by dredging a channel 100 feet wide and 18 feet deep. In April 1950 the controlling depth was 17 feet. No surveys have been made since then.

35 Four bridges cross the river in Hoquiam. The Northern Pacific Railroad bridge, about 300 yards above the mouth, has a swing span with a horizontal clearance of 125 feet and an overhead clearance of 8 feet. The Simpson Avenue bridge, about 700 yards above the mouth, has a bascule span with a horizontal clearance of 125 feet and an overhead clearance of 36 feet. The Eighth Street bridge, about 0.7 mile above the mouth, has a swing span with a horizontal clearance of 124 feet and an overhead clearance of 9 feet. An overhead power cable with a permit clear-

ance of 75 feet crosses the river 1.2 miles above the mouth. At 2.2 miles above the mouth is the Northern Pacific swing bridge with a horizontal clearance of 105 feet and an overhead clearance of 3 feet; the overhead power cable crossing at the bridge has a permit clearance of 43 feet at the north draw. The bridge over Little Hoquiam River, cross the river in the city. The three downstream bridges just above the mouth, has a bascule span with a horizontal clearance of 40 feet and an overhead clearance of 9 feet. The lift bridge over East Fork has a horizontal clearance of 80 feet and an overhead clearance of 3 feet, down, and 56 feet, up. Operating regulations for these bridges are given in § 203.775, Chapter 2.

**Wishkah River** empties into the north side of the Chehalis River in the eastern part of Aberdeen. Four bridges have movable spans with a least horizontal clearance of 75 feet and an overhead clearance of 4 feet. The upstream bridge, known locally as the North Aberdeen bridge, has a fixed span with a horizontal clearance of 75 feet and an overhead clearance of 16 feet. Three overhead power cables cross the river within the city; the least permit clearance is 75 feet. At Aberdeen Gardens, about 7 miles above the mouth, is a fixed bridge with a horizontal clearance of 115 feet and an overhead clearance of 24 feet. Operating regulations for the drawbridges are given in § 203.775, Chapter 2.

**South Bay**, on the southern shore, immediately eastward of Point Chehalis, is about 2 miles long and 2 miles wide. It is full of shoals, bare at low water, with a narrow channel leading through them to the mouth of the Elk River, which empties into the head of the bay. Logs are towed out of Elk River.

**Westhaven Cove**, on the inner side of the north tip of Point Chehalis, is protected by breakwaters marked by lights. The cove is headquarters for many fish boats; the fish pack is shipped out by truck from the town of Westhaven.

A Federal project provides for an entrance channel 16 feet deep. The channel is maintained at or near project depth. Depths are 12 to 16 feet alongside the principal wharves in the cove.

A Coast Guard station is on the west side of the entrance to Westhaven Cove. The lookout tower is 0.4 mile west-southwestward, on the outer side of the point.

**Westport** is a summer resort a mile southward of Westhaven and just eastward of Grays Harbor Light.

**Bay City**, on the eastern shore of South Bay, was formerly the site of a whaling station. The wharf built originally for the old fertilizer factory is now in ruins. A Federal project provides for a channel 14 feet deep in South Bay to Bay City. The channel is maintained at or near project depth. The fixed highway bridge at Bay City has a horizontal clearance of 100 feet and an overhead clearance of 32 feet. The former bridge just north of the present bridge has been removed. Some of the piling remains but the channel is presumed to be clear.

**Ocosta**, on the eastern shore of South Bay, 2 miles northward of Bay City, is a small settlement of no commercial importance.

**South Channel** is a buoyed channel with a controlling

depth of 12 feet and follows the southern shore. This channel is used quite often by small tugs with log rafts. A log dump is about 3 miles eastward of **South Arbor**, at which timber is dumped from trucks hauling it from the surrounding logging camps.

**Markham**, on the southern shore of the bay at the mouth of the Johns River, has a shingle mill; the product is shipped by rail. Logs are towed to the mill by way of the channel southward of **Whitcomb Flats**. It is the terminus of a railroad which follows the southern shore of the bay from South Aberdeen.

**Johns River** enter South Channel at Markham. It is a shallow stream crossed by two fixed bridges. The highway bridge at Markham has a horizontal clearance of 112 feet and an overhead clearance of 36 feet for center width of 75 feet. The former bridge just north of it has been removed but some of the pile bents still remain. The channel is presumed to be clear. The railroad bridge 3.2 miles farther up the river has a horizontal clearance of 36 feet and an overhead clearance of 5 feet.

**Chart 6002.**—From Point Brown the coast extends northward for about 22 miles to Point Grenville as a low, sandy beach, broken occasionally by small streams and in some places by bluffs. A few small settlements, connected by roads or trails, are scattered along this stretch.

**Copalis Head**, 12 miles northward of Point Brown, is a bright yellow bluff, about 2 miles long and 140 to 200 feet high. It is 1.8 miles northward of **Copalis River**. **Copalis Rocks**, two small rocks the larger 34 feet high, lie 500 yards off the head, and a rock awash is about 0.5 mile west-southwestward of the head.

Two small bluffs mark the mouth of **Joe Creek**, about 3.5 miles northward of Copalis Head.

**Moclips River** enters about 6 miles northward of Copalis Head. The southern point at the mouth is bare and sandy; on the northern bank is a bright yellowish bluff 50 feet high. **Moclips**, near the mouth of this river, is connected by a branch of the Northern Pacific Railroad with Hoquiam on the north shore of Grays Harbor. The red tanks and stacks are prominent from seaward; a shingle mill is at Moclips. Some logs and considerable shingles are shipped by rail. A triangular-shaped, yellowish bluff about 110 feet high on the south bank of **Wreck Creek**, which empties about 2.5 miles northward of Moclips, is prominent from offshore.

**Point Grenville** is a broken, rocky promontory with nearly vertical, whitish cliffs over 100 feet high. A triangular-shaped tower, 300 feet high with a flashing red light at the top and two fixed red lights at levels 100 feet and 200 feet below the top, is on the point. Numerous rocks extend for some distance off the point. **Grenville Arch**, dark in color, 83 feet high, is the outer and more prominent of two rocks lying westward of the point; it is over 0.5 mile southwestward of the inner extremity of the point. The arch lies east and west. A rock awash at high water lies 400 yards northwest of Grenville Arch. The western rock, off the western end of the point, is 200 yards off the cliff and 92 feet high. There are a number of rocks inside of it but none outside. Two rocks over 90

feet high lie 400 yards southward of the southern extremity of the point.

An indifferent anchorage in northwestly weather may be had under Point Grenville by vessels of moderate draft, but the depths compel anchoring at such a distance from the beach that little shelter is afforded. The anchorage is in 4 fathoms, sandy bottom, with the inner extremity of the point bearing 338°, and Grenville Arch bearing 293°. This anchorage is not recommended for ordinary use.

Northward of Point Grenville is a series of cliffs, the upper part appearing light gray, the lower part dark, separated by a well-defined line of demarcation. This formation disappears near the southern end of the cliffs where they are broken up and present a stratified appearance, the strata having a downward slope to the northward. Northward of the cliffs is a shingle beach followed by irregular bluffs and cliffs terminating near Taholah in white cliffs of uniform height, which from offshore do not present the stratified appearance noticeable to the southward.

**Quinault River** breaks through the cliffs about a mile southward of Cape Elizabeth. **Taholah** is an Indian village on the banks of the river. The shoreline in this section is low. The river is navigable only by skiffs and outboard motorboats. Some gasoline and supplies are available. A piling dike has been built along the spit in front of the village; a large amount of driftwood and logs has collected in front of this dike, partially hiding the village; however, the tops of the houses are prominent. In the background is a ridge with three long, flat summits. The road serving the beach settlements, and connecting them with Hoquiam, terminates at Taholah.

From Taholah to Cape Elizabeth the cliffs present an almost unbroken face seaward, and in places are about 200 feet high. They appear either white or bright yellow in color, and from offshore present a very noticeable stratification, sloping downward to the southward; an important difference from the direction of slope around Point Grenville.

**Sonora Reef** extends south-southeastward from Cape Elizabeth for over 2 miles, its southern end lying 1.1 miles offshore. The reef lies out of the usual course of vessels.

**Cape Elizabeth** projects about a mile from the general trend of the coast, and when seen from seaward appears as a bright yellow, rocky cliff reaching in places a height of 200 feet. There are no high or large rocks off the cape. A little less than a mile south-southeastward and south-southwestward, respectively, lie two rocks awash at low water, and inside of these, less than 0.5 mile from the extremity of the cape, are some small visible rocks and breaks. The houses of the **Quinault Indian Reservation** are at the eastern end of the cliffs.

From Cape Elizabeth to Destruction Island, a distance of about 20 miles, the coast is nearly straight, with low shores and rocky cliffs heavily wooded to the edges. Numerous rocks lie offshore, but out of the usual track of vessels.

**Flat Rock**, low and black, lies 1.6 miles northwestward

from Cape Elizabeth and 0.9 mile offshore. A sunken rock which breaks in ordinary weather lies 400 yards southward of it. A small rock lies halfway between Flat Rock and Cape Elizabeth, with a smaller one inside halfway to the beach.

**Pratt Cliff**, 3 miles northward of Cape Elizabeth, is a sharp point backed by cliffs, 139 feet high.

**Split Rock**, 70 feet high, is 3.5 miles north-northwestward of Cape Elizabeth and 1 mile offshore, abreast of the northern end of Pratt Cliff. It is split in two, the division showing when seen from westward to north-westward. A small, low, black rock lies 0.5 mile southward of it, and another, somewhat larger, lies 0.4 mile southward of Split Rock.

**Willoughby Rock**, 120 feet high, lies 0.4 mile northeast by east of Split Rock. It is nearly round with an abrupt seaward face. A cluster of rocks lies between Willoughby and Split Rocks and a little southward of them; one is black and conical with a rock awash 200 yards southward from it.

**Sealion Rock**, 8 feet high, small and black, is 3 miles northwest by north of Split Rock and 2.8 miles offshore.

From Pratt Cliff to **Raft River**, 3.5 miles, the coast consists of broken cliffs over 100 feet high bordered by rocks extending over 0.5 mile offshore. Midway between these points are three rocky heads covered with trees to the edges projecting beyond the cliffs and almost detached from them.

**Arch Island** lies in the entrance to Raft River, and at low water is connected with the southern point of the river. It is 157 feet high and 300 yards long. A vertical pillar, 108 feet high, stands 150 yards north-northwestward of the rocks, and a cluster of rocks lies close to under its southeastern point.

From Raft River to **Queets River**, 4.5 miles, the coast consists of cliffs about 80 feet high, broken occasionally by small streams.

**Queets River** is the largest stream between Grays Harbor and Cape Flattery. The southern point is a low, sandy spit about 0.1 mile long, projecting from an abrupt cliff, 80 feet high, and densely wooded. The northern point is 1.3 miles long, low, and sandy, with some trees at the mouth of the river, and a narrow lagoon between it and the bluff.

From Queets River to abreast Destruction Island, about 10 miles, the coast is rather low, and is broken by cliffs about 50 feet high with broad, low-water beaches. **Kalaloch Rocks** lie about 4.5 miles northward of the river, close inshore.

**Destruction Island**, 90 feet high, lies about 20 miles northward of Cape Elizabeth and 3 miles offshore. It is flat-topped and covered with brush, with a few clumps of trees. The island is 0.5 mile long and, at its southern part, 300 yards wide. From the northern end rocks and ledges extend about a mile from the cliffs; these are bordered by a line of kelp on the inshore side.

**Destruction Island Light** (47°40.5' N., 124°29.1' W.), 147 feet above the water and visible 18 miles, is shown from a white conical tower on the southwestern part of

the island; the radiobeacon and the fog signal at the light are synchronized for distance finding. See Appendix for storm warning display.

An indifferent anchorage, affording shelter from northwesterly winds, may be had off the southeastern face of the island in 12 fathoms, sandy bottom, with the light bearing between 293° and 315°. Vessels must leave if the wind hauls westward or southward. During the fishing season many small fishing boats anchor for the night under Destruction Island; it is the only shelter from offshore winds between Grays Harbor and Cape Flattery.

**Chart 6102.**—From abreast Destruction Island at the mouth of Steamboat Creek to Hoh Head, about 6.5 miles, the coast trends in a general northwesterly direction. The cliffs are 50 to 100 feet high, and many rocks and ledges extend in some cases 1.2 miles offshore.

**Abbey Islet**, 3.5 miles northeastward of Destruction Island, is over 100 feet high and covered with trees. It is 200 yards off the cliffs. Many rocks lie close southward of it, the most distant of which is **South Rock**, 46 feet high, 1 mile southward and 0.5 mile offshore.

At the mouth of **Hoh River**, 2 miles eastward of Hoh Head, is a broad sand beach; the absence of cliffs for 0.5 mile is noticeable for a considerable distance offshore. In smooth weather the river can be entered by canoes, but the channel shifts. An Indian village is on the southern bank at its mouth.

**Hoh Head**, 200 feet high, is a bright yellow cliff covered with a dense forest. It projects a little over 0.5 mile from the general trend of the coast. A large cluster of rocks is off the southern cliff of the head and sunken rocks extend to about 1.6 miles offshore between the head and North Rock. A rock with 2¼ fathoms over it has been reported about 1.8 miles northwestward of Hoh Head.

**Middle Rock**, 65 feet high, black with vertical sides, is 0.8 mile off the mouth of the Hoh River and about 1 mile eastward of North Rock. A rock awash is 0.7 mile from Middle Rock on a line between it and Destruction Island. Numerous low flat rocks are between it and the shore.

**North Rock**, 107 feet high, grayish, with nearly vertical sides, is a little over a mile southward of Hoh Head. In the afternoon sun the rock shows white, making it a very distinct landmark.

**Perkins Reef** is a long, bold, and jagged islet, 1.1 miles westward of Hoh Head. Between it and the shore is a small visible rock with two sunken rocks near it.

From Hoh Head to Toleak Point, 5 miles, the coast forms two shallow bights, the southern one being the longer. The cliffs are from 100 to 120 feet high and are broken by two small streams, one 2 miles northward of Hoh Head and the other 1 mile southward of Toleak Point. Several rocky islets, 25 to 120 feet high, are in some cases 1.5 miles offshore, and numerous rocks and sunken ledges, extending over 2 miles offshore, border this stretch of the coast.

**Alexander Island**, 121 feet high, is 2 miles northward of Hoh Head and a mile offshore. It is 0.3 mile long and

0.1 mile wide, covered with low vegetation, and is flat-topped with steep sides. A lone bushy tree is on each end of the flat top. The island is prominent in hazy or smoky weather. A sunken rock, 1.8 miles west by north of Alexander Island, is the outermost known danger in this vicinity. A cluster of three sunken rocks lies nearly 0.5 mile southward of the island. A rock awash at low water is 1.1 miles westward of the island, and a small bare rock 25 feet high is halfway between them. Between the rock awash and the beach are two small rocks, 44 to 68 feet high.

**Toleak Point**, nearly 5 miles northwest of Hoh Head, is a narrow point terminating in a small knob with an abrupt seaward face. A high wooded islet lies 400 yards westward of the point, to which it is connected by an extensive bare reef.

**Rounded Islet**, a round grassy rock 130 feet high with steep sides, is 0.3 mile seaward of Toleak Point. A low black rock is 0.7 mile southward of the islet.

From Toleak Point to Teahwhit Head, 3.5 miles, the coast is irregular and broken with numerous outlying rocks and sunken ledges extending, in some cases, a mile offshore.

The **Giants Graveyard** is an irregular group of rocks, some of which are wooded. The larger ones range in height from 88 to 210 feet. They are 1.5 miles northward of Toleak Point and extend 0.5 mile offshore, the farthest outlying danger being 0.8 mile from the beach.

**Teahwhit Head** is an irregular, jagged, double point 100 feet high and heavily wooded. **Strawberry Bay**, on the southeast side of the head, is a small bight in which fishing boats find shelter from northwest winds. There are numerous rocks in and around the bight.

From Teahwhit Head to the Quillayute River the coast extends for 1.5 miles in high rocky cliffs, changing to a low sand beach 1 mile southward of the mouth of the river.

**Huntington Rock**, 113 feet high, is the largest of a group of islands and rocks 0.5 mile off the cliffs and 1 mile northwestward of Teahwhit Head. It is flat-topped and bare with vertical sides. One of the inner islets is 195 feet high, and another is 182 feet high and wooded. One sunken and five low black rocks extend northward for 0.3 mile from Huntington Rock.

**Quillayute Needle**, 81 feet high, a little over 0.3 mile southeastward of Huntington Rock, is 35 feet in diameter and nearly vertical. It is the southeasternmost of a line of rocks from Huntington Rock, one of which is 47 feet and another 73 feet high.

**James Island**, 183 feet high, is 15 miles northwestward of Destruction Island. It is on the north side of the mouth of the Quillayute River. The island is bold, wooded, and connected with the beach at low water. Numerous smaller wooded islands, immediately northward, are prominent because the beach northward and southward of them is low, bare, and sandy, and the low heavily wooded valley of the Quillayute River is behind them. An indifferent anchorage affording some shelter from northwesterly winds may be had close southward of James Island, in 5 to 6 fathoms, sandy bottom, about 600 yards from the beach. Any swell makes the anchorage unsafe.

A light, 150 feet above the water and visible 12 miles, is shown from a white house on the southern side of the island; a radiobeacon and a fog signal are at the light. A lighted whistle buoy is 1.3 miles southwestward of the light.

**Lapush**, a town across the Quillayute River entrance from James Island, is an Indian village. It has facilities for tourists during the summer season. There are stores and motels, and daily mail service from Forks about 10 miles inland. A small wharf is being built (March 1957) just inside the river mouth. Gasoline and water will be available and diesel oil may be obtained in drums by prior arrangement. There is a road to Forks.

A Coast Guard station is at Lapush. See Appendix for storm warning display.

**Quillayute River** entrance is at the northern end of the sand beach. A jetty is on the easterly side and a dike is on the westerly side of the entrance. Neither the jetty nor the dike were visible at high water in 1957.

A Federal project provides for a channel 10 feet deep from the ocean to a basin of the same depth at Lapush. In April 1958 the controlling depth was 7½ feet with local knowledge.

The channel which passes close to the southeastern shore of James Island is tortuous and dangerous. It is especially bad in southerly weather and when there are breakers of any size making across the entrance it should not be attempted except at better than half tide and with a full-powered boat. Strangers should never attempt it, without a local pilot. An overhead power cable with an approximate clearance of 100 feet crosses the river near its mouth.

Many fishing boats make their headquarters here during the fishing season. Fishing boats can enter and leave the river at any time during the year except in southerly weather. A Coast Guard boat carries mail to Destruction Island at unscheduled intervals.

**Mora**, a former town at the mouth of the **Dickey River**, is abandoned.

From the Quillayute River to Cape Johnson the coast extends northward for about 3 miles; it has steep, wooded bluffs and a narrow beach.

**Cake Rock**, 116 feet high, is 2 miles northwest of James Island and about 1.5 miles offshore. It is about 200 yards long by 100 yards wide, with steep sides and a flat grassy top in the middle of which is a small round mound about 20 feet high. Halfway between Cake Rock and the beach is a jagged rock 136 feet high. A large low black rock is 1.1 miles north by west of Cake Rock and about 1 mile offshore, and two other rocks are 0.3 mile inside of it.

**Cape Johnson** is small and not particularly prominent. It projects less than 0.5 mile from the general trend of the coast, terminating in a vertical cliff about 100 feet high, with a mass of rocks at its base. Several high rocks extend 0.5 mile west-northwestward of the cape, the highest being 103 and 127 feet. Three rocky pillars, from 0.5 to 1 mile south-southeastward of the cape, reach elevations of 130, 226, and 125 feet.

From Cape Johnson to Cape Alava the coast extends in

a general north-northwesterly direction for 12.5 miles. The cliffs are not continuous and they show prominently only in a few places. The slopes are densely timbered. Back from the coast for 10 to 15 miles the country rises gradually to the wooded, snow-capped mountains of the Olympic Range.

**Jagged Islet**, 78 feet high, is nearly 2.8 miles northwestward of Cape Johnson. It is large, bare, brown, covered with guano, and irregular in outline. A low black rock lies 200 yards northward.

**Carroll Islet**, 225 feet high, is 3 miles northwestward of Cape Johnson and 0.8 mile northward of Jagged Islet. About 0.1 mile in diameter, it has vertical whitish sides and wooded top. A pillar rock, 134 feet high, lies 200 yards westward, and a small low black rock lies 200 yards off the southeastern side. Carroll Islet and the pillar rock are quite prominent, especially when in the sunlight.

**Bald Islets** are two high, bare rocks inside of Jagged and Carroll Islets about 0.8 mile offshore. The outer and larger one is 320 feet high with steep sides, and the smaller is 183 feet high. They are 200 yards apart and between them are two pinnacle rocks, close together. A cluster of small low black rocks lies 0.7 mile south-southeastward of the larger islets, and five small black rocks are between the larger islets and the beach. Several low black rocks lie about 1 mile northwestward.

**Hand Rock**, 33 feet high, is 1.5 miles northward of Carroll Islet and 1.5 miles offshore. So named from its shape, the rock is black with a white cap of guano on top. A large rock, 53 feet high, lies halfway between it and the beach, and many rocks are closer inshore.

**White Rock**, 161 feet high, is about 1.7 miles south of Cape Alava and about 0.8 mile offshore. The rock is 100 yards in extent and has nearly vertical sides and a rounded top; it is whitish, and in the sunlight is visible for a long distance. A group of large low black rocks lies 0.8 mile south-southeastward of White Rock and 0.8 mile offshore. A small black rock lies in the same direction, distant 1.5 miles. A rock 6 fathoms deep has been reported 2.2 miles westerly of White Rock.

**Chart 6265.—Cape Alava** is about 13.5 miles southward of Cape Flattery and nearly as far northward of Cape Johnson. The seaward face is about 0.6 mile in extent. A steep rocky islet, 142 feet high and with trees on top, is off its northwestern extremity. The shore is bordered by numerous rocks and sunken ledges. **Ozette Indian Village** is abandoned. Cape Alava is the westernmost point of continental United States.

**Flattery Rocks** and **Umatilla Reef** are rocks and islets extending westward from Cape Alava for 2.3 miles. **Ozette Island**, 236 feet high, is 0.8 mile southwestward of the cape. The island, 0.5 mile long and a little over 0.1 mile wide, is flat-topped and has steep sides. About 0.3 mile off the southern and southeastern sides are low black rocks. **Bodelteh Islets**, about 1.2 miles west-northwest of the northerly end of Cape Alava, have high bold seaward faces. The outer one is 198 feet and the inner one, 189 feet high. A bare rock, 141 feet high, lies close under the

southwestern face of the outer islet, and a whitish rock 132 feet high, with steep sides and sloping flat top, is 200 yards westward of the outer islet.

During the fishing season a few fish boats find shelter in an anchorage off the southeastern end of Ozette Island. 5 The area is small and requires local knowledge to enter. It affords fair protection from the prevailing northwesterly wind.

**Umatilla Reef**, 0.7 mile westward of the outer Bodeliteh Islet, extends for 200 yards in a westerly direction and is 10 about 75 yards wide. It consists of several small low black rocks and some breakers. There is a reported breaker 1.1 miles northeast by north of this reef, and a rock awash 0.3 mile east of the reef. This rock, awash at 15 low tide, endangers the passage inside Umatilla Reef, sometimes used by small boats. Umatilla Reef is difficult to make out, especially in thick weather, and is the greatest danger to navigation off the northern part of the coast.

**Umatilla Reef Lightship (48°10.0' N., 124°50.4' W.)**, 20 is in 25 fathoms about 2.5 miles southwestward of the reef. The vessel has a red hull with the word UMATILLA on each side, and two masts each with a circular gallery at the masthead. The light is 67 feet above the water and 25 visible 14 miles; the radiobeacon and the fog signal are synchronized for distance finding. Difficulty has been reported in hearing the signal during dense fog. The code flag signal and radio call is NNCL. Storm warnings are displayed daytime only.

From Cape Alava the coast extends for about 8 miles 30 in two shallow bights. It then bends eastward, forming Mukkaw Bay, 2.5 miles wide, from the northern point of which it trends northwestward for 3 miles to Cape Flattery. The coast is irregular, with alternate stretches of 35 wooded bluffs and rough rocky cliffs, 100 to 200 feet high. The country immediately back of the beach is not high, but is densely wooded.

**Point of the Arches** is about 5 miles northward of Cape Alava, and is the northern point of the cliffs that 40 extend 1.5 miles southward. Numerous rocks and ledges border the cliffs and extend in some cases 0.8 mile offshore.

**Father and Son**, two rocks connected by a low reef, lie 0.6 mile offshore abreast the southern end of the cliffs. The outer rock is 167 feet high, and the inner one 65 feet. A rock, 38 feet high, is 1 mile northward of Father and 45 Son and 0.5 mile offshore, with several rocks between it and the beach.

**Spike Rock**, 35 feet high, sharp and bare, is 0.8 mile northwestward of the Point of the Arches. It is the outermost of a chain of rocks, the three largest of which range 50 in height from 152 to 185 feet; there are three arches in these rocks. A rock awash, 0.4 mile west-southwest of Spike Rock, is inside the usual course of vessels.

**Portage Head**, 2.5 miles northward of Point of the Arches, has a seaward face about a mile in length of bold 55 rocky irregular cliffs over 410 feet high. A reef extends from the point toward Cape Flattery for 1.5 miles showing several low black rocks, awash at low water, and one small rock 45 feet high. A rock that bares at low water

is 1.3 miles northwestward of Portage Head. There is a depth of about 2 fathoms over it at low tide.

**Mukkaw Bay** is a shallow bight included between Portage Head and Waatch Point, a distance of 3 miles. It affords indifferent shelter in northerly and easterly weather and a smooth sea, but is little used as an anchorage. During the salmon runs it is used by many native pulling boats which are beached at night. The shores are low and sandy. The southern half of the bay is shoal, with reefs and rocks extending about 1.5 miles from Portage Head. The **Sooes River** enters about the middle of the bight. **Waatch River** enters in the northern part of the bight immediately eastward of Waatch Point. It is a tidal slough, and the valley through which it runs extends about 2 miles to Neah Bay on the Strait of Juan de Fuca. This low depression is one of the features for recognizing Cape Flattery.

**Waatch Point**, 3 miles southeastward of Cape Flattery, is the southeastern extremity of the cliffs extending to the cape. This stretch is bordered by numerous rocks and ledges.

**Fuca Pillar** stands 0.2 mile south of the western point of Cape Flattery. It is a rocky column 157 feet high and 60 feet in diameter, leaning slightly northwestward. It is 150 yards off the face of the cliff and is more prominent from northward than from southward.

**Cape Flattery** is a bold rocky head, with cliffs 120 feet high, rising to an elevation of nearly 1,500 feet 1 to 2 miles back from the beach. From southward it looks like an island because of the low land in the valley of Waatch River. Numerous rocks and reefs border the cliffs eastward and southward of the cape. About 0.8 mile southward of Cape Flattery are four rocky masses extending 0.4 mile offshore and ranging in height from 41 to 88 feet. Tide rips are particularly heavy off Cape Flattery.

**Tatoosh Island** is 0.4 mile northwestward of Cape Flattery. The main island of the group is about 0.2 mile in diameter, with three smaller ones and several reefs awash close to on its northwestern face. The main island is 108 feet high, flat-topped, and bare. A reef, the outer rock of which is usually awash, extends 0.2 mile westward. The passage between the island and the cape is dangerous; it is restricted by two rocks awash near the center of it and, although used by small boats, it should not be attempted without local knowledge. The currents are strong and treacherous.

**Cape Flattery Light (48°23.5' N., 124°44.1' W.)**, 165 feet above the water and visible 19 miles, is shown from a white conical tower on a gray sandstone dwelling on the western end of Tatoosh Island; the radiobeacon and the fog signal at the light are synchronized for distance finding. Telegraphic communications are available for reporting vessels or sending messages.

A rocky patch  $7\frac{1}{2}$  fathoms deep, on which the sea breaks occasionally in a westerly swell, is 1.4 miles southwestward of the light.

**Duncan Rock**, small, low, and black, is 1 mile north by west of the light. A ledge 4 fathoms deep is 0.4 mile southeasterly of Duncan Rock, and a covered rock between

them is 250 yards off in the same direction. Another covered rock lies 250 yards from Duncan Rock in the direction toward the light. These dangers constrict the passage between Duncan Rock and Tatoosh Island to less than 0.5 mile. Although narrow, this passage is used by many vessels which favor Tatoosh Island in passing. However, strong currents and tide rips are encountered here which, added to the narrowness of the passage, makes its use inadvisable.

**Duntze Rock**,  $3\frac{1}{4}$  fathoms deep, is 0.2 mile north by west of Duncan Rock and almost in line with it and the light. A lighted whistle buoy is 350 yards northwestward of the rock.

**Chart 6102.—Swiftsure Bank**, about 3.5 miles in extent within the 30-fathom curve, lies off the mouth of Strait of Juan de Fuca, northwestward of the submarine valley making into the strait. The least depth found upon it is 19 fathoms.

**Swiftsure Bank Lightship** ( $48^{\circ}32.0'$  N.,  $124^{\circ}59.7'$  W.), is in 30 fathoms, 13.4 miles northwesterly of Cape Flattery Light. The vessel has a red hull with the word SWIFTSURE on each side, and two masts each with a circular gallery at the masthead. The light is 65 feet above the water and visible 14 miles; the radiobeacon and the fog signal are synchronized for distance finding. The code flag signal and radio call is NNCD. Storm warnings are displayed daytime only.

**Caution.**—All vessels approaching Swiftsure Bank Lightship during fog should observe extreme caution as numerous small fishing vessels anchor nightly within a radius of 8 miles of the lightship during the fishing season, June 1 to November 1.

**Carmanah Point to Amphitrite Point, Canada.**—The coast from Carmanah Point to Cape Beale is very dangerous and, except during fine weather and offshore winds, should be given a wide berth.

**Carmanah Point** is on the Vancouver Island shore, about 13 miles northward of Tatoosh Island. A light, 175 feet above the water and visible 19 miles, is shown from a white octagonal concrete tower on the point; a fog signal is at the light.

**Clo-oose**, a small village and mission, is about 5.5 miles westward of Carmanah Point in the small cove at the mouth of the Cheewhat River, eastward of the entrance to Nitinat Lake. The village is connected with the Government telegraph line to Victoria, and by telephone with Carmanah Light. Shelter and assistance can be obtained here.

A reef 0.8 mile long in a northwesterly direction, with a rock awash in its center, is off this cove. It is marked by a lighted whistle buoy 0.8 mile southwestward of the rock.

**Nitinat Lake**, 11 miles long and about 0.5 mile wide, enters the strait about 1.5 miles westward of Clo-oose. The depths at the entrance vary from 1 to 2 fathoms, and in bad weather the sea breaks entirely across it. The entrance is dangerous and should not be attempted except at slack water by those having local knowledge.

**Tsusiat Lake** is 3 miles westward of Nitinat Lake. At

the seaward end of the lake is a conspicuous waterfall which may be seen at a considerable distance even in hazy weather, and may be used to help fix a vessel's position as it is the only waterfall on this part of the coast. Behind Tsusiat Lake the mountains rise to more than 2,000 feet.

**Pachena Point** is about 25 miles northwestward of Cape Flattery and has depths of 15 fathoms fairly close in. A light, 200 feet above the water and visible 20 miles, is shown from a white octagonal pyramidal tower on the point; the radiobeacon and the fog signal near the light are synchronized for distance finding.

**Pachena Bay**, between Pachena Point and Cape Beale, is about 2 miles long and 0.5 mile wide, with depths of 5 to 6 fathoms. There is usually a heavy swell entering the bay and vessels should not attempt to anchor. At the head of the bay, on the western side, is a small stream into which boats can go and find shelter in rough weather.

**Seabird Rocks** are off the entrance to Pachena Bay. The largest is about 48 feet high, bare, and of small extent. Two rocks lie off it, one 0.5 mile southeasterly and the other 0.5 mile southwesterly from it, the latter being awash at high water. There is no safe passage between Seabird Rocks and the shores northeastward, and the rocks should not be approached closer than 1.5 miles.

**Cape Beale** is a bold rocky point, 120 feet high, or 300 feet to the tops of the trees. A reef with rocks above and below water extends about 0.8 mile southwestward from it. A rescue station, a depot for provisions, and necessities for shipwrecked mariners are maintained on the cape.

A light, 170 feet above the water and visible 19 miles, is shown from a black square skeleton tower near the western extremity of the cape which is about 20 miles westward of the entrance to the strait. A fog signal is on a white building midway between the light and the water. A signal station connected to Victoria by telegraph is maintained at the light.

**Barkley Sound**, an extensive arm of the sea about 31 miles northwestward of Cape Flattery, lies between Cape Beale and Amphitrite Point. It is 15 miles wide at its entrance, and though encumbered by numerous islands and rocks, it maintains a breadth of 13 miles for 8 miles inland, above which it separates into several narrow inlets. The shores are low, except in the northern part and among the inlets, where they become high, rugged, and mountainous.

In the western part of the sound are innumerable rocks and islands with navigable channels between them. Entrance should not be attempted without local knowledge or a pilot. Imperial Eagle Channel is the easiest of access.

The principal channels in the sound are as follows: **Trevor Channel**, the eastermost, is 12 miles long in a northeasterly direction, and its breadth varies from 0.5 to 1.5 miles; its rugged shores are low except in the northeastern part where they are high. **Imperial Eagle Channel**, the largest passage into Barkley Sound, is about 12 miles long, 3 miles wide in the narrowest part, and bounded on either side by numerous small islands, rocks, and part of the mainland. **Deer Islands** are on the east and **Broken Group Islands** on the west. **Loudoun Chan-**

nel, leading into the sound westward of Broken Group, and between it and Sargison Bank, is from 1 to 2 miles wide.

**Amphitrite Point** is the western entrance point of Barkley Sound. A light 58 feet above water and visible 13 miles, is shown from a white rectangular building with a rounded front, on the end of the point; the radiobeacon and the fog signal at the light are synchronized for distance finding. A whistle buoy is 1,050 yards southward of the point.

A more detailed description of Barkley Sound is given in Hydrographic Office Publication No. 175, Sailing Directions for British Columbia, Volume I.

**Directions, approaching and entering the Strait of Juan de Fuca.**—In clear weather no difficulty will be experienced in approaching the entrance of the Strait of Juan de Fuca from any direction, as the land on both sides is high, and Cape Flattery, the southern point at the entrance, is readily distinguished, particularly from southward, on account of the low land between Mukkaw and Neah Bays. Cape Beale, the eastern point at the entrance to Barkley Sound, on the Vancouver Island shore about 20 miles westward of the entrance to the strait, is marked by a light and fog signal. Pachena Light, Carmanah Light, Cape Flattery Light, Umatilla Reef Lightship, and Swiftsure Bank Lightship mark the approaches. All of these stations have a fog signal and, except for Carmanah Light Station, have a radiobeacon synchronized with the fog signal for distance finding. In thick weather the soundings will assist in estimating the distance from shore.

**Depths.**—The depths in the approaches to the Strait of Juan de Fuca are very irregular, especially outside the 50-fathom curve. There is a deep submarine valley with depths of over 100 fathoms and a width of 2 to 4 miles, between the 100-fathom curves, which leads from about 37 miles south-southwestward of Cape Flattery, rounds this cape at a distance of 2 miles, and extends about 32 miles into the strait. The 100-fathom curve on the western side of this submarine valley is very irregular, but on the eastern side it is more regular. Within the strait this curve is regular on both sides of the valley.

The southern extremity of this valley is about 26 miles offshore, and from the western side of this extremity, the seaward 100-fathom curve extends in a northwesterly direction and lies about 40 miles southwestward of Cape Flattery and 35 miles southwestward of Cape Beale.

On the eastern side of this valley the 100-fathom curve is about 20 miles southwestward of Destruction Island, and trends in a northwesterly direction for about 40 miles. It then runs northeastward toward the Umatilla Lightship for about 12 miles and then northward for about 20 miles, passing about 5 miles westward of the lightship. It next turns north-northeastward and passes close outside of Duntze Rock, and then sharply eastward into the strait for about 32 miles. The 100-fathom curve on the western side of the valley is too irregular for description, and the chart must be consulted for details.

In thick weather, therefore, if the 100-fathom curve is

followed for 20 miles or more in a northwesterly direction and is found to change to the eastward, a vessel is probably in the valley about 15 to 20 miles southwestward of Umatilla Reef Lightship; but if the direction of the curve changes to the westward she may be on the outside of the bank about 40 miles west-southwestward of Cape Flattery Light.

The 50-fathom curve is less complicated southward of the strait. From about 25 miles southward of Cape Flattery, it runs in a general northerly direction and passes 3.5 miles westward of Umatilla Reef Lightship. It then curves gradually northeasterly toward Cape Flattery and passes close to Duntze Rock. Vessels from southward, following this curve in thick weather, ought to hear the fog signal, both at Umatilla Reef Lightship and at Cape Flattery, and thereby verify their position.

**Currents.**—The currents at Swiftsure Bank and Umatilla Reef Lightships are described in the Tidal Current Tables, Pacific Coast. Off the entrance of the Strait of Juan de Fuca the coastal current is influenced by the flow into and out of the strait. On the flood there is a set into all the sounds on the Vancouver Island shore, and this, combined with the prevailing northwesterly current and light southerly winds, with possibly some swell from the same direction, makes the coast in the vicinity and westward of Carmanah Light dangerous, especially for small vessels.

The flood current entering the Strait of Juan de Fuca sets with considerable velocity over Duncan and Duntze Rocks, but instead of running in the direction of the channel there is a continued set toward the Vancouver Island shore, which is experienced as far as Race Rocks. The flood current also has more velocity on the northern shore of the strait than on the southern.

The ebb current is felt most along the southern shore of the strait, and between New Dungeness Light and Crescent Bay there is a decided set southward and westward, especially during large tides. With wind and swell against the current, short choppy sea is raised near the entrance to the strait. For additional information on currents in Strait of Juan de Fuca, see the next chapter.

From seaward, vessels should pick up the 100-fathom curve and be guided by the soundings. The relation between the 100- and the 50-fathom curves is the best indication for fixing the position, and vessels should not get inside the latter depth until a fix has been obtained. From seaward the mountain peaks in the interior sometimes can be seen when the coast is obscured by fog.

On this portion of the coast the tendency toward a northerly set inshore is much more pronounced than farther southward. The great majority of the strandings which have occurred have been on the Vancouver Island shore and allowance should be made accordingly.

Sailing vessels approaching the strait should keep well off the mainland coast southward of Cape Flattery, unless working to windward against a fine northerly wind, which is frequently found during the summer. In this case the coast may be approached to within 3 miles. At other times there is no inducement to hug the coast, on which a long rolling swell frequently sets, and this swell, meet-

ing the southeasterly gales of winter, causes a confused sea. The cape and its offlying dangers should be given a berth of at least 3 miles, as the tidal current sometimes sets with great velocity toward Duncan and Duntze Rocks. It is equally necessary when entering or leaving the strait to avoid the coast of Vancouver Island between Port San Juan and Bonilla Point, when there is any appearance of bad weather.

Sailing vessels making the strait during the winter months, especially during November and December, and experiencing the easterly and southeasterly winds prevalent at that season, should endeavor to hold a position southward or southwestward of Cape Flattery, and should on no account open the entrance of the strait until an opportunity offers of getting well inside. It is also important to remember that, though it may be blowing strongly from the southward or south-southwestward outside, on rounding Cape Flattery, an easterly wind may be found blowing out of the strait, and a vessel would then find the Vancouver Island coast a dangerous lee shore.

Coming from the westward with a heavy westerly or northwesterly gale and thick weather, vessels uncertain of their position, should lie-to on soundings at not less than 30 miles from the entrance or on the edge of the bank. These gales seldom last more than 12 hours, and if they veer toward the southwest the weather will clear and vessels may bear up for the strait.

**Fog.**—The fog is generally heavier near the entrance, decreasing in density and frequency up the strait. Near the entrance the fog sometimes stands like a wall, and vessels entering the strait run out of it into clear bright weather, even before passing Tatoosh Island. The fog frequently extends a long distance seaward and, when combined with the smoke from forest fires, becomes ex-

ceptionally dense. The wind gradually works the fog into the strait, and it will follow the northern shore past Port San Juan to the Sombrio River; occasionally it will reach as far as Sooke Inlet and at times to Race Rocks. As a rule, however, the fog follows farther into the strait along the southern shore, at times reaching Port Townsend; frequently the northern shore is clear when the southern shore is enveloped in fog.

During the spring, fog is frequent in the strait. With the westerly wind it often stops at the headland between Crescent and Freshwater Bays, the fog then extending westward while it is clear to eastward. When fog extends past Freshwater Bay the small area about the western bight will often be clear.

**Weather.**—In summer the prevailing northwesterly winds draw into the strait, increasing toward evening and at times blowing a 10-knot breeze before midnight. This occurs, however, only when the winds are strong outside. In light winds sailing vessels may be a week from Cape Flattery to Admiralty Inlet, and vice versa.

In winter southeasterly winds draw out of the strait, causing a confused cross-sea off the entrance, the heavy southwesterly swell meeting that coming out. Under these conditions outbound vessels, especially sail, often make Neah or Clallam Bays and await more favorable weather. The weather off the entrance as a rule is exceptionally severe, and wrecks are of frequent occurrence. The heavy broken seas are probably due to the shoaling off the entrance, the irregularity and velocity of the currents, and the conflict between the wind drawing out of the strait and that along the outer coast.

The rainfall in the vicinity of the entrance is considerable, even during the summer months; the heaviest rains occur during December, January, February, and March.

## 12. STRAITS OF JUAN DE FUCA AND GEORGIA, WASH.

**Chart 6300.**—Strait of Juan de Fuca separates the southern shore of Vancouver Island, Canada, from the northern coast of the State of Washington. The entrance to the strait lies between parallels 48°23' N., and 48°36' N., on the meridian of 124°45' W. This important body of water is the connecting channel between the ocean and the island passages extending southward to Puget Sound and northward to the inland waters of British Columbia and southeastern Alaska.

The commerce of this region is extensive, both foreign and domestic. Vast quantities of lumber and fish, also grain, coal and general merchandise are exported, while the manufacturing and shipbuilding industries are important. Several transcontinental railroads have their western terminals on Puget Sound and the Strait of Georgia. There are several steamer lines, foreign and domestic, operating from this area to places across the Pacific or through the Panama Canal, in addition to the coasting and local steamers, and sailing vessels.

At its entrance and for 50 miles eastward to Race Rocks, the strait has a width of about 12 miles, and thence it has a width of about 16 miles for 30 miles, eastward to Whidbey Island, its eastern boundary. The waters as a rule are deep to within a short distance of the shore with a few outlying dangers, most of which are in the eastern part. The shores on both sides are heavily wooded, rising rapidly to elevations of considerable height, and except in a few places, are bold and rugged.

The northern shore should be avoided as it is the lee shore for most gales, and, with the exception of Esquimalt Harbor, there are no anchorages for strangers that afford shelter from all winds.

The navigation of these waters is simple in clear weather. The aids to navigation are numerous and the chart is a good guide. In thick weather, because of strong and irregular currents, extreme caution and vigilance must be exercised. Strangers should take a pilot.

Radiobeacons on Swiftsure Bank Lightship, Umatilla Reef Lightship, and at Cape Flattery Light Station afford the navigator an excellent opportunity for frequently fixing his position in approaching the Strait of Juan de Fuca.

**Boundary lines of Inland Waters.**—The line established for the Strait of Juan de Fuca is described in § 82.120, Chapter 2.

**Routes.**—Vessels bound for ports in Puget Sound can proceed by rhumb lines through the following positions:

48°26' N., 124°47' W. (from southward).

48°31' N., 125°00' W. (from westward).

48°16' N., 123°31' W.

48°10' N., 122°45' W.

A midchannel course can be followed through Admiralty Inlet and Puget Sound to Seattle.

**Currents, Cape Flattery to Race Rocks.**—The currents may attain velocities of 2 to 4 knots, varying with the range of tide, and are influenced by strong winds. Eastward of Race Rocks, in the wider portion of the strait, the velocity is considerably less. At Race Rocks and Discovery Island the velocity may be 6 knots or more. Along the Vancouver Island shore the currents turn about 1½ hours earlier than on the Washington shore of the strait, and advantage is frequently taken of this by vessels having an adverse current in the strait.

The flood current entering the Strait of Juan de Fuca sets with considerable velocity over Duncan and Duntze Rocks, but instead of running in the direction of the channel, there is a continued set toward the Vancouver Island shore which is experienced as far as Race Rocks. The flood current has also more velocity on the northern shore of the strait than on the southern.

The ebb current is felt most along the southern shore of the strait, and between New Dungeness Light and Crescent Bay there is a decided set southward and westward, especially during large tides. With the wind and swell against the current, a short choppy sea is raised near the entrance to the strait.

The current movement is complicated by a large daily inequality. The Tidal Current Tables, Pacific Coast, should be consulted for times and velocities.

**Tide rips** occur off the prominent points and in the vicinity of the banks. These are particularly heavy off Cape Flattery, Race Rocks, Dungeness Spit, and Point Wilson, at times becoming dangerous to small vessels.

**Pilotage.**—All vessels are subject to pilotage eastward of Port Angeles, inside the international boundary line extending southward to and including Olympia, except vessels under enrollment and vessels engaged exclusively in the coasting trade on the west coast of the continental United States, including Alaska, and/or British Columbia.

Port Angeles has been designated as the pilotage station for all vessels en route to or from the sea. On vessels en route to or from British Columbia ports, pilotage will apply from or to specific points on the international boundary line set forth in the Puget Sound Pilotage Tariff. Pilots may be obtained at Port Angeles, or upon request, at the Puget Sound Pilots office, Seattle.

Vessels desiring a pilot should proceed to a point 500 yards east of Ediz Hook where a pilot will board the vessel. In clear weather vessels should indicate their desire for a pilot by hoisting the International Code Flag G and by blowing one long blast, one short blast, and one long blast on the whistle. In fog or thick weather the whistle

signal will attract the attention of the pilot station and repetition of this signal will assist the pilot boat in locating the vessel. The Pilot Station is 1,200 yards westward from Ediz Hook Light. At night the station will show from a mast 3 vertical lights, the highest and lowest being red and the middle one blue to indicate that the pilot boat is en route to the ship. The marine radar installation at the Ediz Hook Station is used to coordinate contacts with ships and to expedite contact between pilot boats and ships.

Vessels may insure prompt dispatch by advising their ETA Ediz Hook 24 hours in advance, via radio to station KLB addressed Puget Sound Pilots, Seattle, Washington, code word PILOTS. A vessel may also communicate direct with the Pilot Station, Port Angeles, Washington, code word EDIZ, to advise their ETA and amended ETA when subsequent conditions make it desirable. The message is transmitted immediately from KLB to Port Angeles via teletype transmitter.

In an emergency vessels equipped with radiotelephone may call the Coast Guard Air Station on Ediz Hook, call letters NOW, frequency 2670 kc., or 2182 kc., who will transmit the message to the Pilot Station. The Pilot Station is equipped with a signal searchlight for signalling via flashing light.

In British Columbia pilots may be obtained on application at Vancouver or Victoria. A boarding station has been established within a radius of 7 miles of Race Rocks.

Towboats will be found at Port Angeles and can be had by signalling the Cape Flattery Light Station.

**Quarantine.**—Vessels subject to quarantine usually proceed to their docks where they are boarded for inspection.

**Strait of Juan de Fuca, northern shore (Canada).**—Carmanah Point is described in the previous chapter. **Bonilla Point**, the northern entrance point at the western end of the strait, is about 1.8 miles east-southeastward from Carmanah Light. Inland of Bonilla Point, which slopes gradually to the sea, the mountains attain heights up to 3,515 feet and are heavily wooded. A conspicuous house is about 0.5 mile eastward of the point. A reef extends 0.5 mile off the point and the shores should be given a berth of at least 1.5 miles.

From Bonilla Point the coast trends in an easterly direction for 9.5 miles to Owen Point. It is nearly straight, rocky, and bluff, with high mountains rising immediately behind it; all heavily wooded. Vessels are apt to lose the wind near the shore.

**Port San Juan** offers the first anchorage on the northern shore within the entrance to the Strait of Juan de Fuca. The port is conspicuous from seaward, appearing as a deep gap between two mountain ranges.

The entrance between **Owen Point** and **San Juan Point**, 2 miles wide and 3.5 miles long, is 13 miles northeastward of Cape Flattery Light. It is marked by a lighted whistle buoy.

The port is open to southwesterly winds, and a heavy sea rolls in when a moderate gale is blowing from that direction. Though it is possible that a vessel with good ground tackle could ride out a gale if anchored in the most sheltered part, it is recommended that, with any

indication of southwesterly gales, a vessel should weigh anchor immediately, and if outward bound, seek shelter in Neah Bay.

Anchorage may be had in depths of 6 to 9 fathoms anywhere in Port San Juan; a good position is in a depth of 6 to 8 fathoms about 1.5 miles from the beach at the head of the port.

**Cerantes Rock** is one of a group, some of which are high pinnacle rocks with a few trees growing on them, on shoal ground which extends about 300 yards southwestward from San Juan Point. About 800 yards northward of these rocks and 300 yards from shore is another reef partly out of water.

**Port Renfrew** is a settlement with telephone facilities and a post office on the southeastern side of Port San Juan about 2 miles northeastward of San Juan Point. A substantial wharf is available; it has a length of 900 feet and a depth alongside of 15 feet. A light is shown from the wharf.

From Port San Juan the coast trends eastward for 23.5 miles to Sheringham Point. This stretch of coast presents no prominent features. The country is thickly wooded and the land rises to a considerable elevation. The points, some of which are bare on their extremities, are not prominent nor are they easily identified, except from close inshore.

From Port San Juan to Race Rocks, fish traps and broken piles are reported to extend 0.5 mile offshore in places.

**Chart 6382.**—**Sheringham Point** is marked by a light 72 feet above the water and visible 14 miles, shown from a white hexagonal tower having a white dwelling with a red roof attached. A fog signal is at a white square building close southward of the light.

From Sheringham Point the coast continues in an easterly direction for 16.5 miles to Race Rocks, and consists of a number of bays or inlets including **Sooke Bay**, **Sooke Inlet**, and **Becher Bay**, none of which are of more than local importance.

**Beechey Head**, about 11.5 miles southeastward of Sheringham Point, is bold, wooded, and steep-to. Vessels bound up the strait and passing outside Race Rocks should give Beechey Head a berth of 2 miles.

**Race Rocks**, a cluster of low, bare islets or rocks, the outermost lying about 1 mile southeastward of Bentinck Island, occupy a space of about 0.5 mile in extent. With the exception of Great Race Rock, which is 200 yards long and 30 feet high, they are small, a few feet above water or awash at low water. For a distance of about 0.5 mile southeastward of the group the bottom is foul and during bad weather, heavy, dangerous overfalls and races occur. In light winds, sailing vessels should give this group a good berth, especially when to the eastward of them, as the ebb sets in their direction.

Race Rocks Light on Great Race Rock, 118 feet above the water and visible 18 miles, is shown from a circular stone tower painted in alternate black and white horizontal bands with a dwelling attached. A radiobeacon and a fog signal are at the light. Four short blasts, in

answer to the fog signal of a vessel in the strait, will indicate that the northern portion of the strait is clear of fog.

Foul ground, due to dumping of heavy steel wire mesh material, exists 3.2 miles west by south from Race Point Light.

**Rosedale Rock**, with a least depth of 3 feet over it, lies 0.4 mile southeastward of Race Rocks Light. Rocky, uneven bottom, with depths of 5 to 8 fathoms, extends 0.5 mile eastward of the rock. A buoy is 200 yards southward of the rock, which should be given a berth of not less than 1 mile to avoid the tide rips and currents in its vicinity which set toward it and the reefs near it with great velocity.

Eastward of Race Rocks the Strait of Juan de Fuca expands to a width of about 16 miles, and extends for 30 miles east-northeastward to the entrance to Admiralty Inlet on the south, and Rosario Strait on the north. San Juan Archipelago, comprising the numerous channels and islands northward of its eastern end, is described later in this chapter.

A 25-fathom bank is about 8.5 miles southeastward of Race Rocks along the steamer track from Race Rocks Light to Point Wilson Light. The western edge of this bank is sometimes sharply defined by a line of ripples with glassy calm water to the eastward.

**Race Passage** with a width of about 0.5 mile, leads between the dangers off Bentinck Island and those of Race Rocks. Because of the strong tidal currents and the races caused by the irregular nature of the rocky bottom this passage is not recommended.

**Bentinck Island**, about 150 feet high and 1,200 yards long, lies off the shore between **Christopher Point** and **Edye Point**, about 1 mile northeastward. The island is fringed with kelp on its southern and eastern sides, and like the adjacent land, covered with pine trees. An islet 7 feet high lies close off **George Point**, the southeastern extremity. The Government leper station is on Bentinck Island. **Pedder Bay**, **Parry Bay**, and **Royal Roads**, separated by **William Head** and **Albert Head**, form the coast between Bentinck Island and the western entrance to Esquimalt Harbor.

A measured nautical mile, on a  $027^{\circ}43'$  course, is in Parry Bay. The northeastern marker is located on **Goat Islet**, southwestward of **Albert Head**. The markers, except the rear marker of the south range, are white diamond-shaped superstructures with black vertical stripe down the center, on a post. The rear marker of the south range is a white triangular-shaped structure with black vertical stripe down the center, with the base at ground level. Each pair of markers is in line bearing  $297^{\circ}43'$ . Mariners are warned to keep clear of any vessel running full power trials in this area.

**William Head** is a comparatively low promontory extending about 0.5 mile northeastward of **Ned Point**. The southeastern side of this promontory is foul for a distance of about 200 yards offshore.

The quarantine station for Victoria and other ports is on **William Head**. All vessels from foreign ports are required to contact this station, where they may be granted

permission to proceed to their docks for inspection. Vessels should notify the quarantine station by radio of their expected time of arrival. Reciprocal quarantine inspection has been arranged between Canada and the United States; vessels from foreign ports destined for both Canadian and continental United States ports (including Alaska), shall undergo inspection at the primary port of arrival, such inspection ordinarily being sufficient for entry at the port of the other Government.

Anchorage may be had northward of **William Head**; a good position is in a depth of 7 fathoms about 0.5 mile northward of **William Head** and about 1,200 yards from the mainland.

**William Head Light**, 37 feet above the water and visible 10 miles, is shown from black pyramidal structure on the northeastern extremity of the head; a fog signal is at the light.

**Constance Bank**, with general depths of 10 to 13 fathoms, about 2 miles long and 1 mile wide, is within the 20-fathom curve. The least depth of 9 fathoms lies near the northern end of the bank at about 6.8 miles eastward of **William Head Light**. The bottom is rocky and tide rips are formed in this vicinity. Vessels should not attempt to anchor on the bank.

**Albert Head Light**, 90 feet above the water and visible 14 miles, is shown from a black square tower surmounted by a white daymark on the southeastern extremity of the headland; a fog signal is at the light. A rock with a depth of 8 fathoms over it is about 0.68 mile east of the light.

**Fisgard Island Light**, 71 feet above the water and visible 12 miles, is shown from a white circular tower with a red brick dwelling attached, on the western side of the entrance to Esquimalt Harbor. There is a red sector from  $195^{\circ}$  to  $332^{\circ}$ . To clear **Scroggs Rocks** off the eastern entrance point of Esquimalt Harbor the light must show white in approaching from the eastward.

**Chart 6380.—Esquimalt Harbor** affords safe and ample anchorage, and can be entered at any time. The entrance channel has a width of 400 yards with general depths of 8 fathoms and leads between **Duntze Head** and the dangers off **Fisgard Island**. Immediately within the entrance the harbor is broadened to a width of 1 mile by **Constance Cove** and farther northward **Plumper Bay** also widens the harbor. Depths within the entrance gradually decrease for 1.5 miles northward to **Cole Island**, above which the head of the harbor dries. **Constance Cove** is reserved for British naval vessels eastward of a line from **Duntze Head** to **Ashe Head**.

Safe anchorage, in not less than 4 fathoms, may be had in any part of Esquimalt Harbor as far northward as **Dyke Point**, the northern entrance point of **Thetis Cove**, in the northeastern part of **Plumper Bay**. This cove offers suitable anchorage for small craft. Some parts of the harbor are open to direct southerly winds but they seldom blow and there is never sufficient swell to render anchorage inconvenient. If intending to make a lengthy stay vessels should moor for the winds are variable.

A triangular shaped spoil dumping area lies between

Esquimalt and Victoria Harbors. Its southern end is marked by a lighted buoy and its northwest corner is marked by a conical buoy, both painted yellow.

**Victoria Harbor**, which is landlocked and well protected, is about 2 miles east-southeastward of Esquimalt Harbor, and can accommodate the largest vessels. A U.S. Immigration station is in Victoria.

Victoria Harbor is entered between **Macaulay (Sailor) Point** on the west, and the breakwater extending from **Ogden Point** on the east. Vessels requiring a pilot are requested to notify "Pilots Victoria" by radio station **VAK** at least 6 hours in advance of their estimated time of arrival. The harbor extends for more than 0.5 mile northward to **Shoal Point** on the eastern side, and thence trends eastward to **James Bay**. From the northern extremity of **James Bay**, the upper harbor, which is crossed by three bridges, extends about 0.8 mile north-northwestward to **Selkirk Water**, the western extremity of which is connected to **Portage Inlet**. Between Macaulay Point and the breakwater the depths are 35 to 80 feet, decreasing northward, and off Shoal Point they are 18 to 22 feet. In **James Bay** and between Shoal Point and the upper harbor the depths vary from 18 to 27 feet; in the southern part of the upper harbor, the depths are 15 to 21 feet, and in the northern part, they are from 10 to 13 feet. In **Selkirk Water** the depths in the channel are from 6 to 10 feet.

**Brotchie Ledge**, the only outlying danger, about 200 yards in extent within the 5-fathom curve, is about 900 yards southwestward of **Holland Point** which is on the eastern side about 750 yards southeastward of **Ogden Point**; the ledge has a least depth of 12 feet. **Brotchie Ledge Light**, 26 feet above the water and visible 9 miles, is shown from a black conical base with a black square framework top; a fog signal is at the light. A lighted whistle buoy is about 2 miles southwestward of the light.

**Ogden Point Breakwater Light**, 40 feet above the water and visible 11 miles, is shown from a white pyramidal concrete tower on the outer end of the breakwater; a fog signal is at the light.

**Clover Point**, about 2 miles southeastward of the entrance to Victoria Harbor, is low, bare of trees, and steep-to. Strong tide rips which are formed off the point are dangerous to boats.

**Trial Islands**, about 4 miles eastward of Victoria Harbor, are bare and rocky; from most directions the two islands appear as one. The southern and larger island is 80 feet high, and from **Ripple Point**, its southern extremity, a rocky ledge which uncovers 2 feet at low water extends about 100 yards. The northern island is 25 feet high and from it foul ground extends halfway toward **Bold Point** and about 400 yards toward the middle of **McNeil Bay**. Severe tide rips are formed off **Ripple Point**, especially on the flood tidal current, which attains a velocity of 3 to 6 knots during large tides. The point should be given a wide berth.

**Trial Islands Light**, 85 feet above the water and visible 15 miles, is shown from a white square dwelling having a red roof, surmounted by a red cylindrical lantern, near the southern extremity of the islands; a fog signal is near the light.

**Discovery Island**, about 2 miles northward of **Gonzales Point**, lies at the junction of Haro Strait and the Strait of Juan de Fuca. The island is wooded, and near its southeastern extremity **Pandora Hill**, attains a height of about 125 feet. On all sides of the island the shores are fringed with rocks in some places extending as far as 600 yards offshore. The eastern end of the island is fringed with rocks, the outermost of which uncovers 9 feet at low water and lies about 350 yards north-northeastward of **Seabird Point**, the eastern extremity of the island.

**Discovery Island Light**, 91 feet above the water and visible 15 miles, is shown from a white square tower with a dwelling attached on the eastern extremity of the island; a fog signal is at a white square structure close eastward of the light.

A bank with depths of 15 to 20 fathoms extends about 1.5 miles in a northeasterly direction and its shoalest part is about 7.8 miles southward of **Discovery Island**.

**Strait of Juan de Fuca, east end.—Hein Bank**, with a least depth of  $2\frac{1}{4}$  fathoms over it, lies about 8.5 miles southeastward of **Discovery Island**; it is about 2 miles long in a northerly direction, within the 10-fathom curve, and 0.8 mile wide. The shoalest part of the bank is covered with thick kelp in the summer. On the north, east, and western sides of the bank the water deepens quickly; at its southern end the bank is continued for over 2 miles within the 20-fathom curve with a width of 1 mile. It is marked by a lighted bell buoy close northward of the shoalest part of the bank.

A danger zone for a Naval operations area for target practice is in the vicinity of **Hein Bank**; limits and regulations are given in § 204.221, Chapter 2.

**Smith Island** is 5 miles westward of **Whidbey Island** and 6.5 miles north-northwestward of **Point Partridge**. It is irregular in shape and about 0.5 mile in extent. The eastern end is low, but rises abruptly to an elevation of 55 feet at its western end, terminating in a white perpendicular cliff composed of sand and gravel. A field of kelp extends about 1.5 miles westward of the island, with a width of 1 mile and depths of  $4\frac{1}{2}$  to 5 fathoms. A sunken rock, bare at lowest tides, is reported 0.3 mile westerly of the light. **Smith Island Light** ( $48^{\circ}19.1' N.$ ,  $122^{\circ}50.5' W.$ ), 97 feet above the water and visible 16 miles, is shown from a skeleton tower with a white square daymark near the western extremity of the island; a radiobeacon is at the light.

**Minor Island**, small, low, and rocky, lies 1 mile north-eastward of **Smith Island**, and at lowest tide is connected with it by a gravel and boulder spit. A light and fog signal are on the island.

**Whidbey Island**, northward of **Admiralty Head**, forms the eastern side of the Strait of Juan de Fuca. This part of the island has uniformly sandy shore backed by low and rolling upland, about evenly divided between farm and cutover timberland.

A Naval restricted area is off the westerly shore of **Whidbey Island**; limits and regulations are given in § 207.750, Chapter 2.

**Chart 6265.—Strait of Juan de Fuca, southern shore.**—Cape Flattery, the southern point at the entrance, has been described in the previous chapter.

From Cape Flattery the coast trends east-northeastward for 4 miles to **Koitlah Point**, the western point at the entrance of Neah Bay. The shores are rugged and the country is heavily timbered.

**Chart 6266.—Neah Bay**, about 5 miles eastward of Cape Flattery, is used extensively by small vessels as a harbor refuge when the weather is too severe to venture outside. Its proximity to the entrance to the strait and ease of access at all times makes this anchorage very valuable. A rubblestone breakwater approximately 8,000 feet long extends from the western side of the bay to about the middle of Waada Island. Anchorage is in depths varying from 4 to 6 fathoms, sandy bottom. **Waada Island**, about 0.5 mile long and 250 yards wide, forms the northeastern side of the bay; it is 0.3 mile northward of Baada Point and is high and wooded, with a reef and foul ground extending 0.2 mile from its southwestern side. A wharf is on the southwestern side of the island just southward of the foul ground. A light and fog signal are on the northern end of the island. A red sector from 098° to 107° covers Duntze and Duncan Rocks.

The western shore of Neah Bay is high, precipitous, and bordered by craggy outcropping rocks. A reef, bare at low tide and marked by kelp, extends in places a distance of 0.2 mile from the beach. From the town, the character of the shore changes to a low, sand beach, which continues to Baada Point.

Between Waada Island and the mainland southeastward is the entrance channel, having a depth of about 20 feet. A light and fog signal are on the southeastern end of Waada Island.

A reef, bare at low tide and marked by a lighted bell buoy, extends 500 yards northwestward from **Dtokoah Point** at the southeastern entrance to the bay. **Baada Point**, across the entrance channel from Waada Island, is rocky and grass-covered for some distance back from the shore. The buildings of the Coast Guard station, 0.4 mile southwestward of the point, are the prominent features on the point. A T-head pier, 470 feet long, is 500 feet eastward of the Coast Guard launching ways. A group of small white houses are between the pier and the point. See Appendix for storm warning display.

**Neah Bay**, in the southwestern part of the bay, is a large Indian village with a post office and daily mail service. Fishing and logging are the principal industries. Logs are trucked to a boom on the breakwater, 900 yards from the western end, where rafts are made up.

**Directions.**—To enter Neah Bay, pass 100 yards north of the lighted bell buoy, then steer 240° to pass 100 yards north of the outermost wharf in the entrance channel until past buoy 2.

**Pilotage and towage.**—Pilots and towboats are stationed in Port Angeles.

**Customs.**—Neah Bay is a port of entry.

**Supplies.**—Fresh water, diesel oil, fuel oil, and gasoline can be obtained in limited quantities. Gasoline, diesel

oil, and water are piped to the fish wharves; a limited amount of provisions may be obtained.

A cooperative fish wharf, built out to 18 feet from the middle of the south shore of the bay, has facilities for icing and supplying fishing boats. About 400 yards westward is another fish wharf extending out to 18 feet. The ruins of a third wharf are in the southwest part of the bay.

**Communications.**—Telephone service is available to Port Angeles via commercial lines at all times and to Tatoosh Island, via Coast Guard lines, in emergencies only. There is bus service to Port Angeles four times weekly, but it is not dependable.

**Dtokoah Point** and **Klachopis Point** are 0.3 and 0.6 mile, respectively, eastward of Baada Point. Two bights, **First Beach** and **Second Beach**, separate the three points.

**Chart 6300.**—From Neah Bay to Clallam Bay, the coast trends eastward for about 14 miles. The shores are rugged and the country is high and heavily wooded.

**Seal Rock** and **Sail Rock**, 660 and 560 yards offshore, respectively, lie about 2 miles eastward from Neah Bay. Seal Rock, the western one, is 100 feet high, and has a flat top, sloping eastward; it is light in color. Sail Rock is 0.2 mile eastward of Seal Rock; it is lower and more pointed than Seal Rock. Both are prominent landmarks. A line of sunken rocks extends from Seal Rock to the point 1.2 miles 130° from it. There are patches of kelp between Seal Rock and the shore and along the line of sunken rocks.

The wreck of the steamer **ANDALUCIA**, beached with a fire aboard in November 1949, is just off Seal Rock and Sail Rock. The hull is in several pieces and is no longer prominent. Kelp and some rocks extend over 400 yards off a point 5 miles eastward from Seal Rock.

**Sail River** empties near Seal and Sail Rocks. **Sekiu River**, about 6.5 miles eastward, has some logging operations. The railroad trestle over the river shows prominently through the trees.

**Hoko River** enters the strait at **Kydaka Point** about 11 miles eastward of Neah Bay.

**Clallam Bay**, about 15 miles eastward of Neah Bay, is a broad and open bight about 2 miles long and 1 mile wide. It affords anchorage in 9 to 10 fathoms, sandy bottom, and is used to some extent in southerly or thick weather.

**Slip Point**, the eastern point of the bight, is high and wooded; there is a light-colored streak like a landslide down its face, which is visible for a long distance. A reef extends about 0.2 mile westward of the point. A bell buoy is off the end of the reef. **Slip Point Light** (48° 15.9' N., 124° 14.9' W.), 55 feet above the water and visible 13 miles, is shown from a white square tower on a pile structure on the western extremity of the point; a fog signal is at the light.

**Sekiu** is a town on the western end of Clallam Bay and southward of Sekiu Point. There is telephone, truck, and bus service with Port Angeles and Neah Bay. The logging company's tugs, tankers, and steamers call occasionally;

there is no regular freight service by water. The logging wharf has a depth of 15 feet. Log rafts are made up here for shipment.

**Clallam Bay** is a small town on the eastern side of Clallam Bay. Pleasure boats are launched from the beach by means of an overhead cable extending out past the breaker line. A limited amount of general merchandise may be had here.

No directions are necessary for entering other than to give Slip Point a berth of not less than 0.2 mile to avoid the reef projecting westward of it, which is marked by a bell buoy. Storm-bound vessels generally anchor abreast the rocky point near the middle of the long semicircular beach on the southern shore of Clallam Bay.

From Slip Point the coast trends eastward for 6.5 miles to Pillar Point and then east-northeastward for 15.5 miles to Crescent Bay.

**Pillar Point** is a bold point 700 feet high, wooded to the summit, with a dark pillar-shaped rock over 100 feet high lying close under its eastern face. The rock shows prominently from westward.

**Pysht River** discharges into a small bight a mile southward of Pillar Point. The water shoals rather suddenly off the mouth of the river, but good anchorage may be had in 9 to 12 fathoms, sticky bottom, about 0.8 mile southeastward of Pillar Point. This anchorage offers good shelter from the heavy westerly swell, but has no shelter from the brisk easterly and northeasterly winds which prevail in the winter.

Pysht, near the mouth of the Pysht River, is a village with a post office. It has telephone and bus connections. Log rafts are made up for shipment to sound ports.

**Chart 6382.—Twin Rivers**, about 7 miles eastward of Pillar Point, is a small cove protected by shoal spits on either side of it, upon which the sea breaks in rough weather. This cove is about 600 feet wide and indents the shore about the same distance. Both spits are heavily covered with kelp, especially the eastern one. There are depths of 4 fathoms abreast the ends of the spits, and 2 fathoms can be carried close to shore. The cove is an excellent landing place, but offers little protection as an anchorage. Entry can be made between the spits by heading on bearing 180° midway between the rivers which are easily identified.

**Twin** is a small settlement. There are motorbus and rail connections with Port Angeles.

**Gettysburg**, a hamlet at the mouth of Lyre River, is 11.5 miles eastward of Pillar Point. Shoal water makes out a considerable distance from **Low Point**, the eastern entrance point of Lyre River, and vessels should not approach this point closer than 0.8 mile. There are many boulders, bare at low tide, westward of the point.

**Agate Bay**, about 3.5 miles eastward of Gettysburg, is clear and deep; 10 fathoms can be carried to within 0.2 mile of the shore.

**Crescent Bay**, 15 miles eastward of Pillar Point, is a small semicircular bight 1 mile in diameter. The eastern part is shoal and near the western shore the remains of a wharf should be avoided. This is not a good landing

place in northerly weather. The anchorage is of limited extent and suitable only for small vessels. The town of **Port Crescent** has been abandoned, and all buildings and the wharf, which extended from the western shore, have been destroyed by fire.

**Crescent Rock**, with a least depth of  $\frac{1}{4}$  fathom, is 0.4 mile northward of the western entrance point of Crescent Bay. It extends 0.4 mile in an easterly direction, with a narrow channel between it and the point. The channel, with a reported depth of 10 fathoms, is used by the small coasting steamers with local knowledge, but is not recommended for those without local knowledge. The rock is marked by a lighted bell buoy, about 50 yards northward of the shoalest part. A reef extends about 400 yards northwestward from **Tongue Point**, the eastern entrance point of Crescent Bay. A shoal, with a least depth of  $\frac{1}{4}$  fathoms, lies about 0.3 mile westward of Tongue Point. The wreck of the **DIAMOND KNOT** lies off the entrance to Crescent Bay about 600 yards north of Tongue Point.

**Observatory Point** is about 3 miles eastward of Tongue Point. Between these points is a wooded ridge which, because of the lower land behind it, appears as an island when raised from eastward or westward. The ridge attains an elevation of 1,135 feet. On its north face is a conspicuous landslide; the hill is known as **Striped Peak**. A rock, 20 feet high and having a single tree on its summit, lies close off Observatory Point; the rock and the point are almost joined at low water.

**Freshwater Bay**, about 5 miles eastward of Crescent Bay, is a broad, open bight, affording anchorage in 6 to 10 fathoms. It is little used on account of the lack of shelter and its proximity to Port Angeles. There is an old log dump in about the center of the bay at the mouth of **Covill Creek**. Shingles are shipped at times by rail or truck from the bay.

The bay and adjacent waters are designated as an **emergency explosive anchorage**; limits and regulations are given in § 202.230, Chapter 2.

**Angeles Point**, on the eastern side of Freshwater Bay, is low, sandy, and covered with alders. The **Elwha River** empties into the strait at this point. Small boats can enter the mouth under favorable conditions.

**Chart 6303.—Port Angeles** is about 6.5 miles eastward of Freshwater Bay and 56 miles from Cape Flattery; the entrance is about 11 miles southeastward of Race Rocks Light and is included between **Ediz Hook**, a low, narrow and bare sandspit, 3 miles long, and the main shore to the southward. The harbor is about 2.5 miles long with a width of 1.2 miles at the entrance, decreasing to half that width at the head. The harbor is easy of access by the largest vessels and is frequently used by them when weatherbound awaiting orders, or a tug.

The harbor is protected from all except easterly winds which occasionally blow during the winter months. During southeasterly gales in winter, the wind is not usually felt but some swells roll into the harbor. The depths are greatest on the northern shore, and decrease from 30 to 15 fathoms in the middle of the harbor; from the middle, the depths decrease regularly to the southern

shore, where the 3-fathom curve in some places in the eastern part is nearly 0.2 mile from the beach. A depth of 25 feet is north of the southeasternmost dock. The best anchorage is off the wharves, in 7 to 12 fathoms, sticky bottom.

**Ediz Hook Light (48°08.4' N., 123°24.5' W.),** 85 feet above the water and visible 15 miles, is shown from the top of the Port Angeles Air Station control tower, about 660 yards westward of the eastern extremity of Ediz Hook. The radiobeacon and the fog signal near the eastern extremity of the point are synchronized for distance finding. A lighted bell buoy is off the point.

**Port Angeles** is on the southern shore of the harbor. Lumber, logs, pulpwood, and plywood constitute the greater part of the traffic, although considerable oil is brought in by tankers.

A shoal with a least depth of 3 fathoms lies 350 yards northwestward of the northwest corner of the Rayonier, Inc., wharf which projects from the southern shore eastward of the town. A buoy is 225 yards off the north end of the wharf.

There is a harbor for craft drawing up to 12 feet just westward of the Port Angeles wharf, in the southwestern part of the bay. Protection is afforded by timber bulkheads and spoil fill.

**Directions.**—No directions are necessary. Vessels may round Ediz Hook at a distance of over 200 yards and proceed to the wharves or select anchorages as desired.

See Appendix for storm warning display.

**Pilotage.**—Pilots for Puget Sound may be had at Port Angeles. Pilots for Alaska may be had there by prior arrangement. The Pilot Station is 1,200 yards westward from Ediz Hook Light. A dock for moorage of the pilot boat is on the south side of Ediz Hook, adjacent to the pilot station.

Vessels desiring a pilot should proceed to a point approximately 1,000 yards east of Ediz Hook, where a pilot will come aboard. In clear weather vessels should indicate their desire for a pilot by hoisting the International Code Flag G, and by blowing one long blast, one short blast, and one long blast on the whistle. In fog or thick weather the whistle signal will attract the attention of the pilot station, and the pilot boat will answer with a like signal to indicate that the pilot is en route to the vessel.

Vessels may insure prompt dispatch of a pilot by notifying Ediz Hook their estimated time of arrival 24 hours in advance, amending the information if necessary, via radio to Puget Sound Pilots, Seattle, Wash.; code word PILOTS.

**Towage.**—Small towboats are always available, and others can be obtained on short notice.

**Quarantine.**—Vessels subject to quarantine usually proceed to their docks where they are boarded by quarantine officers for inspection. Vessels from foreign ports which expect to enter both Canadian and U.S. ports may receive their inspection either at William Head, Canada, or at a U.S. port; no further inspection being required. Quarantine officers when needed are sent from Seattle.

**Customs.**—Port Angeles is a port of entry.

**Immigration officials** are stationed at Port Angeles.

**Harbor regulations.**—The port of Port Angeles Commission office is at the Port Docks. Complete copies of the harbor regulations may be obtained from the harbor-master of the city of Port Angeles.

**Terminal facilities.**—There is one wharf for general cargo, one for gravel, and one for fuel. The port of Port Angeles maintains a wharf 147 feet by 552 feet with a depth of 30 feet alongside, equipped with transit sheds and modern loading facilities. There is a large crane on the wharf which is used occasionally to lift out small fishing craft of 10 to 12 tons, for repairs. The sawmills and forest products companies have their own exporting wharves with depths ranging from 24 to 34 feet.

**Supplies.**—Water, provisions, and ship chandlery may be obtained; coal is not kept on hand but can be arranged for. There are several oil companies from whom fuel oil, diesel oil, or other petroleum products may be obtained.

**Repairs.**—There are no drydocks at Port Angeles, but it has two small marine railways suitable for ordinary fishing craft. Minor repairs to hulls and machinery may be made at several machine shops and iron works in the city.

**Communication** may be had by rail with Port Townsend and with Puget Sound and British Columbia ports by telephone and telegraph. There are bus and airplane services to Seattle, and an automobile ferry to Victoria, British Columbia.

**Chart 6382.**—From Port Angeles the coast trends eastward for 5 miles to **Green Point**, and thence northeastward for 8 miles to the end of **Dungeness Spit**.

**Dungeness Bay** is about 12 miles eastward of Port Angeles. It affords shelter in westerly winds, but is open eastward, and in northerly weather the protection afforded is only fair. It is a dangerous place in winter gales, especially from the southeast. The bay is formed by a sandspit extending northeastward 4 miles, and forming, in addition to Dungeness Bay, a small lagoon at the head of the harbor, which can be entered by light-draft vessels with local knowledge.

**New Dungeness Light (48°10.9' N., 123°06.6' W.),** 87 feet above the water and visible 14 miles, is shown from a white conical tower on a dwelling on the outer end of the spit; the radiobeacon and the fog signal are synchronized for distance finding. See Appendix for storm warning display.

From the end of the spit a shoal extends northeastward for 0.8 mile from the light. This has been reported as extending farther northward and it should be passed with caution. A buoy marks the shoal; vessels should not pass between the buoy and the light. From the southern side of the bay a shoal makes out about a mile, and in the vicinity of the wharf ruins this shore is bordered by mud flats.

The best anchorage is in 5 to 9 fathoms, sticky bottom, about 1 mile southward of the light.

**Dungeness** is a small town on the southern shore of the

bay. Farm produce is the principal shipment. The ruins of a former wharf extend 4,000 feet out across the flats. Communication with Puget Sound ports is by bus.

**Chart 6403.**—**Sequim Bay** is a landlocked bay 3.8 miles long and 1 mile wide. From the eastern entrance point a sandspit extends westward almost to the western shore and terminates in **Kiapot Point**, leaving only a narrow, winding channel, through which 11 feet can be taken at low water with local knowledge. Northward of this point a shoal extends about 800 yards eastward from the western shore, and southward of the point a bar extends across the fairway. Once inside there is good anchorage anywhere in 6 to 20 fathoms, muddy bottom. The harbor is seldom used and can be approached only by those with local knowledge. A cannery with conspicuous white buildings is on the western side of the entrance to the harbor abreast the sandspit. A wharf with an incline leading to a clam-shipping plant is on the east side of the bay. Some log rafts are made up in the bay. **Sequim Bay State Park** is at the southwestern end of the bay.

**Blyn**, of little commercial importance, is in the southeastern part of the bay.

To enter Sequim Bay proceed close in along the sandspit about 100 yards or less from shore. When rounding **Kiapot Point**, pass to the western side of the channel and continue southward close to shore (not over 100 yards off) until past a rather prominent whitewashed rock, maintained locally as an aid. Then steer  $150^\circ$ , clearing **Pitship Point** by 500 to 600 yards, into deep water. The least depth in this channel is 11 to 12 feet.

**Protection Island** is a prominent feature in approaching Port Discovery. The island, 200 feet high near its western extremity, is 1.5 miles long and 0.5 mile wide; it is sparsely wooded and the northern shore consists of bare, light bluffs. The eastern end and southern shore are clear of dangers, but off **Kanem Point**, its southwestern extremity, a shoal extends southwestward for over 0.2 mile, and depths of 5 fathoms and less are found 0.5 mile westward of the point. This shoal is marked by a buoy about 0.8 mile west-southwestward of **Kanem Point**. **Dallas Bank** extends northward from Protection Island; the 10-fathom curve lies about 2.5 miles from the northern point. Northward of the 10-fathom curve the bank drops off abruptly to depths of over 20 fathoms.

**Port Discovery** is about 2 miles south-southeastward of Protection Island. George Vancouver, the English explorer, anchored and refitted his ships here for commencement of his exploration of these regions in 1792. The bay trends in a southeasterly direction for about 8 miles and has an average width of 1.2 miles. The entrance is masked from seaward by Protection Island, which also protects it from northwesterly winds. There are no outlying dangers, and the depths in midchannel range from 30 fathoms, at the entrance, to 10 and 12 fathoms 1.5 miles from the head; good anchorage may be had in 8 to 10 fathoms, muddy bottom. The flat rises abruptly from depths of 3 and 4 fathoms, and at high water care should be taken to avoid anchoring too close to them. This

harbor is seldom used as it is out of the usual lines of travel.

**Diamond Point** the western point at the entrance to Port Discovery, is the site of the former national quarantine station. The station is now in private ownership; the building remains but the wharf is in ruins. **Gardiner** is 2 miles southward of Diamond Point. The rafting of logs and the operation of two small sawmills at the head of the bay comprise the present commercial activities at Port Discovery.

No directions are considered necessary for entering and a mid-channel course is clear to the anchorage. Entrance may be made either eastward or westward of Protection Island.

The shore from **Cape George**, the eastern entrance point of Port Discovery, to **Middle Point**, a distance of about 3 miles, consists of high, bare, clay bluffs, sparsely wooded on top, attaining a height of 400 feet near the north-easterly end.

A shoal with 2 fathoms over it lies 0.6 mile northwestward of Middle Point; it is marked by a buoy. Vessels are cautioned not to pass between the buoy and the point because a sunken rock has been found southward and eastward of the shoal.

**Chart 6450.**—From Middle Point the shore trends northeastward for 3.5 miles to **Point Wilson**, the western point at the entrance to Admiralty Inlet, and consists of high, bare, clay bluffs, sparsely wooded on top, decreasing in height near Middle Point, and ending abruptly close westward of Point Wilson.

**Point Wilson Light** ( $48^\circ 08.7' N.$ ,  $122^\circ 45.2' W.$ ), 51 feet above the water and visible 13 miles, is shown from a white octagonal tower on a building on the eastern extremity of the low point; the radiobeacon and the fog signal at the light are synchronized for distance finding.

Shoals extend 0.5 mile northwestward of Point Wilson to the 5-fathom curve over irregular bottom; these are generally indicated by kelp. The eastern edge of the shoals rises rather abruptly from deep water. Heavy tide rips extend northward of these shoals, being especially heavy with a westerly wind and ebb current. A buoy is northward of these shoals about 0.7 mile northwestward of Point Wilson Light. The area in the vicinity of the buoy was examined by the wire drag in 1925 and no obstructions other than charted were found.

In approaching Point Wilson in thick or foggy weather, especially if the fog signal is not heard, vessels should obtain soundings constantly.

Admiralty Inlet is described in the following chapter. The western shore of Whidbey Island, between Admiralty Head and Point Partridge, is mostly a sandy beach rising sharply to bluffs 100 to 250 feet high, backed by pine trees. The shoreline is generally heavily strewn with logs.

A naval restricted area is off the westerly shore of Whidbey Island; limits and regulations are given in § 207.750, Chapter 2.

**Admiralty Head**, 80 feet high, on Whidbey Island, the

eastern entrance point of Admiralty Inlet, is the south-eastern extremity of a succession of light bare bluffs which extend northward of Point Partridge, where they attain their highest elevation. About 0.5 mile northward of Admiralty Head an abandoned lighthouse tower 39 feet high stands on top of a bluff.

**Point Partridge**, the westernmost point of Whidbey Island, has a yellow face and is prominent from the northward or southward; being rounding it is not easily identified from the westward. A light and fog signal are on the point.

A rocky ledge extends 0.5 mile westward from the point and in summer is usually marked by kelp.

From Point Partridge the northwestern coast of Whidbey Island extends north-northeastward 11.5 miles to Deception Pass. It is free of offlying dangers, but should not be approached within about 0.8 mile.

**Eastern Bank** lies about 4.5 miles west-southwestward of Smith Island. The general depths on the bank are from 11 to 19 fathoms, with two spots having a least depth of 10 fathoms, sand and gravel bottom.

**Partridge Bank**, within the 10-fathom curve, is about 3 miles long, 1.5 miles wide, and the southeastern extremity reaches within 2 miles of Point Partridge. The northern and eastern sides fall off abruptly to 20 and 30 fathoms. The shoalest part has a depth of  $2\frac{1}{4}$  fathoms and lies near the northern side about midway between the southeastern and northwestern ends of the bank; it is marked close northward by a buoy. A lighted bell buoy is about 0.6 mile south-southeastward of the  $2\frac{1}{4}$ -fathom spot. Depths of 4 and 5 fathoms extend 1 mile west-northwestward of the  $2\frac{1}{4}$ -fathom patch. A considerable part of the bank is covered with kelp which is usually drawn under by currents. The kelp generally extends to the 7-fathom curve, except toward the eastern end where the shoal narrows, and no kelp exists beyond a depth of 4 fathoms.

**Chart 6380.**—The waters of **San Juan Archipelago** embrace the passages and bays northward of the eastern end of the Strait of Juan de Fuca. These passages are used extensively by vessels bound for British Columbia and Alaska ports and by local steamers.

The directions which follow are intended for use only in clear weather; in thick weather or at night strangers should take a pilot. Sailing vessels should not attempt the passages against the current unless the wind is fair and fresh. The tidal currents have great velocity in places causing heavy tide rips that are dangerous for boats. Owing to the variable direction and velocity of the currents compass courses are of little value, and where followed, allowance must be made for the set of the currents.

**Haro Strait**, the westernmost of the three main channels leading from the eastern end of the Strait of Juan de Fuca to the southeastern end of the Strait of Georgia, is the one most generally used. Vessels bound from the westward to ports in Alaska or British Columbia should

use Haro Strait, as it is the widest and best provided with aids to navigation. Vessels bound northward from Puget Sound may use Haro Strait, San Juan Channel, or Rosario Strait.

From between Discovery Island and the southern part of San Juan Island, Haro Strait extends northward for about 16 miles to Turn Point Light on the western end of Stuart Island, and then bends sharply northeastward for 11 miles to its junction with the Strait of Georgia between East Point, the eastern end of Saturna Island, Canada, and Patos Island, both of which are marked by lights. The width varies from 2 to 6 miles, and the depths are generally great.

No difficulty will be experienced in navigating the strait in clear weather; in thick weather strangers should have a pilot.

The eastern shore of the strait will be described in detail, followed by a more general description of the western shore. More complete detail of the western shore is contained in Hydrographic Office Publication No. 175, Sailing Directions for British Columbia, Volume I.

**Caution.**—The International Boundary between the United States and Canada passes through Haro Strait. The position of the boundary is shown on the charts by a dotted line. The International Pilot Rules are used in Canadian waters and in the Strait of Georgia; the Inland Pilot Rules are in effect in United States waters south of the Strait of Georgia.

**Tidal currents.**—In Haro Strait the flood current sets northward through the strait, and the ebb in the opposite direction. On the average the ebb runs longer and has a greater velocity than the flood. At its northern entrance the flood sets eastward on both sides of Sucia Islands and eastward across Alden Bank. The velocity of the current in the strait is 1 to 5 knots at strength. Off Turn Point the ebb may attain a velocity of 6 knots during large tides. The current has moderate velocity between Sucia Islands and Orcas Island. There is a large daily inequality in the current and for times and velocities the Tidal Current Tables, Pacific Coast, should be consulted. These tables contain full daily predictions for a location off Turn Point. Heavy tide rips occur on Middle Bank and northward of it and around Discovery Island. Tide rips also occur between Henry Island and Turn Point on the ebb and around Turn Point. Heavy dangerous tide rips occur between East Point and Patos Island and for 2 miles northward in the Strait of Georgia. The flood current sets eastward from Discovery Island across the southern end of Haro Strait until close to San Juan Island. This eastward set is especially noticeable during the first half of the flood.

**Middle Bank**, which is rocky and has a least depth of 11 fathoms, lies in the southern approach to Haro Strait. The bank is about 3.5 miles in extent and the least depth is near the northeastern extremity of the bank and about 5.5 miles eastward of Discovery Island Light. In the vicinity of this bank heavy tide rips, which are dangerous to boats and small craft, are formed in bad weather.

Two small banks with depths of 7 and 8 fathoms lie about 3.2 miles 031° and 2.5 miles 045°, respectively, from Discovery Island Light. In bad weather heavy tide rips are formed over both of these banks. A small detached bank with a depth of 13 fathoms is 4 miles 071° from Discovery Island Light.

**San Juan Island**, the largest of the group, is about 13 miles long, with a greatest width of 6 miles. The island is rugged and partly wooded. **Mount Dallas**, the highest of several hills on the island, rises abruptly from the middle of the western side to a height of 1,036 feet. In most places the shores are free of outlying dangers. The northern end of the island is indented by several small bays which, with the exception of Roche Harbor, are shoal and of no commercial importance.

From **Eagle Point**, the western shore of San Juan Island trends northwestward and forms the eastern side of the southern part of Haro Strait. This shore is steep to and rocky, and beyond 400 yards offshore it is free of danger; however, the depth off this shore are too great for anchoring.

**False Bay**, 5 miles westward of Cattle Point, the southeastern extremity of the island, dries at low water and has a line of rocks across its entrance.

**Kanaka Bay**, a small cove used by fishing boats, is between False Bay and Pile Point.

**Lime Kiln Light** (43°31.0' N., 123°09.1' W.), 55 feet above the water and visible 13 miles, is shown from a white octagonal tower attached to a building on the west side of San Juan Island; a fog signal is at the light. Two dwellings are about 150 yards southeastward of the light.

Rocks awash at mean lower low water lie close inshore about 1 mile southeast by east of the light.

**Local magnetic disturbance.**—Differences from the normal variation of as much as 4° have been observed in the vicinity of **Bellevue Point**, 1 mile northward of Lime Kiln Light.

During the June-October fishing season, many purse seiners operate from the south side of Lopez Island to Kellett Bluff. At night these vessels anchor close inshore, generally between Cattle Point and Pile Point.

**Chart 6379.**—**Andrews Bay** is a small indentation about 2 miles northward of Lime Kiln Light.

**Hanbury Point** is about 1.8 miles northward of Andrews Bay. It is the northern entrance point of **Mitchell Bay**, in which the charted depths are less than 2 fathoms.

**Mosquito Pass**, which is available only to vessels of light draft and with local knowledge, is entered westward of Hanbury Point. About 0.7 mile northward of Hanbury Point a channel leads northeastward of Mosquito Pass to **Wescott Bay**, in the southern part of which is **Garrison Bay**. These bays are available only to small craft with local knowledge.

**Henry Island** is close westward of the northern point of San Juan Island, from which it is separated by Mosquito Pass and Roche Harbor.

**Kellett Bluff**, at the southern end of Henry Island, is steep and rocky and prominent from either southward or

northward. A light and fog signal are on the southwestern end of the bluff. **Open Bay**, east of Kellett Bluff, offers good holding ground and protection for small boats from northerly and easterly weather.

**Roche Harbor** has its main entrance on the eastern side of the northern end of Henry Island, between it and the western end of **Pearl Island** which is marked by a light. Sand spits with depths of 17 and 18 feet extend into the channel from the islands on each side of the entrance. Therefore, deep-draft vessels should not attempt to enter the harbor. The harbor, which is landlocked, is about 0.5 mile in extent and has depths of 5 to 8 fathoms. It affords good anchorage and in the summer is used extensively by yachts. The lime quarry has been abandoned and the former lime processing buildings are being dismantled (1957). There is a wharf with a depth of 13 feet at its outer end. A general store is on the wharf. A moorage for yachts is being constructed (1957). There are to be repair facilities, both hull and engine, for craft up to 60 feet long. Petroleum products, provisions, water, and electricity are to be available. There is a good road to Friday Harbor and other parts of San Juan Island. The customs officer stationed at Friday Harbor makes inspections at Roche Harbor by request.

**Battleship Island**, small, 30 feet high, with several trees on it, is about 0.2 mile west-northwestward of McCracken Point, the northern extremity of Henry Island, and is the western point in the approaches to Roche Harbor.

**Danger Shoal**, with a least depth of 1 fathom, is in the fairway to Spieden Channel about midway between Battleship Island and Spieden Bluff. A lighted bell buoy is close southwestward of the shoal which is marked by kelp at slack water.

A rock, marked by kelp with 2 fathoms over it, is about 200 yards northwestward of **Barren Island**; it is marked by a buoy close northwestward of the rock. Another rock, marked by kelp with 1 fathom over it, is about 350 yards eastward of the one marked by the buoy.

**Directions.**—To enter Roche Harbor from westward, pass 0.2 to 0.5 mile northward of Battleship Island on a 115° course until the middle of the entrance bears 199°. Stand on this bearing, keeping the entrance points of **Nelson Bay** at the head of the harbor just open, so as to see across the low neck of land at its head. Steer nothing eastward of midchannel in rounding the southwestern point of Pearl Island. Anchor in 5 to 7 fathoms, soft bottom.

From eastward, steer so as to pass 250 yards northward of the buoy marking the 1½-fathom rock northward of Barren Island; and, when up with this buoy, head for Battleship Island until the middle of the entrance bears 199° and thence proceed as directed in the preceding paragraph.

**Spieden Channel** leads eastward between Spieden Island on the north and Battleship, Henry, and San Juan Islands on the south; the channel leads from Haro Strait to President Channel and San Juan Channel. The eastern entrance, the narrowest part, is 0.6 mile wide, and for 2 miles westward of it the channel is free of danger. How-

ever, in the western entrance which has an irregular bottom are several dangers, but the fairway is deep throughout. The meeting of the flood currents, which flow eastward from Haro Strait and westward from San Juan Channel, causes heavy tide rips and eddies. This channel is not recommended for sailing vessels.

**Spieden Island** lies with **Spieden Bluff**, its northwestern extremity, about 1.5 miles north-northeastward of Battleship Island. The island is 2.5 miles long in an easterly direction with an extreme width of 0.5 mile. The eastern end, marked by a light, is low and grassy; there are few trees on the southern side of the island but the northern face is well wooded.

**Sentinel Island**, steep, wooded, and of small extent, lies about 300 yards off the southern shore of Spieden Island and near its western end. **Sentinel Rock**, low and bare, is about 400 yards westward of Sentinel Island; a sunken rock marked by kelp with  $\frac{3}{4}$  fathom over it is about midway between them. **Center Reef**, marked by kelp and bare at low water, is nearly 0.4 mile southwestward of Sentinel Rock.

**Chart 6380.**—**Stuart Island**, northwestward of Spieden Island, is wooded and has two rather prominent hills 640 feet high, near the middle of it. **Turn Point** is the western extremity which is bold and steep-to. **Turn Point Light** ( $48^{\circ}41.3' N.$ ,  $123^{\circ}14.2' W.$ ), 44 feet above the water and visible 12 miles, is shown from a white tower on the end of the point; a fog signal is at the light.

**Reid Harbor** indents the southeastern shore of Stuart Island and trends northwestward about 1.5 miles. The harbor, which is landlocked and 400 yards wide, affords good anchorage in depths of 4 to  $4\frac{1}{2}$  fathoms, soft bottom. The harbor is free of danger, but from the eastern entrance point foul ground is charted as extending about halfway across the entrance. Enter in midchannel and anchor anywhere in the middle of the wider portion of the harbor.

**Prevost Harbor**, on the northern shore about 1.5 miles eastward of Turn Point, affords good shelter and anchorage. There is a pier for small vessels and a state park on the southern shore. The village of **Prevost**, with 7 feet at the wharf, is on the western shore; it has a post office and a mail boat operates between the village and Anacortes. The Washington State Parks and Recreation Commission maintains a landing float for the use of small boats in the harbor.

**Satellite Island** lies within Prevost Harbor, with reefs and shoals extending off the southeastern extremity. Vessels should not pass eastward of the island. Enter in midchannel westward of Satellite Island and anchor in 6 to 7 fathoms, muddy bottom, in the middle of the wider portion just within the entrance, keeping clear of a rock that bares about 8 feet, about 200 yards off the southern shore.

**Johns Island** is close eastward of Stuart Island, and is separated from it by **Johns Pass**, which should not be attempted without local knowledge.

**Ripple Island**, **Cactus Islands**, and a number of small

islets and rocks lie southward and eastward of the eastern point of Johns Island, and between it and Spieden Island.

**Waldron Island**, steep and rocky on the eastern side, but flat with sandy beaches on the northern and western sides, is about 6.5 miles eastward of Turn Point. It is irregular in shape, 3 miles in length, with an extreme width of 2 miles. The highest point, 580 feet, is near **Point Disney**, its southern extremity. On the northern and eastern sides of the island there is a high, yellow sand bluff, terminating abruptly in **Point Hammond**.

**Cowlitz Bay**, which indents the southwestern shore of Waldron Island, is a broad, open bight affording anchorage in fair weather. Shoal water extends about 0.5 mile southward of **Sandy Point**, the western extremity of the island. **Mouatt Reef**, which has a least depth of  $\frac{1}{2}$  fathom and is marked by kelp, lies 700 yards offshore and 0.5 mile northward of Point Disney. The village of **Waldron**, with a wharf built out to 7 feet, is on the shore northeastward of Mouatt Reef. Waldron has a post office and a small general store.

San Juan Channel is described later in this chapter.

**Bare Island**, small, grassy, and bare of trees, is about 0.5 mile northwestward of Point Hammond, and **Skipjack Island**, 120 feet high and wooded, is about 1.2 miles westward. The passages between them should be avoided on account of the velocity of the current in their vicinity. A small, bare rock lies off the eastern end of Skipjack Island and another, awash, lies about midway between it and Bare Island. A light is on the northwest side of Skipjack Island.

**Patos Island** is about 4 miles north-northeastward of Point Hammond. The island is about 60 feet high and is wooded except at its western end toward which it gradually decreases in height. **Active Cove**, at the southwestern extremity of the island, is reported to be a good anchorage for small vessels with local knowledge. **Patos Island Light** ( $48^{\circ}47.3' N.$ ,  $122^{\circ}58.2' W.$ ), 52 feet above the water and visible 13 miles, is shown from a white square frame tower on a fog-signal house on **Alden Point**, the western extremity of the island; the radiobeacon and the fog signal at the light are synchronized for distance finding.

**Sucia Islands**, a group consisting of one large and several smaller islands, are southeastward of Patos Island. The large island, 60 to 160 feet high and heavily wooded, is horseshoe-shaped; its western side is a series of steep, wooded cliffs. **Echo Bay** indents the eastern side of the island, between **Johnson Point**, the southeastern extremity of the island, and **Ewing Island**, about a mile north-northeastward. In westerly weather small vessels with local knowledge can find good anchorage in depth of 4 to 5 fathoms near the head of the bay. At the head of **Fossil Bay**, on the southern side of Sucia Islands, there is a state park with a small-craft anchorage and float pier; fresh water is available.

**West Bank**, about 1.5 miles southward of Patos Island, is about 1 mile in extent within the 10-fathom curve. The least depth of  $1\frac{1}{4}$  fathoms is 1 mile westward of the western extremity of the westernmost of the Sucia Islands.

Depths of  $3\frac{1}{2}$  and  $3\frac{3}{4}$  fathoms lie within 0.5 mile eastward and southeastward of the shoalest spot. The channel between the bank and Sucia Islands is not recommended.

**Clements Reef**, about 0.5 mile northward of Sucia Islands, is about 1.2 miles long and 0.3 mile wide. It is marked by a buoy at its northern end. The channel between this reef and Sucia Islands should not be attempted without local knowledge.

**Boundary Pass**, the channel between Patos and Saturna Islands, is the widest and at present the most-used passage from Haro Strait to the Strait of Georgia. At times, however, the passage between Patos and Sucia Islands is preferable, especially for vessels from San Juan Channel, or for sailing vessels with a northwesterly wind.

The tidal currents are particularly heavy and dangerous between Patos Island and East Point and for 2 miles northward in the Strait of Georgia.

The passage between Patos Island and Sucia Islands is almost free of tide rips, and the tidal currents set more fairly through it and are less strong and more regular than in Boundary Pass.

**Haro Strait, southwestern approach (Canada).**—The various channels and passages leading between the islands and dangers off the coast of British Columbia from Gonzales Point to **Cadboro Point**, 2.8 miles north-northeastward, constitute the southwestern approach to Haro Strait. These passages and channels should be used only by vessels with local knowledge.

**Baynes Channel** leads to the southern end of Haro Strait from the northern ends of **Mayor Channel**, **Hecate Passage** and **Plumper Passage**. A buoy marks the northern extremity of **Fulford Reef** at the northeastern entrance to Baynes Channel.

Discovery Island has been described previously.

**Chatham Islands**, northward of Discovery Island, and separated from it by a narrow boat channel, are low, wooded, and almost joined at low water.

**Oak Bay**, southward of Cattle Point, except during southeasterly gales, affords fair anchorage to small craft with local knowledge.

**Cadboro Bay** indents the shore of Vancouver Island between Cattle Point and Cadboro Point. The bay is open to the southeastward, but is not subject to heavy seas, and vessels with local knowledge may obtain good anchorage in depths of  $4\frac{1}{2}$  fathoms near the entrance to the bay.

**Haro Strait, western side (Canada).**—Discovery Island and Chatham Islands are on the western side of the southern end of Haro Strait. Farther northward on the western side are the eastern coast of Vancouver Island and several islands and dangers.

**Johnstone Reef** is about 1.5 miles northward of Cadboro Point and about 0.7 mile offshore. The shoal is marked by a buoy about 300 yards north-northeastward of the  $1\frac{3}{4}$ -fathom spot.

**Zero Rock** is about 1.8 miles north-northeastward of

**Gordon Head.** The rock is of small extent and bares 10 feet. It is marked by a daybeacon—a pole surmounted by a triangular topmark, 25 feet high.

**Gordon Rock**, which bares at low water, is about 275 yards north of Gordon Head.

**Little D'Arcy Island**, 120 feet high, is the largest of several rocks and islets lying within 700 yards of the eastern and northeastern sides of **D'Arcy Island**.

**Unit Rocks**, of which the southernmost and highest dries 6 feet, are about 0.5 mile southeastward of the southern point of Little D'Arcy Island. Foul ground lies between these rocks and D'Arcy Island and also extends almost 800 yards northeastward from the rocks.

**Kelp Reefs**, on the western side but near the middle of Haro Strait, are about 2.2 miles northeastward of Zero Rock and about 7 miles northward of Discovery Island. The southernmost reef is awash; foul ground is between Kelp Reefs and D'Arcy Island. A light is on the northeastern reef.

**Sidney Channel** leads between Zero Rock and **James Island** on the west, and Kelp Reefs, D'Arcy Island and **Sidney Island** on the east. It is a good, deep, navigable channel and is about 0.8 mile wide in its narrowest part. Two detached shoals on the eastern side of the channel at the northern end are marked by a lighted buoy and an unlighted buoy.

**Sidney**, on Vancouver Island west of the north tip of Sidney Island, has a government wharf with a berthing length of 150 feet and depths of 16 to 20 feet alongside. It is a port of entry. An automobile ferry operates between here and Anacortes during summer months, April through September. An airport is about 2 miles westward of the city.

**D'Arcy Shoals**, with a least depth of  $2\frac{3}{4}$  fathoms, are in the fairway about 0.8 mile westward of the western extremity of D'Arcy Island. A buoy is on the southeastern edge of the shoal.

**Hughes Passage**, about 600 yards wide, leads between the rocks northward of D'Arcy Island and **Sallas Rocks**.

**Halibut Island**, 100 feet high, is small and wooded, and lies about 1 mile northward of the eastern extremity of Sidney Island. A detached shoal with a depth of  $2\frac{3}{4}$  fathoms is 900 yards southeastward of the southeastern end of Halibut Island.

**Mandarte Island**, 95 feet high, is about 0.7 mile northward of Halibut Island. Except for a few low trees on its northwestern end, the island is bare. A rocky ridge, drying 12 feet on its highest part, is about 0.5 mile southeastward of Mandarte Island and extends about 400 yards southeastward.

**Gooch Island**, wooded and 240 feet high to the top of the trees, is about 1.5 miles northward of Mandarte Island. **Tom Point** is the eastern extremity of a small islet, 145 feet high, which lies close eastward of the eastern end of Gooch Island. About 200 yards eastward of Tom Point is a rock that dries 1 foot and another with a depth of less than 6 feet.

**Cooper Reef** dries 7 feet and lies about 0.5 mile north-

ward of Tom Point. A rock with a depth of 1 foot is about 400 yards westward of the reef, and between the two, the depth is less than 5 fathoms.

**Arachne Reef** is 1.5 miles north-northwest of Tom Point, and consists of three small drying heads, the highest of which dries 5 feet. A 6-fathom patch is about 0.5 mile northeastward of the reef.

**Moresby Island** is on the western side of Haro Strait, at its northern end. The island is thickly wooded except for a large clearing on its northwestern side; near the middle of its southern side is a fairly conspicuous hill that attains a height of 575 feet to the tops of the trees. **Fairfax Point** is the southern extremity of the island. A rock 14 feet high lies close off Fairfax Point. **Pelorus Point**, about a mile north-northeastward of Fairfax Point, is the eastern extremity of the island.

**Wallace Point**, the southeastern extremity of North Pender Island, is about 3 miles northward of Turn Point.

**South Pender Island**, close eastward of the southern end of North Pender Island, is rocky and mountainous, but to a large extent is wooded. Near the western extremity of South Pender Island is **Mount Norman**, whose summit attains a height of 890 feet to the tops of the trees, and near its southern side is **Curtis Peak**, which attains an elevation of 645 feet.

**Bedwell Harbor**, formed between North and South Pender Islands with an average width of 600 to 800 yards, extends about 2 miles northwestward from between Wallace and Tilly Points. The harbor affords anchorage protected from the southerly winds that sometimes blow with great force. Sunken rocks lie close off **Tilly Point**, the southern extremity of South Pender Island, and off the southern shore between Tilly Point and **Gowlland Point**, about 0.8 mile eastward.

**Blunden Island**, grassy and 64 feet high, lies close off the eastern extremity of South Pender Island. The narrow passage between these islands is foul and foul ground extends about 0.2 mile eastward from Blunden Island. Because of tide rips Blunden Island should be given a berth of at least 0.5 mile.

**Saturna Island**, on the western side of Boundary Pass, is the highest island in this vicinity, reaching a height of 1,425 feet near the middle of its southern side. **Taylor Point**, the southeastern point of the island, lies nearly 2 miles northeastward of Blunden Island. **Java Islets**, with heights of 10 to 16 feet, lie about 600 yards off the shore, midway between Taylor Point and Monarch Head, about 1.5 miles eastward. **Monarch Head**, about 800 feet high, is bold and rocky and faced with cliffs almost 400 feet high. The coast between Monarch Head and Taylor Point consists of steep, rocky cliffs. **East Point** forms the eastern extremity of Saturna Island.

**Saturna Island Light** (48°47.0' N., 123°02.6' W.), 121 feet above the water and visible 16 miles, is shown from a skeleton tower on the extremity of East Point; a fog signal is close northward of the light. A light on the same structure shows a red sector between 149° and 211½°. The light should not be approached from the northward or westward within 1.5 miles.

**Boiling Reef**, about 1 foot high on its outer part, ex-

tends about 800 yards north-northeastward from East Point and should be given a wide berth.

**Rosenfeld Rock**, on the western side of Boundary Pass, is about 0.8 mile northeastward of **Tumbo Point**, the eastern extremity of Tumbo Island. It has a depth of 1 fathom over it and is generally marked by kelp; depths of 5 fathoms are about 800 yards southeastward and 400 yards south-southeastward of the rock. A buoy is about 400 yards eastward of Rosenfeld Rock and it should be given a wide berth. Close eastward of the rock overfalls and dangerous tide rips are formed.

**Plumper Sound** is entered from Haro Strait between Blunden Island and Taylor Point, and extends northwestward between Saturna Island on the northeast and South Pender and North Pender Islands on the southwest. The sound offers no difficulties to navigation for the few dangers lie close to the shore and are easily avoided; moreover, the velocity of the tidal current in the fairway does not exceed 2 knots, and most of the rocky shoal patches are marked by help in summer and fall. It is recommended as an anchorage because it is safe, convenient, and easy of access. For the first 2 miles inside the entrance the depths are too great for anchoring except within 0.2 mile of the southern shore where there are depths of 10 to 12 fathoms. Beyond the first 2 miles inside the entrance the depths decrease rather suddenly to 10 fathoms, and excellent anchorage may be obtained. The most convenient position is in a depth of 8 fathoms off the entrance to **Port Browning**, an arm entering between the western end of South Pender Island and **Razor Point**, on North Pender Island, at about 0.5 mile offshore. However, the cable area from Port Browning to a point close southward of **Elliot Bluff** on Saturna Island should be given sufficient clearance.

**Narvaez Bay** is between Monarch Head and East Point. The bay is open eastward and with easterly winds a heavy swell rolls in; consequently, the bay is not recommended as an anchorage except in fine weather.

**Tumbo Island** is about 700 yards northward of the eastern end of Saturna Island and is separated from it by **Tumbo Channel**. This channel, though deep, is useless for general navigation, being obstructed at either end by many dangers. Tumbo Island is wooded and reaches a height of 285 feet to the tops of the trees; steep cliffs, 20 to 50 feet high, extend along the whole of its southern side. **Tumbo Reef**, on which are several rocks with depths less than 6 feet, extends almost a mile east-northeastward from the eastern side of the island.

**Swanson Channel**, the southern part of which lies between Moresby Island and North Pender Island, leads westward from Haro Strait, connects Trincomali Channel and Active Pass, and thus leads to the Strait of Georgia. Vessels bound for Alaska use Swanson Channel and Active Pass as an alternate route.

**Parkin Point** forms the northeastern extremity of Moresby Island and lies 1.3 miles northwestward of Pelorus Point. Depths of less than 5 fathoms are within 250 yards of the northern side of Moresby Island, between Parkin Point and Reynard Point.

**Canoe Rock** is on the southwestern side of Swanson

Channel at about 800 yards west-northwestward of **Reynard Point**, the northwestern extremity of Moresby Island. There is foul ground between the rock and the point. A light is on the rock.

**Mouat Point**, on North Pender Island, is fairly steep-to and lies about 4.5 miles northwestward of Wallace Point. between Wallace and Mouat Points the southwestern shore of the island is bold and steep-to and is composed of cliffs that on the southern part are 300 to 400 feet high, but near Mouat Point are only 30 to 40 feet high. There are rocks awash about 300 yards off the shore along the coast southeastward of Mouat Point.

**Portland Island**, about 1 mile westward of Moresby Island, is wooded and near its southwestern side reaches a height of 325 feet to the tops of the trees. **Moresby Passage** enters Swanson Channel between Portland and Moresby Islands. **Chads Island**, 149 feet high, lies close westward of the northern extremity of Portland Island, with rocks and shoal water between the two islands.

**Chesil Bank**, with a least depth of 5½ fathoms over it, lies about 800 yards northward of the northern point of Portland Island.

**Saltspring Island**, on the western side of Swanson Channel, is the largest and most important of the Gulf Islands. The southern part of the island is wooded and mountainous, but the hills in the northern part are not more than 1,000 feet high. **Bruce Peak**, 2,330 feet high, is the summit of the island and lies about 3.2 miles northward of its southern extremity; from a distance the peak can be identified by its flat summit.

**Beaver Point**, the eastern extremity of Saltspring Island, lies on the western side of Swanson Channel opposite Mouat Point, and about 2.2 miles northward of Portland Island.

**James Point**, on the eastern side of Swanson Channel, lies about 1.8 miles northward of Mouat Point. Good temporary anchorage may be had in 8 fathoms in **Otter Bay** which is on the southern side of James Point; however, the head and southern side of this bay are foul. A rock, 75 feet high, lies close southward of James Point, and another rock, 14 feet high, is about 0.2 mile northeastward of the point.

**Stanley Point**, the northwestern point of North Pender Island, lies 0.7 mile northward of James Point, and between these two points the shore is indented by **Port Washington**, a small cove which is visited regularly by coastal steamers. Stanley Point and the shore for 0.2 mile northeastward of it are foul for a distance of about 100 yards offshore.

**Prevost Island**, thickly wooded and 434 feet high near its southeastern side, lies on the western side of Swanson Channel; **Liddell Point**, the southern extremity of the island, lies about 2 miles northward of Beaver Point. A reef which dries 3 feet at its outer extremity extends about 400 yards southeastward from Liddell Point. A buoy is close off the outer end of the reef.

**Portlock Point**, the northeastern extremity of Prevost Island, lies about 1.3 miles northward of Liddell Point. A light with a red sector covering Enterprise Reef is on the point; a fog signal is 300 yards southeastward of the

light. The shore of the island for a distance of 0.5 mile south of the point is fronted by a shoal.

**Active Pass** leads northward from Swanson Channel to the Strait of Georgia; it lies between Galiano Island and Mayne Island. The pass is deep but tortuous and in its narrowest part is about 600 yards wide. The dangers do not extend over 200 yards from shore.

Vessels should enter Active Pass at slack water, if possible, but a vessel with a speed of 10 knots can always get through. A vessel with local knowledge can take advantage of the eddies and variations of the tidal currents, but others should keep in midchannel. Active Pass is not suitable for sailing vessels due to strong tidal currents and the absence of steady winds. Daily current predictions for Active Pass are contained in the Tidal Current Tables, Pacific Coast.

**Caution.**—At all times great care should be taken in order to avoid the shoals on either side of the northern entrance of Active Pass.

**Enterprise Reef** lies in the southern approach to Active Pass at about 1,800 yards northward of the light on Portlock Point. The reef consists of two rocky heads with depths of less than 6 feet and lying about 400 yards apart; foul ground extends between the heads and 200 yards westward of the western head. A light is on the western head of the reef.

**Helen Point**, the western extremity of **Mayne Island**, forms the eastern point of the southern entrance to Active Pass. The thickly wooded land within the point rises gradually and attains a height of 842 feet at **Mount Parke**, the summit of Mayne Island. A light and fog signal are on the point.

**Collinson Point**, the western point of the southern entrance of Active Pass, is steep-to, rugged, and rocky. The point is easily identified and lies at the foot of a steep summit, 1,090 feet high about 0.5 mile northwestward of the point.

**Mathews Point**, with some drying rocks close to it, is on the northern side of Active Pass 1 mile east-northeastward of Collinson Point.

A rocky ledge which dries 8 feet lies on a shoal about 400 yards northeastward of Collinson Point. A rocky patch, well marked by kelp and having several heads with depths of 5 feet, is within about 250 yards of the shore and about 800 yards northeastward of Collinson Point.

**Mary Anne Point**, around which Active Pass turns sharply to the northward, lies about 1,200 yards eastward of Mathews Point, and between these points is a bight whose shores are foul. A light is on the point.

**Miners Bay** indents the southeastern side of Active Pass between **Reserve Point**, about 1.5 miles eastward of Helen Point, and **Laura Point**, about 0.7 mile farther northward. A prominent church is near the shore of the bay about 0.5 mile southeastward of Laura Point. The north-flowing tidal current sets strongly into the bay along its northern shore; the south-flowing tidal current sets strongly into the bay along its southern shore. If necessary, anchorage may be obtained in Miners Bay, but a vessel must go close in to get 12 fathoms. Even then a vessel is barely out of the whirl of the tidal currents

and caution must be exercised. **Mayne** is a small settlement at the head of the bay where there is a wharf with a depth of 15 feet at its head. Supplies and water can be obtained in small quantities; there is local steamer service.

**Burrill Point**, on the western side of Active Pass, lies 1,200 yards northward of Mary Anne Point, and between these points the shore is indented by two bights, the shores of which are foul. **Rip Point** lies about 1,000 yards northward of Burrill Point.

**Georgina Point**, the northern extremity of Mayne Island, forms the eastern point of the northern entrance to Active Pass. The point is fronted by rocks, sunken and above water, up to a distance of almost 200 yards.

**Active Pass Light** ( $48^{\circ}52.4' N.$ ,  $123^{\circ}17.4' W.$ ), 55 feet above the water and visible 12 miles, is shown from a white square tower with a building attached on Georgina Point; a fog signal is near the light.

**Fairway Bank**, with a least depth of 5 fathoms over it, lies in midchannel about midway between Georgina and Rip Points. The bank is not marked by kelp but its position is indicated by tide rips except at slack water.

**Georgina Shoals** are about 300 yards off the northern shore of Mayne Island and extend, with the 10-fathom curve, for about 1,300 yards in an easterly direction. The sea breaks occasionally on the western part of the shoals, which has a least depth of 5 feet, lying about 0.3 mile northeastward of the light. Patches with depths of 2 and 3 fathoms lie on the eastern part of the shoals.

**Gossip Island**, with the southeastern extremity about 800 yards northward of Rip Point, lies on the western side of the entrance to Active Pass. **Gossip Shoals**, on which are several drying rocks with depths less than 6 feet, extend from the eastern side of Gossip Island almost 0.3 mile both southeastward and northwestward of the southeastern point of the land. There is a lighted bell buoy off the eastern end of the shoal about 600 yards east-northeastward of the southeastern point of the island.

**San Juan Channel** is the middle one of the three principal channels leading from the eastern part of the Strait of Juan de Fuca to the southeastern end of the Strait of Georgia; it separates San Juan Island from the islands eastward. It is 13 miles long from its southern end to its junction with President Channel at the northern end; the width varies from 0.5 to 3 miles. San Juan Channel is deep throughout and, except near its southern entrance, has few off-lying dangers.

**Currents.**—In the south end of San Juan Channel, between Goose Island and Deadman Island, the current attains a velocity of 5 knots or more and severe rips and eddies occur during flood. Current predictions for this location may be obtained from the Tidal Current Tables, Pacific Coast.

**McArthur Bank**, with a least depth of 14 fathoms, lies about midway between Smith Island and the southern entrance of San Juan Channel.

**Cattle Point**, the southeastern extremity of San Juan Island, forms the western point at the southern entrance to San Juan Channel. A light is on the point.

**Salmon Bank**, on the western side of **Middle Channel**,

is an extensive shoal lying southward of Cattle Point, with depths ranging from  $1\frac{1}{2}$  to 3 fathoms; it is marked by kelp. A lighted bell buoy is off the southern end of the shoal about 1.5 miles southward of Cattle Point.

**Lopez Island** is the southeasternmost one of the San Juan Archipelago; **Lopez Hill**, 480 feet high, is near the middle of the island.

**Iceberg Point**, about 3.3 miles east-southeastward of Cattle Point, is on the western extremity of the southern part of Lopez Island. A light is on the point.

**Long Island**, about 1.5 miles northwestward of Iceberg Point, is the largest of a group of islands and rocks lying off the southwestern part of Lopez Island.

**Whale Rocks**, two dark rocks about 5 feet high, are on the eastern side of the Middle Channel about 0.6 mile westward of Long Island. A sunken rock in  $2\frac{1}{4}$  fathoms of water, marked by kelp, is about 400 yards southward of Whale Rocks, and a reef with  $2\frac{1}{4}$  fathoms over it lies 600 yards southward of them.

**Richardson** is a village with a post office on the northern shore of the cove northward of Iceberg Point, and close northward of **Charles Island**. A group of six fuel tanks are a prominent landmark from seaward. A wharf directly below the fuel tanks has a face 120 feet long and extends over rocks to a depth of 17 feet. Diesel oil and gasoline are available. Between the mainland and Charles Island there are overhead cables with a permit clearance of 54 feet. A light is on a ledge extending from the shore of Lopez Island at Richardson.

**Mackaye Harbor**, northward of Iceberg Point, affords good shelter in 5 to 6 fathoms, soft mud, and small craft with local knowledge, can obtain excellent shelter in **Barlow Bay**, on the southern side of the harbor. Vessels approaching Mackaye Harbor or Richardson should pass at least 0.3 mile southward and eastward of the off-lying islands and islets. Local vessels, by keeping close to the northern shore to avoid rocks near midchannel, use a small channel between Lopez and Charles Islands, but this channel should not be attempted without local knowledge.

**Twin Rocks**, in midchannel, are marked by a daybeacon.

**Davis Point**, the southwestern extremity of Lopez Island, is on the eastern side of the south entrance to San Juan Channel. **Deadman Islet** is close off the eastern side of the entrance and several rocks lie within 600 yards northward of the islet.

**Goose Island**, small and low, lies about 0.5 mile northward of Cattle Point and close off the western side of the entrance to San Juan Channel.

**Shark Reef**, awash at low water, is about 1.2 miles northward of Deadman Islet and close off some white cliffs on the eastern side of San Juan Channel.

**Griffin Bay** indents the eastern shore of San Juan Island immediately within the entrance and on the western side of San Juan Channel. Many rocks and shoals are in this bight and the shore should not be approached closer than 0.5 mile. Good anchorage for small vessels can be had west of **Harbor Rock** between the 10- and 20-fathom curves.

**North Bay** comprises the northwestern part of Griffin Bay and is entered between **Pear Point** and **Dinner Is-**

**land.** The village of **Argyle** is on the shores of North Bay. **Little Island**, at the head of North Bay, is connected to the mainland by a narrow spit. A small cannery is on Little Island and the shores of the island have been bulkheaded. The cove affords fair anchorage in 7 to 10 fathoms, about 800 yards northward of Dinner Island. In the approaches to the cove are two dangers, **Argyle Shoal**, with a depth of  $1\frac{3}{4}$  fathoms and marked by kelp, is about 1,200 yards eastward of Dinner Island; and a rocky shoal with 1 fathom over it and marked by kelp, is about 700 yards southeastward of Dinner Island. Rocks and shoals, some of which bare at low water, extend southward and south-eastward of Dinner Island for a distance of about 600 yards. The passage westward of Dinner Island should not be attempted.

**Fisherman Bay**, on the eastern side of San Juan Channel abreast North Bay, is a shallow lagoon entered by a narrow, tortuous channel. Good anchorage with shelter from all winds may be had in 10 to 12 feet, soft bottom, for small, light-draft vessels with local knowledge. The tidal currents have considerable velocity. **Lopez** is a small village with a post office at the entrance. About 2 miles northward of Lopez is the southern entrance to Upright Channel.

**Chart 6379.**—At **Turn Island**, San Juan Channel turns northwestward for about 9 miles, and connects at its northern end with Haro Strait and President Channel.

**Turn Rock**, about 0.2 mile eastward of Turn Island, is a ledge bare at half tide, and should be given a berth of not less than 100 yards. A light is on the rock.

**Reid Rock**, about 1.3 miles northwestward of Turn Rock, lies in midchannel off the entrance to Friday Harbor. The rock has a depth of  $2\frac{1}{4}$  fathoms over it, rising abruptly from deep water. It is marked by a buoy on the eastern side.

**Friday Harbor**, on the eastern shore of San Juan Island, about 1 mile westward of Turn Rock, is a small cove about 1 mile long and nearly as wide. **Brown Island**, which is wooded, occupies the middle of the harbor. Shoals extend about 200 yards off both its eastern and southern shores; a shoal, with  $2\frac{1}{2}$  fathoms over it, extends nearly into midchannel from the western shore of the island. The harbor may be entered either eastward or westward of Brown Island, but in both cases the San Juan Island shore should be favored to avoid the shoals off Brown Island. Anchorage may be had off the wharves in 6 to 7 fathoms and city floats provide berthing space for pleasure craft.

**Friday Harbor**, on the western shore of the cove, is a county seat, and the most important town in the San Juan Archipelago. It is the center of a prosperous agricultural district and the headquarters for the fishing fleet operating through the western part of the archipelago. Produce and fish are shipped and a salmon cannery, a creamery, and log booms are here. Provisions may be obtained.

The **University of Washington** maintains a station, about 0.8 mile northward of the town of Friday Harbor, for oceanographical and marine biological research. The

east pier, a high structure cantilevered about 35 feet out from shore, makes a prominent landmark in entering Friday Harbor. Near the main building is the landing wharf, extending 204 feet from shore. The face is 32 feet long with depths of 11 to 13 feet. The wharf is exposed to winds from the northeast, but is easily approached.

Friday Harbor is a customs port of entry but marine documents are not issued. The customs office is on the wharf at the ferry slip. A unit of the Coast Guard, with an 83-foot patrol boat, is stationed here.

There are a number of wharves built out to deep water at which water and fuel oils can be obtained. The city wharf has a depth of 16 feet alongside. The wharves eastward of the city wharf have more water alongside and those westward of it have less than at the city wharf. The city maintains berthing space at the Standard Oil Co. dock west of the cannery.

A shipyard of sufficient size to handle small boats up to 90 feet is at the south end of the harbor.

Communication is maintained by ferry, freight boats, and seaplane with other ports in the islands and the mainland; there are telephone connections. A seaplane taxi service operates from a float landing only during the summer months.

**Point Caution**, about 2.2 miles northwestward of Turn Island, is on the southwestern side of San Juan Channel. The point is steep-to, and between it and the head of Rocky Bay, about 4 miles northwestward, the southwestern shore of the channel is free from off-lying dangers.

**Hicks Bay**, on the opposite side of the channel on the southern side of Shaw Island, has a small, private landing.

**Parks Bay** is immediately northward of **Point George** on Shaw Island and about 2 miles northward of Turn Rock. It affords a good anchorage for small vessels in 6 to 8 fathoms, soft bottom. The harbor is clear, but a shoal extends 300 yards from its head.

**Wasp Islands** lie in the western approach to West Sound between **Neck Point**, the northwestern extremity of Shaw Island and **Steep Point**, the southwestern extremity of Orcas Island. Several narrow channels lead between the islands; the channels in general use are the North and Pole Passes, close under the Orcas Island shore. The tidal currents have considerable velocity in the channels, which should be attempted only by vessels with local knowledge.

**North Pass**, between Steep Point and Wasp Islands, leads eastward from San Juan Channel to Deer Harbor and Pole Pass. The pass is about 0.2 mile wide between Steep Point and **Reef Island**, and is free of outlying dangers, except for a rock with a depth of  $1\frac{3}{4}$  fathoms about 0.3 mile eastward of the northern end of Reef Island.

**Deer Harbor**, at the eastern end of North Pass, is eastward of Steep Point. Good anchorage may be had in 6 to 7 fathoms about 0.2 mile from the head of the harbor. **Fawn Island** lies near the entrance of the harbor and about 200 yards from the western shore; vessels may pass on either side of the island.

A midchannel course leads through North Pass and to the anchorage north of Fawn Island. The eastern shore of Deer Harbor should be given a berth of at least 300

yards because of a shoal which in some places extends more than 200 yards.

**Deer Harbor** is a small village with a post office on the eastern shore near the head of the harbor. A cannery is on a point opposite the village, and a small wharf extends to a depth of 12 feet. In 1954 the cannery was not in operation and the wharf was in ruins. Small quantities of provisions and gasoline may be obtained.

A rock with a depth of 4 feet over it is about 100 yards north-northwestward of the wharf and constitutes a danger to steamers pulling away from the wharf.

**Crane Island** is off the entrance to Deer Harbor and almost a mile southeastward of Steep Point. The northern shore of the island is foul, and in places shoals extend 250 yards off it; a rock with a depth of less than 1 fathom over it lies 250 yards off the northern shore and about 750 yards west-northwestward of Pole Pass Light. Foul ground extends about 300 yards eastward from the eastern extremity of the island. There is a small private landing on the eastern side of the island.

**Pole Pass** leads from Deer Harbor to West Sound, and separates Crane Island from Orcas Island; in its narrowest part the fairway is 75 yards wide. Pole Pass should not be attempted without local knowledge. A light is at the western end of the pass.

**Wasp Passage** leads from San Juan Channel to West Sound and separates Crane Island from the northern shore of Shaw Island. This passage should not be attempted without local knowledge. A light is on the rock 300 yards eastward of Bell Island.

**Bell Island**, small and wooded, is about 0.3 mile eastward of Crane Island. A rock which bares at extreme low water, is about 300 yards eastward of the island, and about 300 yards northward of this rock a 1-fathom shoal lies almost in midchannel. Vessels using Pole Pass keep the northern shore of Bell Island close-to in order to avoid reefs and shoals extending from the opposite side of the pass.

**Cliff Island**, the southernmost of the Wasp Islands, is about 300 yards northward of Neck Point. A light is on the south side of the island. **Low Island**, small and 10 feet high, is about 600 yards westward of Cliff Island. **Nob Island**, 40 feet high, is close-to and northwestward of Cliff Island.

Local vessels, bound from Friday Harbor to Deer Harbor, use a clear, deep channel, about 70 yards wide through the rocks and shoals lying between Cliff Island and Low Island about 600 yards westward.

**Yellow Island**, the westernmost of the Wasp Islands, lies about 0.8 mile west-northwestward of Neck Point; the island is small, grassy, and nearly bare of trees. A shoal extends 300 yards westward of the island and terminates in a rock, marked by kelp, with a depth of 1 fathom over it. This island should be given a berth of not less than 0.5 mile. **McConnell Island**, northeastward of Yellow Island, is the largest of the group. **Coon Island** lies close to and southeastward of McConnell Island. **Bird Rock**, awash at high tide, lies between McConnell and Crane Islands. A light is on the northerly reef of the group.

**Jones Island** is on the eastern side of the northern entrance to San Juan Channel; the island is wooded. Small pleasure craft anchor in the bight which indents the northern shore.

**Spring Passage** separates Jones Island from the southwestern extremity of Orcas Island. With the exception of a shoal that fringes the eastern side of Jones Island and in places extends as far as 250 yards offshore, the passage is free of danger.

**Rocky Bay**, on the southwestern side of San Juan Channel, is a small open bight. **O'Neal Islet**, surrounded by a shoal, lies almost in the middle of the bay, and a reef that is usually marked by a breaker is near the head of the bay.

**Limestone Point**, about 1.2 miles north-northwestward of O'Neal Islet, forms the western point of the northern entrance to San Juan Channel; the point is the northeastern extremity of San Juan Island. Heavy tide rips and eddies are formed off Limestone Point and Green Point, lying 0.7 mile northward, and forming the eastern end of Spieden Island.

**Flattop Island**, prominent in the northern approaches to San Juan Channel, is about 1.2 miles northeastward of the eastern end of Spieden Island. It is about 130 feet high, flat on top, and sparsely covered with underbrush and trees. Gull Rock, 30 feet high, of small extent and bare, is about 0.3 mile northwestward of the island.

**Chart 6380.—White Rock**, 35 feet high, is in the northern part of San Juan Channel, about midway between Flattop and Waldron Island. Waldron Island has been described previously. Rocks, bare at low water and marked by kelp, extend nearly 600 yards northwestward from White Rock.

**Danger Rock**, with 3 feet over it and marked by kelp, lies 600 yards southeastward of White Rock.

The northwestern approach to San Juan Channel, from Haro Strait and Boundary Pass, is between Waldron Island on the east and Johns Island and the dangers southeastward of it on the west.

**President Channel**, separating Waldron and Orcas Islands, is about 5 miles in length and has a least width of 1.2 miles. The depths are generally great and the passage is free of dangers. The tidal currents have a velocity of 2 to 5 knots, and off the northern point of Waldron Island and between Waldron and Patos Islands are heavy swirls and tide rips, especially with an adverse wind. The rips are generally heaviest with the ebb current. Rips and swirls are also heavy off Limestone Point and the eastern end of Spieden Island.

**Orcas Island** is wooded and mountainous. **Mount Constitution**, 2,409 feet high, in the eastern part of the island is marked by a stone lookout tower, with an elevation of 2,454 feet. **Turtle Back Range**, 1,497 feet high, and **Orcas Knob**, 1,060 feet high, conical, and bare on the summit, in the western part of the island, are prominent and easily recognized from northward and southward.

**Point Doughty**, the northwestern extremity of Orcas Island, is bare and terminates in a small knob on its outer end. **Freeman Island**, is a small islet in the broad bight

southward of Point Doughty. Foul ground, marked by kelp, extends about 350 yards westward from the southern point of this bight, which lies about 1.2 miles southward of Point Doughty. A 3-fathom shoal is about 400 yards offshore at about 1.2 miles eastward of Point Doughty.

**Local magnetic disturbance.**—Differences from the normal variation of 2° or more have been observed in the vicinity of Point Doughty.

**Parker Reef**, consisting of two rocky patches bare at low water, is about 0.7 mile off the northern shore of Orcas Island and about a mile northwestward of Point Thompson. Kelp covers the reef and the area between it and the shore. A light is on the reef.

**Point Thompson** is about 3 miles eastward of Point Doughty. **North Beach** lies just westward of Point Thompson.

A passage between Sucia Islands on the north and Orcas Island on the south connects the northern end of President Channel with the junction of the Strait of Georgia and Rosario Strait.

**Chart 6379.—Minor Passages, San Juan Archipelago.**—**Upright Channel**, between Lopez Island and Shaw Island, is about 3 miles long and has an average width of about 0.8 mile; **Canoe Island**, off Flat Point, contracts the passage to a width of 600 yards. A rock awash is about 300 yards southwestward of Canoe Island. A sunken rock marked by kelp is on the northwestern side of the channel and about 300 yards southeastward of the southern point of Shaw Island. The depths in the channel range from 20 to 35 fathoms. Anchorage for small vessels may be had in **Indian Cove**, westward of Canoe Island, in 6 to 7 fathoms, soft bottom.

**Harney Channel**, between the northern shore of Shaw Island, and Orcas Island, is the widest approach to West Sound from the eastward, but small vessels with local knowledge may approach from the westward by Pole Pass or Wasp Passage. Harney Channel has depths of 10 to 25 fathoms and there are no offlying dangers.

**Orcas**, on the northern shore in a cove at the western end of Harney Channel, is a small settlement and summer resort, and has a post office and telephone service. A wharf with a depth of 10 feet at its head is here; water and gasoline are available from pipelines on the wharf. An automobile ferry slip is just eastward of the wharf. There is daily communication by mail boat and ferry to the other islands and the mainland. A rock with 2½ fathoms over it lies about 125 yards southward of the wharf; there is deep water between the rock and the beach.

**Blind Bay**, a small cove on the southern shore of Harney Channel, is shoal and in it are several reefs. **Blind Island** lies in the entrance to the bay, and a reef bare at low water, extends 200 yards from the western entrance point of the cove. A rock, partly bare at low water, lies about 250 yards southeastward of Blind Island at the entrance to the bay. Several rocks, awash, are within 200 yards northwestward of the island.

**Shaw Island**, a village at the eastern entrance point of Blind Bay, has a post office, telephone service, and regular

ferry service. It has a store, warehouse, and a float for small boats. Provisions and gasoline may be obtained.

**Broken Point**, about 1.2 miles westward of Blind Island, extends about 0.3 mile northward from the northern side of Shaw Island.

North Pass, Pole Pass, and Wasp Passage have been described previously.

**West Sound** indents the western part of the southern shore of Orcas Island, and with an average width of about 0.8 mile, trends northwestward for about 2.8 miles. The depths range from 7 fathoms to over 20 fathoms. Anchorage in 7 to 12 fathoms may be had anywhere in the sound northward of Double Island.

**Double Island** consists of two small islands connected at low water; it is close to the western shore near the entrance. **Victim Island** is close to the western shore about 0.2 mile northward of Double Island.

**Westsound**, a settlement with a post office, is in the cove on the eastern shore of the inlet about 2 miles above the entrance. There is a wharf with a depth of 12 feet of water; only a few piles remain of an old sawmill wharf. Care should be taken when leaving the wharf to avoid some submerged piling about 100 feet southwestward of it. Provisions in small quantities are available.

**Sheep Island**, a low islet in the southern part of the cove, is connected to the shore at low water; a shoal extends about 150 yards westward from the island.

**Harbor Rock**, partly bare at low water, lies in mid-channel about 0.8 mile from the head of West Sound; the rocky patch, marked by a daybeacon, is of small extent and is surrounded by depths of 2 to 10 fathoms.

**Chart 6380.—East Sound**, on the southern shore of Orcas Island, extends northwestward for about 6 miles. The depths vary from 15 fathoms at the entrance to 9 fathoms at less than 0.2 mile from the head. There are no outlying dangers and the shores may be approached to within 0.2 mile; however, a bank with depths less than 5 fathoms extends about 700 yards off the western shore about 0.8 mile within the entrance. Anchorage may be obtained anywhere in the sound.

**Local magnetic disturbance.**—Differences from the normal variation of as much as 2° have been reported in the upper end of East Sound.

**Shag Rock**, marked by a daybeacon, is about 300 yards offshore and about 0.6 mile eastward of **Foster Point**. The rock bares at high water; a ledge extends about 150 feet northward from the rock.

**Olga**, a summer resort with a post office, is on the western shore of **Buck Bay**, a small cove on the eastern shore of the sound, just within the entrance. There is a wharf with 20 feet at its head; provisions may be obtained in small amounts. Telephone facilities are available.

**Cascade Bay** is a small cove on the eastern side of the sound, about 3 miles inside the entrance. A private landing wharf with a depth of 25 feet alongside is at its head. The large private residence on **Rosario Point**, the western point of the bay, is prominent.

**Eastsound**, a summer resort with a post office, is in the western of two small coves at the head of East Sound.

It is the second largest village in San Juan Archipelago. Gasoline, water, and lubricating oil may be obtained at the wharf, which is built out to 10 feet. Communication with other islands and the mainland is maintained by telephone.

**Obstruction Pass**, about 350 yards wide at its narrowest part, separates Obstruction Island from the southeastern part of Orcas Island, and leads westward from Rosario Strait to the inner passages and sounds of the San Juan Archipelago. A submerged rock, marked by kelp, has been reported in midchannel near its narrowest part. A small privately maintained float is in its northern extremity. No trace remains of the former ferry slip. **Obstruction Island** is marked on its eastern and southern ends by lights.

**Deer Point**, on the northern side of the eastern approach to Obstruction Pass, forms the southeastern extremity of Orcas Island.

**Peavine Pass** separates the northern extremity of **Blakely Island** from the southern shore of Obstruction Island. The pass is a little over 200 yards wide at its narrowest part and in midchannel the least depth is 6 fathoms. Peavine Pass is both safer and straighter than Obstruction Pass. A daybeacon marks a group of bare rocks which lie about 0.2 mile offshore on the southern side of the entrance.

The currents through the passes have estimated velocities of  $5\frac{1}{2}$  to  $6\frac{1}{2}$  knots at times. Heavy tide rips occur eastward of Obstruction Island.

A rock with a depth of  $1\frac{3}{4}$  fathoms over it is about 0.5 mile westward of the northern part of Blakely Island and 1.3 miles southwestward of the light on the southern point of Obstruction Island.

**Thatcher Pass**, between the southern extremity of Blakely Island and the northern shore of **Decatur Island**, is about 0.5 mile wide in its narrowest part. With the exception of Lawson Rock, Thatcher Pass is deep and free of danger. **Lawson Rock**, which dries, is in midchannel about 700 yards northward of Fauntleroy Point; it is marked on its southern edge by a buoy. **Fauntleroy Point**, the northeastern extremity of Decatur Island, is marked by a light and a fog signal. With a southerly wind and the ebb current heavy rips will be encountered off the eastern entrance to Thatcher Pass.

**Lopez Sound**, on the eastern side of Lopez Island, may be entered from Rosario Strait by Thatcher Pass or Peavine Pass. The depths in the greater part of the sound are from 3 to 5 fathoms, mud, but along the eastern shore, a narrow and deeper channel extends as far southward as **Center Island**. The sound is of little commercial importance at present.

**Thatcher**, a small village, is in the shallow cove on the western side of Blakely Island. At the village is a small wharf and a sawmill dock in ruins.

**Leo Reef**, awash at high tide, is in the entrance to Swifts Bay and is marked by a light.

**Port Stanley** is a small village on the shores of Swifts Bay on the northeastern side of Lopez Island.

There is a yacht club with landing at the head of **Shoal Bay** on the north side of Lopez Island.

**Upright Head**, the northern extremity of Lopez Island, is a narrow peninsula which attains an elevation of 260 feet. An automobile ferry slip is in the small cove at the northeastern extremity of the peninsula. A fixed red light, 15 feet above the water, is mounted on a fender float which is 50 yards out from the slip. There is daily ferry service with the other islands and the mainland.

**Decatur**, a small village with a post office, is on the western side of Decatur Island, about 1 mile eastward of **Trump Island**. A wharf with 8 feet of water at its head is at the village.

**Lopez Pass**, at the southern extremity of Decatur Island, leads from Rosario Strait into Lopez Sound at a point about 2 miles from its head. The pass has depths of 9 to 12 fathoms, but is very narrow and little used. A light is at the south end of Decatur Island.

**Rosario Strait** is the easternmost of the three main channels leading from the Strait of Juan de Fuca to the Strait of Georgia. It is about 20 miles long and from 1.5 to 5 miles wide. The water is deep and the most important dangers are marked.

The strait is in constant use by vessels bound to Bellingham, Anacortes, or the various ports in the San Juan Islands. Vessels bound for British Columbia or Alaska also frequently use it in preference to the passages farther westward at times when greater advantage can be taken of the tidal currents.

**Currents**.—For times and velocities of current in Rosario Strait and vicinity, the Tidal Current Tables, Pacific Coast, should be consulted. The currents in Lopez, Thatcher, and Obstruction Passes are reported to attain velocities at strength of 3 to 7 knots, which fact should be taken into account when proceeding through Rosario Strait, particularly at night or in thick weather. On the ebb of a large tide, a southerly wind causes tide rips off the entrance to the passes which are dangerous to small craft.

**Point Colville**, the southeastern extremity of Lopez Island, forms the western point of the southern entrance to Rosario Strait.

**Colville Island**, 64 feet high, small, and bare of trees, is about 0.5 mile southwestward of Point Colville; the island should be given a berth of not less than a mile.

**Davidson Rock**, which bares at extreme low water, is about 600 yards eastward of Colville Island. The rock is marked by a light and fog signal. Heavy kelp extends westward of Colville Island.

A shoal with a least depth of  $3\frac{3}{4}$  fathoms and marked by a lighted buoy, is about 1.9 miles east by south of Davidson Rock. The ship passage is between Davidson Rock and the buoy.

**Aleck Bay** is the westernmost and largest of three small bays on the southern shore of Lopez Island. It affords good anchorage for small vessels in 4 to 7 fathoms, mud bottom; good protection is afforded except from heavy southeasterly winds. **Hughes** and **McArdle Bays**, adjacent, are smaller, with less protection, and are not used. An irregular, dark-brown rock 40 feet high is about 0.3 mile offshore on the western side of the entrance to Aleck

Bay; from this rock a reef and detached rocks, awash, extend more than 200 yards eastward. Two shoals with least known depths of 4 and 4½ fathoms lie, respectively, about 700 yards 278° and 1,050 yards 318° from the western point of Colville Island. Except for these dangers, the passage inside Colville Island is clear and is used by small boats.

A bank with depths of 10 to 20 fathoms extends across the southern entrance to Rosario Strait. A shoal with 3¾ fathoms over it and marked by a lighted buoy is in the western part of the bank, 1.8 miles eastward of Davidson Rock. **Lawson Reef**, small in extent with a least depth of 1¾ fathoms over it and marked by a buoy on the eastern edge, is in the eastern part of the bank, 1.7 miles westward of Deception Island. Depths of less than 10 fathoms extend 700 yards northward and 1,000 yards southwestward from the reef.

**Chart 6376.—Deception Pass**, between Whidbey Island and **Fidalgo Island**, is about 2 miles long and connects the northern end of Skagit Bay with the southern end of Rosario Strait. Near the middle of the pass the navigable channel leads southward of Pass Island, which reduces the width of the channel to about 200 yards. The fixed highway bridge crossing at this island has an overhead clearance of 144 feet at the center of the arch. The overhead power cable 0.2 mile to the eastward has a permit clearance of 248 feet.

Deception Pass is commonly used by local vessels bound from Seattle to Anacortes, Bellingham, and ports in the San Juan Islands. Vessels plan to make the pass at the time of slack water, as the velocity of the stream at other times makes it unavailable to most vessels. Some fast vessels run it at all stages of the tide. The pass is also frequently used by tows of logs from the northward, bound to Everett or Seattle, which take this route to avoid the rough weather westward of Whidbey Island.

The currents in the narrows of Deception Pass attain velocities of 5 to 8 knots or more at strength, at which times strong eddies are formed along the shores. Daily predictions of the times of slack water and the times and velocities of strength of current for Deception Pass are given in the Tidal Current Tables, Pacific Coast.

**Canoe Pass** is between the northern shore of Pass Island and Fidalgo Island. This pass is not recommended except for small craft with local knowledge.

**Deception Island** is about 0.4 mile northwestward of **West Point**, the northwestern extremity of Whidbey Island. Foul ground exists between West Point and Deception Island. Vessels should not attempt to pass between them.

A light is on **Lighthouse Point**, the southwestern extremity of Fidalgo Island.

**Strawberry Island** is in Deception Pass, 0.4 mile eastward of Pass Island. A reef, marked by kelp, extends from the southern side of the island.

**Ben Ure Island** is 0.2 mile southward of Strawberry Island at the entrance to Cornet Bay. A light is at the northeastern extremity of the island.

**Cornet Bay**, shallow and suitable for small craft only, lies directly south of Ben Ure Island. There is a wharf on the eastern side with floats on either side for boat moorage. Naval Air Station crash boats are berthed here. Privately owned boats are allowed to land on the eastern side. At the head of the bay are two floats privately maintained for the mooring of yachts.

In approaching Deception Pass from the westward, the best water will be found 0.2 mile westward of **Rosario Head**, a point about 0.5 mile northeast of Deception Island. Steer a southeasterly course to pass about 100 yards southwestward of the light on Lighthouse Point; then follow an easterly course through the middle of the pass, being careful to guard against sets from the current when running partly across it. After passing under the bridge favor slightly the northern shore so as to avoid the pinnacle rocks and ledges making out from the southern shore. After leaving Pass Island, steer to pass about midway between Ben Ure and Strawberry Islands. Strawberry Island should not be approached within 125 yards because a reef, marked by kelp, extends southward of the island. From a position off Ben Ure Island Light steer a northeasterly course to pass about midway between **Hoypus** and **Yokeko Points**. North and west of Strawberry Island the flood current sets northeastward and this set should be guarded against.

**Reservation Bay**, a small bight between **Reservation Head** and Rosario Head, offers anchorage for small craft in 2¼ fathoms, mud bottom.

**Sares Head**, about a mile northward of Deception Island, is steep-to and attains a height of 480 feet.

**Northwest Island**, 28 feet high and grass-covered, is between Rosario and Sares Heads.

**Langley Point** is about 2.1 miles northward of Deception Island.

**Burrows Bay** indents the western shore of Fidalgo Island between Langley Point and **Fidalgo Head**. It is a broad, open bight, affording anchorage in the northern part in 15 to 16 fathoms, soft bottom. Protection from westward and northward is afforded by **Burrows** and **Allan Islands**, 635 and 269 feet high, respectively, but the bay is exposed in southerly weather. In the southeastern part of the bay the depths are less than 6 fathoms, and in places, shoals extend almost 0.4 mile off the eastern and southern shores of the bay. **Young Island** is southeast of and close to Burrows Island. Eastward of the passage between Allan and Burrows Islands is a middle ground with a least depth of 5 fathoms. Vessels using Deception Pass, bound to or from ports in the islands or from Bellingham Bay, pass through Burrows Bay and the passage northward of Burrows Island. **Burrows Island Light** (48°28.6' N., 122°42.7' W.), 57 feet above the water and visible 13 miles, is shown from a white square tower on a building at the western end of the island; a fog signal is at the light.

**Williamson Rocks**, a group of small, grass-covered islets, close together, and several small rocks extending westward thereof, lie about 0.5 mile southward of Allan Island. **Dennis Shoal**, which bares at low water, is about

500 yards off the southern shore of Allan Island and 0.6 mile northwestward of Williamson Rocks. A small bare rock is 700 yards northeastward of Langley Point and about 500 yards offshore. A rock awash is about 0.9 mile northeastward of Langley Point, and 650 yards off the southern point of a small cove on the eastern shore of Burrows Bay.

**Flounder Bay**, a shallow lagoon at the northern end of Burrows Bay, was formerly a log pond. It is now unused but numerous piling still remains. Only the piling of the wharf extending from the southwest end of the bay remains. The former sawmill buildings are being removed (1957), but the brick stack remains and is prominent.

**Chart 6380.—Bird Rocks**, consisting of three rocks close together, are almost in the middle of Rosario Strait, about 2 miles west by north of Burrows Island Light; the southernmost and largest is 30 feet high. There is deep water close to and passage may be made on either side of the rocks.

**Belle Rock**, bare at extreme low water, is about 0.5 mile northeastward of Bird Rocks. A light is on the rock. **Tide Point**, the western extremity of Cypress Island, and **Lawrence Point**, the eastern extremity of Orcas Island, in range, bearing about 359°, lead about 1,200 yards eastward of Belle Rock.

**Kellett Ledge**, about 2 miles northward of Point Colville, is 700 yards off **Cape St. Mary**. The ledge is of small extent, marked by kelp, and bares at lowest tides.

Lopez Pass has been described previously.

**Dot Rock**, about 2.8 miles northward of Cape St. Mary, is close under a white cliff on the southeastern side of Decatur Island.

**Decatur Head**, the eastern extremity of Decatur Island, is a small peninsula having a height of 125 feet and lying about a mile north-northeastward of Dot Rock.

**James Island** is close off Decatur Head, and between them is a deep but narrow passage; on the island are two hills with heights of 280 and 219 feet.

Thatcher Pass has been described previously; Guemes Channel and Bellingham Channel are described later.

**Pointer Island**, locally known as **White Rock**, is 16 feet high and is about 600 yards off the southeastern shore of Blakely Island on the northern side of the entrance to Thatcher Pass.

**Black Rock**, 4 feet high, is about 0.8 mile northeastward of Pointer Island and 0.5 mile from the Blakely Island shore; it is marked by a daybeacon. There is a passage between Blakely Island on the west and Black Rock and Pointer Island on the east, but it is not recommended.

**Cypress Island**, 1,530 feet high, steep on the lower slopes and gently rounding at the top, is northward of the entrance to Guemes Channel, and from southward the island appears to lie in the middle of Rosario Strait.

**Reef Point**, the southwestern extremity of Cypress Island, has a shoal extending about 500 yards southward; the outer end of the shoal is marked by a buoy. Vessels rounding the point should give the buoy a berth of 400

to 500 yards to avoid submerged piles that may be in this vicinity.

**Strawberry Island**, small and low, is about 400 yards from the western shore of Cypress Island. There is a passage eastward of it but it is not recommended. An indifferent anchorage may be had in **Strawberry Bay** in 7 fathoms; it is seldom used.

**Towhead Island**, small, round, and wooded, is about 400 yards northward of the northern extremity of Cypress Island. The passage between them is used by local vessels, especially those plying between Bellingham Bay and Obstruction Pass.

**Cypress Reef** is a dangerous rocky patch westward of Towhead Island. The southern end, bare at low water, is 550 yards westward of Towhead Island, and from this point it extends northward for 650 yards with a least depth of 1¼ fathoms. It is well marked by kelp.

**Lydia Shoal**, of small extent and with a least depth of 3¼ fathoms, is about a mile northeastward of the light on the eastern end of Obstruction Island.

Obstruction and Peavine Passes have been described previously.

**Buckeye Shoal**, with a least depth of 3½ fathoms, is about 1 mile northwestward of Towhead Island; it is marked by a lighted bell buoy.

**Peapod Rocks** are a group of small rocks extending about a mile in a general north-northeasterly direction, parallel with and a little over 0.5 mile from the Orcas Island shore. They are bare of trees; the northernmost rock is the highest and largest and is marked by a light and fog signal. A rock with a depth of 1¼ fathoms is off Doe Bay, about 0.7 mile northwestward of the southern Peapod. Vessels using the passage westward of the Peapods must favor the southern Peapod to avoid this rock; otherwise this passage is clear. Vessels must not pass between the rocks forming the Peapod group.

**Doe Bay** indents the southeastern shore of Orcas Island abreast Peapod Rocks. **Doebay**, a village with a post office, is on the shore of the bay. There is a wharf with 12 feet at its head; during strong southerly winds the wharf should not be approached.

**Sinclair Island**, northward of Cypress Island, is wooded and comparatively low in places; reefs extend off the northern shore for nearly 0.5 mile. **Urban Landing** is a village with a post office at the southwestern end of the island. There is a wharf with 12 feet of water at its head.

**Boulder Reef** is a dangerous shoal which extends over 0.5 mile from the northwestern shore of Sinclair Island; portions of the reef uncover at half tide and a large boulder is at the inner part of the reef. It is well marked by kelp but this is frequently drawn under by the current. The outer end of the reef is marked by a buoy.

**Lummi Island**, which is wooded and about 8 miles long, forms the eastern side of the northern end of Rosario Strait, opposite Orcas Island. The northern part is low, but in the southern part **Lummi Peak** attains an elevation of 1,740 feet. Lummi Island has automobile ferry service with the mainland.

**Lummi Rocks**, a group of rocks and islets, are off the southwestern shore of Lummi Island about 3 miles north-westward of the southern extremity.

Shoals extend over 0.5 mile from **Point Migley**, the northwestern extremity of Lummi Island; the northwestern edge of the shoals is marked by a buoy. **Sinclair Island**, open westward of **Village Point**, leads westward of this shoal.

**Clark Island** and **Barnes Island**, with a small number of adjacent islets, form a group lying almost in the middle of Rosario Strait, about 2.5 miles northwestward of Lawrence Point, the eastern extremity of Orcas Island. These islands may be passed on either side but they should be given a berth of 0.5 mile.

**Matia Island**, a wildlife refuge about 1.5 miles eastward of **Sucia Islands**, is 120 feet high and wooded. A fresh-water spring is at the head of the small cove on the southeastern point. **Puffin Island**, with a reef extending about 400 yards eastward from the southern extremity, is close eastward of Matia Island, from which it is separated by a narrow channel with a least charted depth of 5½ fathoms. A light is on the outer extremity of the reef extending eastward of Puffin Island.

**Sucia Islands**, **Ewing Island**, and **Patos Island** have been described previously.

**Alden Bank**, within the 10-fathom curve, is about 3 miles long in a southeasterly direction, with a greatest width of 1.5 miles. The shoalest part, on which are patches of 2¾ and 3 fathoms, covering a considerable area, is near the southeastern part of the bank and is approximately 3.2 miles northward of Matia Island. A lighted bell buoy is at the southern extremity and an unlighted buoy marks the eastern edge of the bank.

**Chart 6376.—Skagit Bay** is between the northern part of **Whidbey Island** and the mainland. The bay is entered from the north through Deception Pass and from the south the approach is through **Saratoga Passage**. **Skagit River**, described in the next chapter, empties in the southeastern part of the bay.

The greater portion of **Skagit Bay** is filled with flats, bare at low water. Shoals extend about 100 to 300 yards from the **Whidbey Island** shore. Along the shore of **Whidbey Island**, between it and the edge of the flats, is a narrow channel varying in width from 0.2 to 0.5 mile. This channel is about 6.5 miles long from its southern end to **Hope Island**, where it narrows to 150 yards. The channel is marked with aids to navigation from Deception Pass to the jettied entrance of **Swinomish Channel**. The main channel from Deception Pass southward through **Skagit Bay** has a controlling depth of 6½ fathoms. Current velocities up to 2 knots have been observed in the channel. The **Tidal Current Tables**, **Pacific Coast**, should be consulted for current predictions.

**Skagit Island**, 111 feet high and steep-to on its southern extremity, and **Kiket Island**, 194 feet high and steep-to along its northwestern side, are eastward of **Hoypus Point** on the eastern side of **Skagit Bay**.

**Similk Bay** is in the northeastern end of **Skagit Bay**. The northeasterly portion of the bay is used extensively

for log rafting operations and is unsafe for other navigation.

**Hope Island** is in the northern part of **Skagit Bay**. A light is on the southwestern extremity of the island. The eastern shore of the island is fringed with offlying rocks.

**Ala Spit**, abreast the western end of **Hope Island**, is a low, projecting point; a shoal extends about 350 yards from the point. In the small cove westward of the spit are fish stakes and a wharf in poor condition which bares at low water.

Good anchorage may be had northward of **Hope Island**, and vessels at times make use of this anchorage area while waiting for slack water in **Deception Pass**.

The narrow channel eastward of **Hope Island** is used by small craft with local knowledge. This channel, with a controlling depth of 5 fathoms, passes about 130 yards off the **Hope Island** shore. The bottom is rocky and very irregular, and numerous dangers marked by heavy kelp are between the channel and the **Fidalgo Island** shore. Southward of **Hunot Point** is an anchorage for pleasure craft during the summer months.

**Seal Rocks** are about 1.4 miles southward of **Hope Island**, on the eastern side of the main channel in **Skagit Bay**. They are marked by a light.

**Swinomish Channel** connects the waters of **Skagit Bay** with those of **Padilla Bay**, 5 miles northward. A Federal project provides for a channel 12 feet deep and 100 feet wide from deep water in **Skagit Bay** to deep water in **Padilla Bay**. In April-September 1958 the controlling depth was 8½ feet to about 1,000 feet above **Morris Street** at **La Conner**, thence 7½ feet to the railroad bridge, and thence 9 feet to **Padilla Bay**.

The channel leads northeastward along the northern side of **Goat Island**, which is rocky, steep, and timber covered; then continues past the southern point of **Fidalgo Island** and the western end of **McGlenn Island**. **Hole in the Wall** is the name used locally to refer to the narrow opening between **McGlenn** and **Fidalgo Islands**, through which the channel connects with **Swinomish Channel**. The channel is marked with lights, daybeacons and buoys. Lights are also off the outer ends of the north and south jetties at the southern entrance.

**Swinomish Channel** is crossed by a fixed bridge just below **La Conner** with a horizontal clearance of 100 feet and an overhead clearance of 75 feet. The west portion of the former swing bridge at **La Conner** is being used as a dock. The remainder of the bridge structure was being removed in 1957. At the entrance to **Padilla Bay** are two bridges. The highway bridge has a lift span with a horizontal clearance of 100 feet and an overhead clearance of 12 feet, down, and 75 feet, up. The railroad bridge has a swing span with a horizontal clearance of 100 feet and an overhead clearance of 5 feet. The signal for opening these bridges is 4 long blasts. The least permit clearance of the overhead power cables crossing the channel is 76 feet at **La Conner**.

Most of the yachts going between **Bellingham** and **Seattle** use **Swinomish Channel** in preference to **Deception Pass** because of the weaker currents and shorter run. The channel is used extensively for towing logs.

**La Conner**, near the southern end of Swinomish Channel, is the center of a rich agricultural district. It has wharves with depths of 4 to 14 feet. A limited amount of provisions can be obtained. There is a small marine railway capable of handling boats up to 65 feet in length.

**Ika Island**, 410 feet high, 0.6 mile eastward of Goat Island, is heavily wooded, and on its southern and eastern sides is characterized by weathered cliffs rising from the high-water line. Shifting channels of 1- to 2-foot depths exist across the mudflats from Skagit Bay to the North Fork of the Skagit River and to Sullivan Slough.

**Guemes Channel**, separating Guemes Island on the north and Fidalgo Island on the south, leads eastward from Rosario Strait to Padilla Bay. The channel, which is about 3 miles long and 0.5 mile wide at its narrowest point, has depths of 8 to 18 fathoms. The channel has been swept clear to a least depth of 48 feet by wire drag. Buoys mark the channel at the western entrance.

**Shannon Point**, the southern point at the western entrance to Guemes Channel, is low and rounding; a rocky shoal, marked by a lighted buoy at its northern extremity, extends 200 yards northward from the point.

In Guemes Channel the current velocity exceeds 5 knots at times. It is reported that the flood (eastward current) is accompanied by an eddy between the eastern end of Guemes Island and Capsante, with the westward counter current extending about 200 yards from the shore along the north side of Fidalgo Island.

Current predictions for Guemes Channel may be obtained from data given in the Tidal Current Tables, Pacific Coast. During periods of strong currents, vessels anchoring in the channel should guard against dragging anchor, as the holding ground is poor.

**Ship Harbor** is a bight close eastward of Shannon Point, at the western entrance to Guemes Channel. The former large wharves have been removed.

**City of Seattle Rock**, with  $1\frac{1}{2}$  fathoms over it, is 200 yards offshore on the southern side of the channel, about 2 miles eastward of Shannon Point.

**Anacortes**, on the southern shore of Guemes Channel, is the center of an extensive salmon-canning industry, and canneries with wharves built out to depths of 12 to 20 feet line the southern shore of the channel. A large fertilizer factory, veneer plant, shingle mill, and cold storage plant are here.

The port is incorporated in the **Port of Anacortes**. Commerce includes logs, lumber products, wood pulp, salmon, fertilizer, and farm produce.

**Capsante Waterway**, leading to the eastern waterfront of Anacortes, is marked by a lighted range, buoys and lights on the ends of the breakwaters forming the boat harbor. A Federal project provides for a channel 12 feet deep and 150 to 250 feet wide from deep water in Fidalgo Bay to a mooring basin of the same depth inside the harbor. In July 1957 the controlling depth was 10 feet. There is space in the basin for about 300 boats.

**Anchorage** may be had off the wharves in 6 to 12 fathoms. During periods of strong current vessels at anchor in the channel should guard against dragging as the holding ground is poor.

**Tides**.—The mean range of the tide at Anacortes is about 5 feet while the range between mean lower low water and mean higher high water is about 8 feet.

**Pilotage**.—Pilots may be obtained through the Puget Sound Pilots' Association, Seattle.

**Towage**.—Several local towboats are available.

**Quarantine**.—Vessels subject to quarantine usually proceed to their docks where they are boarded for inspection. If vessels require fumigation after discharging cargo at Anacortes, this service is performed at the port. Advance notice should be given the senior surgeon of the U.S. Public Health Service of Seattle. The Public Health Service maintains an outpatient office in the city.

**Customs**.—Anacortes is a port of entry.

**Immigration** officials are stationed at Anacortes.

**Harbor regulations**.—No harbor regulations are prescribed. The port manager has an office at the foot of Commercial Street.

**Terminal facilities**.—The port wharf at the foot of Commercial Street is used for general cargo. It has a frontage of 440 feet and a depth of 30 feet alongside, and can accommodate deep-draft vessels. There is 118,000 square feet of covered warehouse space. A fog signal is on the wharf. Fuel oils in any quantity may be obtained at the oil wharf on March Point on the eastern side of Fidalgo Bay.

**Supplies and repairs**.—Fuel oils, water, coal, provisions, and ship chandlery can be obtained. A shipyard with a marine railway having a capacity of 300 tons and capable of hauling out vessels up to 120 feet in length and 14-foot draft is in Anacortes. There are several marinas for the servicing and accommodation of small craft. They are equipped for both hull and engine repairs.

**Communication** is by rail, telegraph, and telephone. Ferry service is maintained to Guemes Island and San Juan Archipelago, and during the summer months, to Sidney, Vancouver Island.

**Fidalgo Bay**, a shallow arm of Padilla Bay, extends southward from the eastern end of Guemes Channel. A shallow channel leads through the flat toward the head of the bay.

**Padilla Bay** is between the mainland and the northern part of Fidalgo Island. The bay is largely occupied by drying flats, but deep water lies eastward of Capsante and Guemes Island. Entrance to the bay may be had from Rosario Strait through Guemes Channel; a passage eastward of Guemes Island leads into Padilla Bay from the northward.

March Point, low and wooded, is on the northern end of a peninsula separating Fidalgo and Padilla Bays. Two oil-loading piers extend northward from the point to deep water in the bay southwestward of Hat Island. The outer ends of the westerly pier are marked by lights, and the outer westerly end of the easterly pier is marked by a fog signal. A light 0.6 mile northward of the point marks the entrance to the channel across the flats leading to Swinomish Channel.

**Hat, Dot and Saddlebag Islands** are on the western edge of the flat extending from the eastern side of Padilla Bay. Northward of these islands, flats and shoals extend to

William Point at the northern end of the bay. **Huckleberry Island**, small and low, is nearly in midchannel between Guemes and Saddlebag Islands.

**Chart 6378.**—**William Point** about 100 feet high, is the western point of **Samish Island**, which forms the northern side of Padilla Bay. The point is wooded and, because of the low land eastward of it, appears as an island. The western extremity of the point is marked by a light.

**Jack Island**, on the western side of the bay, is about 1.4 miles east-southeastward of Clark Point, the northern extremity of Guemes Island. South-southwestward of Jack Island a shoal with depths less than 3 fathoms extends about 700 yards off the northeastern side of Guemes Island.

**Bellingham Channel**, between Cypress and Guemes Islands, is the most direct and the one generally used by vessels proceeding to Bellingham Bay from the southward. The depths vary from 17 to 60 fathoms in midchannel. Between Cypress, Guemes and Sinclair Islands, the tidal currents have considerable velocity, but between Sinclair and Vendovi Islands, the velocity of the current is considerably less. A shoal marked by a buoy fringes the yellow bluff forming the southwestern side of Guemes Island.

A light is on the western side of Bellingham Channel on the eastern extremity of Cypress Island. **Deepwater Bay** is southwestward of the light.

**Cone Islands**, a group of five islets on the western side of Bellingham Channel, are off the northeastern side of Cypress Island just northward of **Eagle Harbor**. The easternmost, 70 feet high, is the largest of the group. Foul ground extends about 300 yards westward of the northernmost islet.

**Clark Point**, on the eastern side of Bellingham Channel, is a steep bluff forming the northern point of Guemes Island. A reef extends about 300 yards northward from the point.

**Vendovi Island**, about 1.8 miles northeastward of Clark Point, is on the southeastern side of the southern approach to Bellingham Bay. A shoal with a least depth of  $4\frac{1}{4}$  fathoms is about 700 yards southwestward of Vendovi Island and is marked on its western side by a buoy.

A light is on the southeastern end of Sinclair Island.

Deep-draft vessels approaching Bellingham Bay from the northward use the channel between Lummi and Sinclair Islands. With the exception of Viti Rocks and the dangers northward of Sinclair Island, this channel is free of danger. The fairway is deep and has a width of 1,200 yards at its narrowest part, between Viti Rocks and **Carter Point**, the southern extremity of Lummi Island.

**Viti Rocks** are about 0.7 mile southwestward of Carter Point and extend 500 yards northwestward. The northwesternmost rock is 35 feet high, 200 yards long, and 70 yards wide, and is marked by a light on its highest point.

A measured course, 6,484 feet long (1.066 miles) on bearing  $160^{\circ}34'$ , is eastward of Eliza Island. The southerly markers are the lights on Viti Rocks and Eliza Rock; the northerly markers are white tripods—the front

marker on the north tip of Eliza Island and the rear marker on the shore of Lummi Island.

**Hale Passage**, separating Lummi Island from the mainland northeastward, is about 6 miles long and has an average width of about 0.8 mile. The depths vary from  $2\frac{1}{2}$  fathoms on the bar near the northwestern end to 20 fathoms in the southeastern end of the channel.

**Lummi Point**, on the western side of Hale Passage, is about 1.5 miles southeastward of Point Migley, the northwestern extremity of Lummi Island. It is marked by a lighted buoy.

**Lummi Bay**, northward of the northwestern end of Hale Passage, indents the mainland between **Sandy Point**, about 2.2 miles northward of Point Migley, and a point about 3.5 miles south-southeastward. The bay is almost completely filled with a drying flat.

**Lummi Island**, a village with a post office, is on the western side of Hale Passage, about a mile southward of Lummi Point. A wharf with a depth of 10 feet off its end serves the ferry operating to **Fishermans Cove**, the bay southward of **Gooseberry Point on Lummi Indian Reservation**. Just westward of the ferry slip is a small wharf equipped with a trolley for launching and hoisting small pleasure craft. There is a 70-foot float alongside from which gasoline and other petroleum products are available to small craft.

From **Point Frances**, the northern point at the southeastern entrance of Hale Passage, a bank extends to Eliza Island. The depths range from  $4\frac{1}{2}$  fathoms to  $1\frac{1}{2}$  fathoms about midway between the point and the island. A buoy is close southward of the shoal. The end of the spit making out southeastward from Point Frances is marked by buoys.

**Bellingham Bay**, from William Point to the head, is about 12 miles long and 3 miles wide. Anchorage may be obtained almost anywhere in the bay; the depths, over the greater portion vary from 6 to 15 fathoms, mud bottom; however, due to the nature of the mud bottom, vessels are apt to drag anchor in heavy weather.

**Samish Bay**, separated from Padilla Bay by Samish Island, with flats bare for a considerable distance at low water, constitutes the southeastern part of Bellingham Bay. Extensive oyster culture is carried on in the eastern portion of the bay.

**Eliza Island**, low and partially wooded, is 1 mile northeastward of Carter Point. On the northwestern side of the island are the ruins of a marine railway and pier. The island is fringed by a shoal, and in most places the shores should not be approached within about 400 yards. A rock with a depth of 1 fathom is about 500 yards northward of the western extremity of the island. **Eliza Rock**, off the southern end of the island, is marked by a light and fog signal.

**Chuckanut Bay**, which indents the eastern shore of Bellingham Bay, is a cove affording shelter to small vessels. A cannery with wharf and an old stone quarry are on the east shore. Chuckanut Island and Chuckanut Rock lie close within the entrance.

**Post Point**, on the eastern side of Bellingham Bay, is 1.5 miles north-northwestward of the northern entrance

point of Chuckanut Bay. A sandy spit, marked by a lighted bell buoy, extends about 450 yards from the point.

**Starr Rock**, with a depth of  $1\frac{1}{4}$  fathoms over it, is about 300 yards offshore, 0.7 mile southwestward of the entrance to the Whatcom Creek Waterway; it is marked by a buoy. Vessels should not pass inside the rock.

A haven for a large number of small boats is adjacent to, and eastward of, Squalicum Creek Waterway. Ice, fuel, provisions, and repair facilities are available.

The villages of **Lummi** and **Marietta** are near the mouth of the **Nooksack River** which empties into the northwestern part of Bellingham Bay. Extensive mud flats fill this corner of the bay.

**Bellingham** is at the head of Bellingham Bay on the eastern shore. The principal products are wood pulp, canned fish, cement, lumber, and agricultural products. There is a shipyard at the Squalicum Creek Waterway. A Coast Guard patrol boat is stationed in the Whatcom Creek Waterway. A chain foundry and cannery are the principal industries in South Bellingham.

**Prominent features.**—The local newspaper building bears the lighted sign **HERALD** which is particularly noticeable at night. During the day the Bellingham Museum, a red brick building with a clock tower, shows prominently. The stack at the cement plant, 1.8 miles northwestward of Whatcom Creek Waterway, is conspicuous.

A light and fog signal are on the northwest corner of the warehouse of the municipal wharf at the entrance to the **Whatcom Creek Waterway**. The red sector of the light covers the shoreline on the southeast side of the bay and **Starr Rock**.

A light is on the east side of the channel at the entrance to **Squalicum Creek Waterway**. The southerly entrance to the small-boat basin to the eastward of the Squalicum Creek Waterway is between two breakwaters, the channelward ends of which are marked by lights. A fog signal is also on the end of the southerly breakwater. The entrance from the Squalicum Creek Waterway is marked by a light on the north end of the breakwater.

**Channels.**—A Federal project provides for a channel in the Whatcom Creek Waterway 26 feet deep from deep water in the bay for a distance of 750 yards inside the light, thence 18 feet deep for the inner 435 yards; for an entrance channel in the Squalicum Creek Waterway 26 feet deep from deep water in the bay to the main pierhead line and a basin of the same depth; and for a small-boat basin 12 feet deep eastward of the Squalicum Creek Waterway protected by two breakwaters.

The Whatcom Creek Waterway is maintained at or near project depths. In September 1955 the controlling depth for the Squalicum Creek Waterway was 23 feet and the basin 20 feet. In September 1958 the small-boat basin was at project depth.

**Anchorage.**—Bellingham Bay is mostly mud bottom but the mud is a thin accumulation over hardpan and is not good holding ground in heavy weather. A general anchorage and an explosive anchorage are in the bay; limits and regulations are given in § 202.230, Chapter 2.

**Tides.**—The mean range of the tide at Bellingham is about 5 feet; the range between mean lower low water

and mean higher high water is about  $8\frac{1}{2}$  feet. A range of about 14 feet may occur at the time of maximum tides.

See Appendix for **storm warning** display.

**Pilotage.**—Pilots may be obtained from the Puget Sound Pilots' Association, Seattle.

**Towage.**—Towboats up to 400 horsepower are available in Bellingham. Larger tugs, when required, are available from Everett or Seattle by arrangement.

**Quarantine.**—Vessels destined for Bellingham which require quarantine inspection usually proceed to their docks where they are boarded by quarantine officers. Fumigation may be had at Bellingham by giving advance notice to the senior surgeon of the U.S. Public Health Service at Seattle. The Public Health Service maintains an outpatient office in the city.

**Customs.**—Bellingham is a port of entry; marine documents are issued.

**Immigration** officials are stationed in the city.

**Harbor regulations** are prescribed for Bellingham Harbor, and are enforced by a harbormaster. The limit of speed for vessels within 2,000 feet of the wharves is 6 miles an hour, and from 2,000 feet to 1 mile from the wharves it is 8 miles per hour. The Port of Bellingham office is on the port wharf.

**Terminal facilities.**—A number of wharves are built out from the northern and eastern shores with depths of 18 to 35 feet alongside. Ordinary facilities are available for handling dry cargo. There are no facilities for heavy lifts available for public use. There are several warehouses. A large cold storage plant and an ice plant are along the Squalicum Creek Waterway.

**Supplies.**—Provisions and ship chandlery may be obtained. Water can be had at the wharves and fuel oil at the oil docks.

**Repairs.**—There are marine railways available. Major hull and engine repairs can be made to vessels not exceeding 1,500 tons, 250 feet in length, and a 20-foot draft.

**Communication** is by rail or bus, and by telegraph and telephone. Marine radiotelephone service is available. The airport is about 1.5 miles northwestward of the city. Bellingham is on U.S. Highway 99.

**Chart 6300.**—The **Strait of Georgia** between the southeastern end of Vancouver Island and the mainland northeastward, extends about 115 miles northwestward from the convergence of Rosario Strait and the continuation of Haro Strait and San Juan Channel. In the Strait of Georgia, the general depths are great and in many places exceed 200 fathoms. Rosario Strait, Haro Strait, and San Juan Channel have been described previously.

Vessels bound to the Strait of Georgia from Puget Sound should give the southern shore between Boundary and Active Passes a berth of at least 2 miles because it is fringed with dangers. Point Roberts, on the northern shore, affords an excellent landmark.

**Tidal currents.**—In the Strait of Georgia, the tidal currents are not nearly as strong as those in the channels leading to it from the Strait of Juan de Fuca. The currents in the Strait of Georgia attain a velocity of 3 knots at times, particularly during the freshets of summer, when

the Fraser River discharges a large volume of fresh water. This fresh water, which has a peculiar milky color, flows across the banks at the mouth of the river and almost directly toward Active Pass. Frequently this water extends entirely across the strait and at times reaches into the inner channels along the shore of Vancouver Island; at other times, it reaches only to the middle of the strait and forms a striking contrast with the deep blue water of the Strait of Georgia.

In the middle of the strait northward of Patos and Saturna Islands, the velocity of the current varies from 1 to 3 knots, seldom exceeding the latter. The velocity is still less northwestward of the mouth of the Fraser River, where the width of the strait is about 15 miles. Southeastward of the mouth of this river the tidal currents are slightly stronger off the southern shore than off the northern one; within a line joining Point Roberts and Sandy Point, the currents are scarcely felt and vessels can take advantage of this, especially since good anchorage can be obtained in this vicinity.

The tidal currents are stronger close to the southern shore which is swept by the rapid currents out of Active, Porlier, and Gabriola Passes. The south-going tidal current in the Strait of Georgia sets strongly southwestward into Active Pass.

**Chart 6380.**—Between Sandy Point, previously described, and Cherry Point, about 4.5 miles north-northwestward, the shore of the mainland forms a bight in which there are no offlying dangers. An oil-loading wharf with a trestle approach extends 0.4 mile from shore, 2.4 miles northward of Sandy Point. A fog signal is on the outer end of the wharf.

**Point Whitehorn**, about 2.8 miles northwestward of Cherry Point, is a conspicuous, bold bluff about 150 feet high; its seaward face is a steep cliff of white clay.

**Chart 6300.**—Birch Bay, on the eastern side of the Strait of Georgia, is between Point Whitehorn and Birch Point, about 3 miles northwestward; it is an open bight, affording anchorage in 4 to 5 fathoms. It is open southward and westward, but affords some protection from northward. The bay is circular in shape and about 2 miles in extent. Flats, bare at low water, occupy a considerable area at the head of the bay. A number of resorts are along the shores of the bay.

The **International Boundary** between the United States and Canada is marked by 3 sets of range lights where it crosses Semiahmoo and Boundary Bays. One set is in the eastern part of Semiahmoo Bay and the other two sets are northward of Point Roberts on the western side of Boundary Bay.

The **Peace Monument** on the boundary is a masonry arch, facing north and south, about 28 feet above the ground, and painted white. It is a distinctive landmark as it stands alone and shows offshore against a background of dark trees.

**Caution.**—The attention of all mariners, especially those frequenting Puget Sound or Canadian waters, is

called to the fact that the International Rules govern in Canadian waters.

**Point Roberts** is the prominent feature in approaching from either northward or southward. The eastern face is about 180 feet high and is composed of white, vertical bluffs. The point is well wooded, and owing to the low land behind it, is usually made as an island, especially from southward. The southwestern extremity of the point is marked by a light.

Temporary anchorage may be obtained westward of Point Roberts in a depth of 8 fathoms, good holding ground, about 1 mile  $321^\circ$  from Point Roberts Light. The position is about 0.3 mile from the edge of Roberts Bank; vessels should not anchor any farther northward.

**Chart 6399.**—**Semiahmoo Bay** has its entrance between Birch Point and Kwomais Point, about 5 miles north-northwestward. It is funnel-shaped and is connected, at its eastern end, by a narrow channel with Drayton Harbor. The eastern part of the bay is shoal. Anchorage may be had in the bay in 5 to 9 fathoms, but is exposed southward and westward.

**Drayton Harbor** is a small basinlike cove formed by **Semiahmoo Spit**, the extension of a sandspit northward of Birch Point. It is about 2 miles in extent, but flats bare at low water occupy a large area in the eastern and southern parts of the harbor. The small-boat harbor extension, enclosed by a breakwater, provides shelter in depths of 12 feet. Additional piers and facilities have been established.

A light and fog signal are near the northern extremity of the extensive sand flats that extend off the northwestern side of Semiahmoo Spit. A buoy marking the western edge of the sand flats is about 70 yards southwestward of the light. Another buoy, marking the northwestern side of the channel leading into Drayton Harbor, is 550 yards northeastward of the light.

The channel from Semiahmoo Bay into Drayton Harbor has a controlling depth of 28 feet. There is a 16-foot spot about 200 yards northward of the cannery wharf on Semiahmoo Spit; in entering Drayton Harbor, vessels should favor the southern side of the channel.

**California Creek**, entering the southeastern part of the harbor, has its entrance barred by a fixed highway bridge having a horizontal clearance of 10 feet and an overhead clearance of 5 feet; the entrance to this creek may be reached only at high water with shallow-draft boats.

**Dakota Creek** may be entered at high water by boats drawing not more than 3 feet as far as the bridge which is 0.5 mile above the mouth and at the head of navigation.

In the harbor is a large low-water area which is to be avoided even at high tide. Numerous piles, wreckage, and dumps make high-water navigation hazardous even with a shallow-draft boat. There are many boulders between the low-water and high-water lines.

**Blaine** is near the entrance on the northern shore of Drayton Harbor. Blaine city wharf, with a depth of 24 feet along its face, has a service station where water and petroleum products for small craft can be obtained. A

well protected boat basin with a project depth of 12 feet is on the south side of the city wharf. It is being enlarged (1957) and the rubble breakwater to the southward is being extended.

Several buildings, an elevated tank, and a cannery, constituting the town of **Semiahmoo**, are at the northern end of the sandspit. A depth of 30 feet has been reported at the large cannery wharf. Provisions and water are obtainable.

To enter Drayton Harbor from Semiahmoo Bay pass about 300 yards northward of Semiahmoo Harbor Light, and steer a course about midway between the cannery wharves and the boat basin. After reaching the cannery wharves favor the northern side of the channel to avoid the spit east-southeastward of the cannery, and anchor as convenient.

The depths in Drayton Harbor and its entrance are subject to change, hence the charted data should be verified.

**Tides.**—The mean range of tide at Blaine is about 6 feet while the range between mean lower low water and mean higher high water is about 9½ feet.

See Appendix for storm warning display.

**Pilotage** is compulsory for all vessels except under coasting trade on the west coast of the United States, including Alaska and British Columbia. Pilots may be obtained from the Puget Sound Pilots, Seattle, on short notice.

**Customs.**—Blaine is a port of entry.

**Communication** may be had by rail and there are telephone and telegraph facilities. The United States-Canadian boundary line passes through the northern edge of Blaine; the Pacific Highway, providing freight and bus service, passes through the town.

**Chart 6300.**—**Strait of Georgia, eastern shore (Canada).**—**Boundary Bay** indents the mainland between **Kwomais Point**, the northern entrance point of Semiahmoo Bay, and Point Roberts. The greater portion of the bay is filled with flats, bare at low water. In the northeastern part of the bay the flats are intersected by narrow, shallow channels leading to the **Nicomekl** and **Serpentine Rivers**.

Except for **English Bluff** about 1.5 miles northward of **Boundary Bluff**, the coast northward to Point Grey is low, featureless, and barely discernible from the Strait of Georgia.

**Roberts Bank** and **Sturgeon Bank** are formed by the alluvial deposits of the Fraser River. The former, extending northwestward of Point Roberts, is southward of the river channel and the latter, extending southwestward of Point Grey, northward of it. These banks dry in patches and in places extend 4.5 miles offshore. They are steep-to; soundings of 50 fathoms will be found very close to the edge of the bank. Vessels proceeding along the edge of Roberts Bank should not bring the southern extremity of Point Roberts or the edge of the high trees immediately within it to bear more than 114°. A buoy marks the entrance to the channel leading through Roberts Bank to Canoe Pass.

The cooperation of ships' masters is requested in not navigating their vessels, wherever practicable, within 2

miles of Sturgeon Bank. This is in the interest of the fishing industry and the reduction of damage to nets and fishing vessels by ships passing in close proximity to the fishing ground. It is understood that mutual agreement has been reached on this point between the shipping and fishing interests and the Department of Transport urges mutual cooperation.

The **Fraser River** enters the Strait of Georgia about 10 miles northwestward of Point Roberts. The river is joined by the **Coquitlan** and **Pitt Rivers** about 3.5 miles, respectively, above New Westminster. The **Harrison River** joins the Fraser River about 60 miles above the mouth.

The least depth in the channel from the Strait of Georgia to Westminster, on the northern bank about 20 miles up the river, was 21 feet in 1957; between New Westminster and **Port Mann**, about 3 miles eastward, the least depth was 23 feet. In 1957 by operating on the tides, vessels drawing 28 feet were using the river to New Westminster.

The river is at its lowest level during January, February, and March. It begins to rise in April with a more rapid rise in May and reaches its highest level about the end of June. The river begins to subside between the middle and end of August, and in September the current is not inconveniently strong. September, October, and November are favorable for the navigation of the river as the water is then sufficiently high for vessels to reach **Hope**, 80 miles above the mouth, and the strength of the current has considerably abated.

**Caution.**—The channels in the Fraser River are constantly changing and the aids to navigation which mark them are moved accordingly.

**Pilotage** on the Fraser River is governed by the New Westminster Pilotage District of British Columbia, 713 Columbia Avenue, New Westminster. Pilots can be obtained from New Westminster. They usually meet inbound vessels about a mile seaward of Steveston Jetty Light. Pilotage is not compulsory, but the payment of pilotage dues is compulsory for all vessels over 250 net registered tons, with certain exceptions.

**Towboats** of 500 maximum horsepower are available at New Westminster.

The harbor commissioner's office is at 713 Columbia Avenue.

The main entrance to the Fraser River is between the two lighted buoys westerly of the light near the outer end of Steveston Jetty; thence between Sturgeon Bank on the north and Roberts Bank on the south.

The channel entrance is protected on its northern side by **Steveston Jetty**, built along the southern edge of Sturgeon Bank, extending 1.5 miles west-northwestward and thence 3.2 miles southwestward from Garry Point. **Sand Heads Light** (49°06.4' N., 123°18.1' W.), 53 feet above the water and visible 12 miles, is shown from a square tower on a rectangular aluminum building on a pier near the outer end of Steveston Jetty; the radiobeacon and the fog signal at the light are synchronized for distance finding. A lighted whistle buoy 1.2 miles southwestward of the outer end of the jetty, marks the western extremity of Roberts Bank.

**Steveston** on **Lulu Island**, about 0.5 mile eastward of **Garry Point**, the northern entrance point to Fraser River, extends along the bank of the river about 1 mile. Several canneries and wharves are here; large fishing boats can lie alongside the wharves at all stages of tide. Small quantities of gasoline and diesel oil are available.

A number of islands are in the mouth of the Fraser River.

**Canoe Pass** is a narrow channel about 3 miles south-eastward of **Pelly Point**, the southern entrance point of Fraser River. Light-draft vessels with local knowledge use the narrow and intricate channel from Canoe Pass through Roberts Bank to the Strait of Georgia. A swing bridge crosses the northeastern end of Canoe Pass.

The tidal currents in the Fraser River are affected by the weather in the Strait of Georgia, the rains, and the amount of water in the river. In the channel above **Garry Point** during freshets, the flow, which may be checked by the rise of the tide, is almost continuously toward the mouth of the river. During the freshets the greatest velocity occurs 2 to 3 hours before low water and may amount to 5½ knots. After the freshets are over, the greatest velocity occurs on the average about 1½ hours before low water and is reduced to 3 or 4 knots. During the low stage of the river there is a flood and ebb on all the larger tides; the flood begins soon after high water and commences first along the bottom.

At New Westminster the flood current is unable to reverse the river current except in the autumn months. The river is seldom frozen over here; loose pieces of ice, which do no damage to shipping, occasionally come down the river.

**New Westminster** is on the northern bank about 20 miles above the entrance. Several canneries and sawmills are here and a conspicuous grain elevator stands about a mile below the town. A large cold storage plant is available. The wharves have depths of 27 to 34 feet along-side; most of the wharves have warehouses and sheds and many have railroad tracks. Extensive engine repairs and minor hull repairs can be effected. Supplies of all kinds are available; small quantities of coal, diesel oil, and fuel oil are available.

A railroad car ferry operates between Port Mann and Victoria, Vancouver Island.

**North Arm** is entered by a channel, dredged for a width of 300 feet and a depth of 10 feet, heading from the Strait of Georgia about 0.5 mile southwestward of Point Grey. North Arm, under the name of **North Fraser Harbor**, has been developed for sawmilling and other purposes. It is spanned by several swing bridges.

A jetty, which forms the southern side of the western entrance channel to North Arm, extends about 3 miles northwestward of **Iona Island**, which is on the southern side of the entrance proper of North Arm. Navigational aids mark this channel.

**Middle Arm** is a branch of North Arm and is separated from the western end of North Arm by **Sea Island**.

**Point Grey**, the southern entrance point of **Burrard Inlet**, is a rounded bluff forming the western termination

of a wooded promontory. The point is very conspicuous from southward. On the high land above the point are the conspicuous buildings of the University of British Columbia.

The 6-fathom curve is about a mile offshore, and depths of 3 fathoms are about 0.5 mile northwestward of Point Grey. A lighted bell buoy is about 1.2 miles northward of Point Grey.

**Point Atkinson**, the northern entrance point of Burrard Inlet, is comparatively steep-to; however, a rock which dries 5 feet is 100 yards offshore about 700 yards north-eastward of the point and a rock awash is about 500 yards northeastward of the point. **Point Atkinson Light** (49° 19.9' N., 123° 15.8' W.), 108 feet above the water and visible 16 miles, is shown from a white hexagonal tower on the point; the radiobeacon and the fog signal at the light are synchronized for distance finding.

Tide rips occur frequently off Point Atkinson, caused by the meeting of the tidal currents from Burrard Inlet and Howe Sound.

**Spanish Bank** extends about 1,200 yards northward from the western half of the promontory terminating in Point Grey. The bank, which dries, is composed of hard sand, is steep-to, and its position is indicated by a ripple during strong westerly winds at or near low water. On its northern edge, about 1.5 miles northeastward of Point Grey, is a heap of boulders which dries 5 feet. The bank is steep-to and its position is indicated only by a ripple during westerly winds and then only at or near low water. A measured course, 6,077 feet long, on bearing 090° is on Spanish Bank. Each of the two pairs of markers consists of a large triangle on a post.

**English Bay**, on the southern shore of Burrard Inlet, is immediately within the entrance of Point Grey. The depths in the bay decrease regularly from the 10-fathom curve, but northward of the bay a deep channel has been scoured by the discharge through First Narrows from the upper portion of Vancouver Island. A rocky shoal fringes the western side of Stanley Park Peninsula. **False Creek** is an inlet leading southeastward from the eastern extremity of the bay. In 1957, foul ground was reported to exist off the entrance. The entrance to the creek is marked by a light and echoboard on the south shore and range lights on the first two bridges. The first of the four bridges crossing the inlet has an overhead clearance of 90 feet.

**Vancouver Harbor** includes all the tidal waters in Burrard Inlet eastward of a line drawn from Point Grey to Point Atkinson. A secure harbor, available to the largest vessels afloat, is formed between First and Second Narrows, and on its southern shore is the city of **Vancouver**, the third largest city of Canada and the commercial metropolis of British Columbia. A U.S. Immigration station is in the Credit Foncier Building, 850 West Hastings, Vancouver, B.C.

The three principal anchorages in Vancouver Harbor are English Bay, the outer anchorage; **Vancouver** within First Narrows; and **Port Moody**, at the head of the eastern arm of Burrard Inlet.

The general depths in First Narrows are  $5\frac{1}{4}$  to 12 fathoms; the fairway has been swept to a depth of 32 feet.

In First Narrows the average velocity of the tidal current at strength is nearly 4 knots and velocities of 6 knots or more occur at times. Daily current predictions for First Narrows and data from which similar predictions may be made for Second Narrows are published in the Tidal Current Tables, Pacific Coast.

First Narrows is formed between the northern part of the Stanley Park Peninsula and a flat extending 200 to 600 yards off the mouth of the Capilano River. Off Prospect Point, the northern extremity of the Stanley Park Peninsula, the channel is not more than 300 yards wide.

From a distance seaward, the entrance to First Narrows is difficult to identify without local knowledge. The twin spires of a church about 1.8 miles southeastward of Navy Jock Point (Reardon Point) are prominent.

Prospect Point is a high bluff on the southern side of First Narrows.

A signal station is on the suspension bridge crossing the First Narrows. The station is at the middle point of the bridge and vessels may communicate with the station by any form of visual signaling. Signals to warn mariners of the presence of other vessels in First Narrows are displayed from the yardarms of the signal mast. The signals are visible to outbound vessels immediately after they round Brockton Point. One black ball, on the southern yardarm, indicates one or more inbound vessels; two black balls, horizontally placed, indicate one or more inbound vessels with tows. At night the balls are replaced by white lights. One red cone with the point up, on the northern yardarm, indicates one or more outbound vessels; two red cones, points up, placed horizontally, indicates one or more outbound vessels with tows. At night the cones are replaced by red lights. A cone, point down, over a cone, point up, indicates the fairway is obstructed; at night a red flare indicates the fairway is obstructed.

Prospect Point Light ( $49^{\circ}18.9' N.$ ,  $123^{\circ}08.4' W.$ ), 35 feet above the water and visible 11 miles, is shown from a white square tower with a red band located under the bluff; a fog signal is at the light. Between Prospect and Brockton Points the southern shore of the channel is fringed with drying ledges that extend as far as 150 yards offshore.

The flat delta at the mouth of Capilano River on the northern side of First Narrows, is steep-to and dries about 12 feet; it is composed of shingle and boulders. A light and fog signal 525 yards westerly and a light and fog signal 900 yards easterly of the bridge crossing the First Narrows mark the northern side of the channel.

A suspension bridge, with an overhead clearance of 200 feet, crosses First Narrows close eastward of Prospect Point.

Pilotage for all waters of British Columbia, except the Fraser River, is controlled by the British Columbia Pilotage Authority, Federal Building, 325 Granville Street, Vancouver, B.C. Pilotage is not compulsory, but payment of dues is compulsory for all vessels over 250 net registered tons.

Chart 6380.—Strait of Georgia, western shore (Canada).—The coast between East Point and Active Pass should be given a berth of at least 2 miles as it is fringed with dangers. East Point, Rosenfeld Rock, and Tumbo Island have been described previously.

Belle Chain Islets, a narrow rocky ridge lying parallel with several islets and drying rocks along the northern shore of Samuel Island, extend about 2 miles northwestward from about 1,300 yards northwestward of Winter Point, the northern port of Saturna Island. The largest islet, 34 feet high with a few trees on it, is near the southeastern extremity of the ridge. About 800 yards within the northwestern extremity of the ridge is a rock 3 feet high.

Edith Point, the northeastern extremity of Mayne Island, is almost 3.5 miles northwestward of Winter Point. Foul ground, with a depth of 5 fathoms at its outer end, extends about 0.3 mile southeastward from Edith Point.

A rocky patch with two heads, each of which has a depth of 4 feet, is about midway between Edith Point and the northwestern end of Belle Chain Islets. Between this patch and the northwestern end of Belle Chain Islets are some 5-fathom patches.

Campbell Bay, on the eastern side of Mayne Island, is between Edith Point and Campbell Point. A rock which dries 11 feet is about 100 yards offshore and 0.2 mile within Edith Point, but elsewhere the bay is free of danger. A good temporary anchorage, open to the southeastward, can be had in 12 fathoms, mud bottom, about 800 yards from the head of the bay and about 100 yards southward of an islet, 3 feet high. Vessels entering the bay should round Edith Point at a distance of about 800 yards by steering for Campbell Point bearing  $217^{\circ}$ , thus passing between the foul ground off Edith Point and the rocky patch with two heads farther southward.

Chart 6300.—Active Pass has been described previously. Salamanca Point, on the southeastern side of Galiano Island, is conspicuous from both southeastward and northwestward. The point is rocky and the trees on it grow down nearly to the high-water mark.

Between Salamanca Point and the entrance to Porlier Pass, about 12 miles northwestward, the southern shore of the Strait of Georgia is formed by the northeastern shore of Galiano Island, which may be approached safely to a distance of 0.5 mile.

Porlier Pass separates Galiano and Valdes Islands and connects Trincomali Channel with the Strait of Georgia. The pass has a minimum width of about 800 yards, but the navigable channel is narrow and the tidal currents attain velocities up to 8 knots. Current predictions may be obtained from data given in the Tidal Current Tables, Pacific Coast. It is advisable to employ a pilot on the first visit to this pass.

Range lights on bearing  $196^{\circ}$  mark the entrance to the pass. A bell buoy is close eastward of the shoals and rocks on the western side of the northern approach to the pass.

Gabriola Pass is between the northwestern end of Valdes

Island and Gabriola Island, connecting the northwestern end of **Pylades Channel** to the Strait of Georgia. This pass, being narrow and intricate and having many dangers on its eastern approach, is not recommended for general navigation and should be used only by those with local knowledge.

**Gabriola Reefs**, a dangerous group of rocks, extend from about a mile east-northeastward to about 2 miles northeastward of the southern point of **Breakwater Island**, which is at the entrance to Gabriola Pass. On the reef are some rocks that dry 3 to 7 feet, but the northernmost and southernmost dangers have depths of 3 fathoms.

**Thrasher Rock**, a detached steep-to-rock that dries 1½ feet, is about 400 yards eastward of the northern end of Gabriola Reefs and about 2 miles northeastward of the southern extremity of Breakwater Island. A light is on the rock. A rocky 5-fathom patch is about 400 yards northeastward of the rock.

Nanoose Hill, bearing less than 287° and open northward of Berry Point, clears Gabriola Reefs and leads northward of Gabriola Reefs and Thrasher Rock.

**Flat Top Islands**, northward of Breakwater Island, are close off the eastern point of Gabriola Island.

**Berry Point** is the northeastern point of Gabriola Island. The northern shore of the island is thickly wooded and apparently bold; it has not been thoroughly surveyed and should not be approached within 0.8 mile.

**Entrance Island**, about 0.5 mile northeastward of Berry Point, is a sandstone rock 30 feet high, bare of trees, but some vegetation grows on it. **Entrance Island Light** (49° 12.8' N., 123° 48.8' W.), 58 feet above the water and visible 13 miles, is shown from a red octagonal lantern on top of a white square wooden dwelling; a fog signal is at the light. Rocky patches, with depths of 7 to 8 fathoms, lie within 1.8 miles eastward of the island; the patches are surrounded by deep water. Vessels without local knowledge should pass outside Entrance Island and not through **Forwood Channel** between the island and Berry Point which is used by local steamers.

Sailing vessels working through the Strait of Georgia at night should keep Entrance Island Light in sight; the light is obscured when bearing more than 301°.

**Tinson Point**, about 1.5 miles westward of Berry Point, is the northeastern extremity of a small peninsula at the northwestern end of Gabriola Island. From the western end of the peninsula kelp-covered reefs with depths of 1 to 5 fathoms extend about 600 yards northwestward.

**Snake Island**, a smooth-topped, grassy island 35 feet high, is about 1.8 miles northwestward of Tinson Point. Several rocks above water and others that dry are on reefs extending about 200 yards northward, eastward, and southward and about 100 yards westward. A rocky ledge, marked by a bell buoy and usually by kelp, extends about 400 yards southward from about 0.2 mile southeastward of the southern point of Snake Island. A rock with a least depth of 6 feet is on this ledge.

**Fairway Channel**, the easternmost of the channels in the northern approach to Nanaimo, leads between Snake Island and Tinson Point. The channel is deep and has a navigable width of 0.8 mile.

**Five Finger Island**, 40 feet high, a bare, rugged island with five hummocks resembling the knuckles of a closed hand, is about 1.2 miles northwestward of Snake Island. Foul ground fringes the island on all sides and extends about 250 yards southward of it. A detached 3-fathom patch is about 0.3 mile westward of the island.

**Hudson Rocks**, five small islets 4 to 37 feet high, lie between 800 and 1,200 yards southwestward of Five Finger Island. Reefs surround Hudson Rocks and in places extend about 200 yards from them. A light is on the summit of the southwestern islet. A detached 3-fathom patch is about 350 yards east-northeastward of the southernmost of the Hudson Rocks.

**Rainbow Channel** leads between Snake Island on the east and Five Finger Island and Hudson Rocks on the west; this channel is deep and over a mile wide.

**Horswell Channel**, the westernmost of the channels in the northern approach at Nanaimo, leads between Hudson Rocks and the Vancouver Island shore; the fairway is deep and almost 0.5 mile wide.

**Clarke Rock** lies on the western side of Horswell Channel. The rock dries 4 feet and is marked by a daybeacon.

**Horswell Bluff** forms the southern point of the western side of Horswell Point. Foul ground extends about 600 yards east-southeastward from the bluff. A buoy is about 200 yards east-southeastward of the extremity of the foul ground.

**Newcastle Island**, 377 feet high, is on the western side of the northern approach of Nanaimo and about a mile southward of Horswell Bluff. The shores of the island are rocky. The area has been swept to a depth of 29 feet at low water.

**Protection Island** lies with **Batchelor Point**, its northeastward extremity, about a mile south-southeastward of McKay Point. With the exception of its northern and southern extremities, the island is thickly wooded with the tops of the trees on its summit reaching a height of about 200 feet; on the southern part of the island are some buildings connected with a coal mine.

**Nanaimo Harbor** is entered between **Gallows Point** and the drying mud flats westward of **Jack Point**; the flats form the southern side of the harbor. Good anchorage can be had in 5½ fathoms.

**Nanaimo** is a port of entry. Pilots are available and will meet vessels outside by arrangement. Wharves have depths up to 31 feet alongside. Supplies of all kinds are available. Foundry and machine shops are available for hull and engine repairs.

**Neck Point**, about 2 miles westward of Five Fingers Island, at the northwestern entrance point of **Hammond Bay**, is fringed with foul ground that extends almost 200 yards offshore; on this foul ground are three islets, of which the highest, 19 feet, is the southernmost.

A submerged target is 4 miles eastward of Maude Island Light. Anchoring and fishing are prohibited within 0.25 mile of the light.

The coast of Vancouver Island from Neck Point trends westward for 3 miles to **Icarus Point**, with **Blunden Point** 2 miles beyond and on the southern side of the entrance to Nanoose Harbor. The coast is fairly steep-to, the 10-

fathom curve being charted 500 yards offshore; it has not been closely surveyed.

**Nanoose Harbor**, about 8 miles northwestward of Nanaimo, is easily recognized by Nanoose Hill on the northern side of the harbor. The hill appears as a double or notched peak from the southward; the northeastern peak has an elevation of 799 feet, but the trees on it increase the height to 854 feet. The southwestern peak has an elevation of 716 feet. The trend of the harbor is east and west and it is about 2 miles long with an average width of about 1,500 yards; the head is low and swampy. It is available for all classes of vessels; there are depths of 12 to 16 fathoms in the entrance.

Between **Wallis Point**, the northern entrance point of Nanoose Harbor, and **Dorcas Point**, about 4 miles northwestward, the shore is fronted by several islands and numerous islets, rocks, and shoals lying in the northern approach to Nanoose Harbor. No vessel without local knowledge should attempt to pass between them or between any of them and the shore.

**Maude Island**, about 0.8 mile eastward of Wallis Point, forms the northern side of the approach to Nanoose Harbor. The island is wooded and 119 feet high to the tops of the trees. A light is on the southern side of the island. A detached bare islet, 11 feet high, is 75 yards off the western extremity of Maude Island and a rock drying 2 feet is 125 yards southward of the same extremity; foul ground extends 75 yards eastward and westward of the latter rock. The eastern point of the island is foul for 100 yards southward.

**Edgell Banks** are 1,500 yards eastward of Maude Island, and consist of four separate shoals, the three eastern of which have least depths of 8, 9, and 10 fathoms, respectively; the western one has a least depth of  $4\frac{1}{2}$  fathoms. The latter shoal is 1,200 yards east-northeastward of the eastern extremity of Maude Island.

**Winchelsea Islands**, the outermost of those to the northward of Nanoose Harbor, are five islands lying close together about 1.3 miles northward of Maude Island. The westernmost of the group, 84 feet high, is the highest, but the easternmost island, 79 feet high, is the largest. All these islands are covered with grass and on them are a few stunted trees.

**Gray Rock**, 2 feet high, is a small, gray rock about 0.2 mile eastward of the southern end of the Winchelsea Islands. **Rudder Rock**, about 400 yards southeastward of Gray Rock, having a depth of 6 feet, is the head of a shoal which has depths of less than 10 fathoms and is not marked by kelp.

**Yeo, Douglas, and Gerald Islands**, with **Amelia Island** between them and the shore, lie between 2 and 3 miles northwestward of Winchelsea Islands. In the vicinity of these islands there is much foul ground and a vessel without local knowledge should not attempt to pass between them, or between any of them and the shore.

**Ballenas Islands**, two islands on the southern side of the Strait of Georgia, are located with their southern extremity about 2 miles northeastward of Dorcas Point. The northern island is about 250 feet high and has only two or three trees on it; its summit terminates in a sharp, bare nipple on which stands an old lighthouse, 33 feet high, consisting of a white square wooden tower with a red lantern. The southern island is wooded and 175 feet high. They have the appearance of being one island when seen from any direction, being separated only by a narrow passage which, at the eastern entrance, is less than 200 yards wide. The western end of this channel is almost closed and there is no passage into it from that direction.

The islands are steep-to and bold on all seaward sides, except for a rocky shoal with a depth of 4 fathoms, about 450 yards off the southeastern extremity of the southern island.

**Ballenas Islands Light** ( $49^{\circ}21.1' N.$ ,  $124^{\circ}09.5' W.$ ), 70 feet above the water and visible 14 miles, is shown from a white octagonal tower with a red octagonal lantern on the northern point of North Ballenas Island; a fog signal is at the light.

**Ballenas Channel** is not less than 0.7 mile wide in the fairway. Steamers and coasting vessels may take this channel but it should not be used without local knowledge.

**Halibut Bank**, about 18 miles easterly of Ballenas Island Light, consists of two parts; the southeastern and small part has a depth of 15 fathoms, and the northwestern part has a least depth of 12 fathoms, hard sand and stones.

### 13. PUGET SOUND, WASHINGTON

**Chart 6401.**—Puget Sound extends about 53 miles in a general southerly direction from Point Wilson and then turns southwestward for about 30 miles, expanding into numerous inlets and passages, the majority of which are navigable by deep-draft vessels. Admiralty Inlet is the northern portion of the sound from Point Wilson to Foulweather Bluff.

Navigation of this area is easy in clear weather and the chart is an excellent guide. The outlying dangers are few and marked by aids, and generally a mid-channel course can be followed with safety. The currents follow the general direction of the channels and have considerable velocity. In thick weather, vessels with local knowledge depend upon the echo from the whistle in navigating these waters, but owing to the uncertainty of the currents and the great depth which render the lead useless in many places, strangers are advised to obtain a pilot.

**Anchorage.**—General, explosives and foul weather anchorages have been established for the Puget Sound area; limits and regulations are given in § 202.230, Chapter 2.

**Dangers.**—Restricted areas have been established for the Puget Sound area; limits and regulations are given in § 207.750, Chapter 2.

The large tides of Puget Sound are very complex and variable; use of the Tide Tables is advised.

**Currents.**—Daily predictions of the times of slack water and the times and velocities of strength of current in Admiralty Inlet off Bush Point, together with factors and differences for obtaining the times and velocities of the current for other points in the northern part of Puget Sound are given in the Tidal Current Tables, Pacific Coast. The Tidal Currents Charts, Puget Sound, Northern Part, show the direction and velocity of the tidal current for each hour of its cycle in the waterways of Puget Sound from Admiralty Inlet to Seattle. They are designed for use with the current predictions for Admiralty Inlet contained in the Tidal Current Tables, Pacific Coast. A similar publication entitled Tidal Current Charts, Puget Sound, Southern Part, covers the sound from Seattle to Olympia.

In Admiralty Inlet and Puget Sound, the tidal currents are subjected to daily inequalities similar to those of the tides. Velocities of 2 to 5 knots at strength occur from Point Wilson to Point No Point. In the more open waters of the sound southward of Point No Point the velocities are much less.

At Point Wilson and at Marrowstone Point, slack water occurs from one-half to one hour earlier near shore than in mid-channel.

In the winter when southerly winds prevail, there is generally a northerly surface drift which increases the

ebb current and decreases the flood current. This effect is about  $\frac{1}{2}$  knot between Nodule and Bush Points.

The tidal currents in the southern entrance of Possession Sound are weak and variable.

Between Foulweather Bluff and Misery Point, the tidal currents have an average velocity of about  $\frac{3}{4}$  knot at strength, while in the southern part of Hood Canal, the average velocity at strength is only about  $\frac{1}{2}$  knot; at times of tropic tides, however, the greater ebbs may attain velocities more than double these average values.

The tidal currents have velocities up to 6 knots or more at strength in Agate Passage.

**Chart 6405.**—Port Townsend lies immediately southward of Point Wilson and has its entrance between Point Hudson and Marrowstone Point. It extends in a general south-southwesterly direction for 2.5 miles, with a width of 1.5 miles, and then turns southeastward for 3 miles, with a reduced width to its head. Inside Point Hudson the depths range from 15 to 8 fathoms to Haddock at the head of the bay. It is an excellent harbor with good anchorage throughout and easily entered. The prevailing winds in summer are from west to southwest, and in winter generally in the southeastern quadrant. Southeasterly gales, sweeping up the long expanse of Hood Canal and across the low land at the head of the bay and at the ends of Kilisut Harbor into Port Townsend, are at times severe.

The large pulpmill at Port Townsend emits a continuous yellowish smoke which acts like fog, but is more persistent. At times the visibility in Admiralty Inlet is reduced to about 0.5 mile by the smoke as far north and west as Dungeness with easterly winds, and as far south as Double Bluff with westerly winds. The smoke has a characteristic sulphurous odor. The visibility conditions are particularly bad when the natural fog occurs at the same time.

**Point Hudson**, on the western shore about 1.7 miles south-southeastward of Point Wilson, is low and sandy. Its extremity is marked by a light and fog signal. The outer limits of the shoal making out from the point is marked by a buoy 0.2 mile northeasterly of the light.

**Marrowstone Point**, the eastern point at the entrance to Port Townsend, is low at its extremity but rises abruptly to a bluff about 120 feet high. The buildings of Fort Flagler, now unused, are about 0.5 mile to the south. A pier, also unused, with 20 feet of water alongside, extends out abreast of the buildings. A former pier, of which only isolated piling now remains, lies about 0.5 mile to the westward of the light. **Marrowstone Point Light** ( $48^{\circ}06.1' N.$ ,  $122^{\circ}41.2' W.$ ), 28 feet above the water and

visible 10 miles, is shown from a white square structure on the eastern extremity of the point; a fog signal is at the light.

**Midchannel Bank** extends northwestward from Marrowstone Point about 2 miles toward Point Wilson with depths varying from  $4\frac{1}{2}$  to 10 fathoms.

**Port Townsend**, the principal town, is on the western shore immediately southward and westward of Point Hudson. The depths at the wharves are ample.

**Anchorage.**—The usual anchorage is about 0.5 to 0.75 mile southward of the railroad ferry landing in 8 to 10 fathoms, muddy bottom, or off the wharves in town. In southerly gales better anchorage is afforded closer inshore off the northern end of Marrowstone Island or near the head of the bay in moderate depths, muddy bottom. Two **explosive anchorages** are in the bay; limits and regulations are given in § 202.230, Chapter 2.

A haven for small boats, with a depth of 10 feet, is maintained by the port of Port Townsend, 1 mile southwestward of Point Hudson. There are lights at the entrance and a light on the southern corner.

**Tides.**—The mean range of tide at Port Townsend is 5.1 feet. The range between mean lower low water and higher high water is 8.3 feet. Because of the large diurnal inequality in this vicinity there may be only one high water and one low water a day. Reference should be made to the Tide Tables which give daily tide predictions for Port Townsend.

See Appendix for storm warning display.

**Pilots** for Puget Sound are available at Port Angeles.

**Towage.**—There are no large towboats stationed at Port Townsend, but they may be obtained from Seattle or other sound ports.

**Quarantine.**—There is an outpatient office of the U.S. Public Health Service in Port Townsend.

**Customs.**—Port Townsend is a port of entry; marine documents are issued. The customs officer also handles immigration matters.

**Supplies.**—Provisions and ship chandlery can be obtained. Water may be had at the wharves. A limited amount of coal is on hand, but any amount may be supplied on short notice. Fuel oil may be obtained in limited quantities; gasoline and diesel oil may be obtained at several small oil wharves.

**Repairs.**—There are no drydocks, and minor repairs only can be made. There are facilities for hauling out launches and fishing boats up to 85 feet in length, 8-foot draft, and 300 tons deadweight.

**Communications.**—A passenger and automobile ferry operates the year around between Port Townsend and Keystone Harbor, just eastward of Admiralty Head, Whidbey Island. During the winter months it operates on a reduced schedule of 4 days weekly. There are rail and bus connections with Port Angeles. Port Townsend is on the Olympic Loop Highway, which encircles the Olympic Peninsula and connects with Seattle through Olympia. There are telephone and telegraph facilities.

**Glen Cove** is about 2.2 miles southwestward of Point Hudson. A large paper mill with a wharf for deep-draft vessels is situated at the northern end of the cove. It is

the principal industry of the area. An area surrounding the wharf and extending to deep water has been dredged to a depth of 30 feet. The northern edge of the dredged area is marked by buoys. A lighted range for approaching the wharf and a fog signal are maintained by the mill. The large white building and tall stacks of the mill are prominent.

**Irondale**, on the western shore about a mile from the head of the bay, is the site of a former iron foundry. Shoal water extends 0.2 mile from the shore at this place. Log booms extend northward 0.8 mile to **Kala Point** which is marked by a light. The mouth of **Chimacum Creek** lies just north of Irondale.

**Hadlock**, a village with a post office at the head of the harbor, has a landing wharf but a few submerged pilings near it make local knowledge necessary to avoid them.

A Federal project provides for **Port Townsend Canal** with a channel 15 feet deep and 75 feet wide connecting Port Townsend and Oak Bay. The canal is subject to considerable shoaling. In June 1957 the controlling depth was 14 feet. Jetties are at the southern end of the canal which are almost submerged at high water. Lights are at both entrances to the canal. The light at the southern entrance is on the outer end of the west jetty, and the light at the northern entrance is on the west side of the canal. The currents through the canal are strong at times although there is no particular danger from them as the channel is wide and straight, but there are strong eddies at the south end on the ebb current. The canal is crossed by a fixed highway bridge with a horizontal clearance of 236 feet and an overhead clearance of 60 feet over the center width of 127 feet. There are two overhead wire crossings with sufficient clearance to accommodate the general traffic. Rules and regulations for the use of the canal are given in § 207.750, Chapter 2.

**Kilisut Harbor**, separating **Indian Island** on the west and **Marrowstone Island** on the east, is a narrow inlet extending about 4 miles in a south-southeasterly direction, with an average width of 0.5 mile; the entrance is about 2.5 miles southwestward of Marrowstone Point. The entrance channel is winding, with a least depth of about 11 feet; inside good anchorage is afforded in 4 to 5 fathoms. At the southern end of the harbor the two islands are connected by an earthfilled causeway. This inlet is little used and local knowledge is necessary to enter. The village of **Nordland** lies on the eastern side of **Mystery Bay**, a small shallow cove midway on the eastern side of Kilisut Harbor. It has a post office, store, service station, and a small wharf which bares at low water. The head of the cove is used as a log dump.

A line of piling and the ruins of a pier extend from the northerly coast of Marrowstone Island about 1.6 miles westerly of Marrowstone Point Light.

**Chart 6450.**—**Admiralty Inlet** extends from the Strait of Juan de Fuca to Foulweather Bluff.

**Admiralty Bay**, eastward of Admiralty Head described in the previous chapter, is used only occasionally as an anchorage as it is exposed to southwesterly winds and has hard bottom and strong currents. **Keystone Harbor**, an im-

proved part of **Lake Crockett** lies just northeastward of Admiralty Head. A Federal project provides for an entrance channel 18 feet deep and 150 feet wide, and a mooring basin of the same depth. In June 1957 a survey showed slight shoaling on the west edge of the entrance channel and along the edges of the basin. Within the basin is a passenger and automobile ferry landing and a concrete ramp for launching small boats. About 300 yards eastward of the entrance to the basin are the ruins of a wharf.

**Bush Point** is marked by a light and fog signal at the end of a low sandspit. Back of the spit the land shows as a low timbered point from northward or southward. The flood current is reported to set strongly toward Bush Point. Tidal Current Charts for this area should be consulted. A rock lies 250 yards offshore and 1.1 miles southeastward of Bush Point.

**Oak Bay** is a cove on the western side of Admiralty Inlet, westward of the southern ends of Marrowstone and Indian Islands. A shoal which extends southward of the eastern entrance point is marked by a buoy.

**Mutiny Bay**, northwestward of Double Bluff, affords temporary anchorage near the center in 10 to 20 fathoms, which may be used if overtaken by fog. The extremities are clay bluff. The center is low with extensive flats. There are several sport fishing resorts, some equipped with marine railways for launching small boats. Petroleum products and provisions are available. Strong tide rips, at times dangerous for small boats, occur off Double Bluff, particularly on the ebb with strong northwesterly winds. There is frequently an eddy in Mutiny Bay; tidal current charts should be consulted.

**Double Bluff**, marked by a light and fog signal, consists of bare, white cliffs, 300 to 400 feet high on its eastern face, but much lower on its southwesterly face. A lighted buoy marks the extremity of the shoals extending 600 yards westward of the bluff. The shoals are usually marked by kelp.

**Chart 6421.—Foulweather Bluff**, on the east side of the entrance to Hood Canal, is one of the most prominent cliffs in Puget Sound. The northern face, which is bare, is 0.5 mile broad and consists of vertical, grayish sand and clay bluffs, 225 feet high, sloping off on the eastern side to a bluff 40 feet high, but on the Hood Canal side the point is steep and high. At the top of the bluff is a growth of fir and underbrush. There are several boulders which bare at low tide within 100 yards northward of the highest part of the bluff, and a shoal with depths of 2 to 18 feet extends 200 yards eastward from the extremity and in line with the face of the bluff. If overtaken by fog, temporary anchorage may be had 0.5 mile northward of Foulweather Bluff, in not less than 60 feet. A lighted buoy marks the shoal 0.4 mile northerly of the bluff.

At times there are tide rips northward of and around Foulweather Bluff sufficiently heavy to be dangerous to small craft and to break up log rafts. This is most dangerous when the ebb current from the main body of Puget Sound meets that of Hood Canal off the point,

and particularly so with the ebb against a strong northerly or northwesterly wind.

The entrance to **Port Ludlow**, in the western part of Admiralty Inlet, lies 9 miles southward of Marrowstone Point and on the west side at the entrance to Hood Canal. From the broad entrance the bay extends in a general southerly direction 2.5 miles, terminating in a basin 0.5 mile in diameter. The basin affords good anchorage in 40 to 48 feet, soft bottom; the shores are fairly steep.

**Tala Point**, the eastern point at the entrance, is bluff and wooded, and about 310 feet high. **Colvos Rocks**, three in number, are 1.2 miles northwestward of Tala Point and about 0.3 mile off the western shore; the westernmost rock, 25 feet high and of small extent with deep water around it, is marked by a light. From the other two a bank with 7 to 29 feet extends to Tala Point.

**Snake Rock** is 0.4 mile southwestward of the western Colvos Rock and 300 yards offshore; it is 150 yards in extent and shows slightly above high water.

**Klas Rock** is 0.6 mile northward of the western Colvos Rock and 0.2 mile from the western shore abreast the narrow entrance to **Mats Mats**, a small lagoon; it is of small extent and is awash at high water. The rock is marked by kelp and is surrounded by deep water with depths up to 100 feet between it and the shore.

The entrance to **Mats Mats** is approximately 100 yards wide at high water. A sunken rock which uncovers at low tide lies slightly northward of midchannel about 200 yards inside the entrance. A rock quarry is in the small cove on the east side of the lagoon at **Mats Mats**, from which barges of rock and gravel are towed to Puget Sound ports. Small vessels and pleasure craft use **Mats Mats** as an anchorage which is practically landlocked and protected from wind. There is a float extending from the south shore but there are no service facilities. Entrance to the cove should not be attempted except with local knowledge and preferably at high tide, favoring the south shore of the entrance and making the turn toward the south with extreme caution.

**Port Ludlow**, a former lumber mill town on the north shore of the bay of the same name, is practically abandoned. Nothing remains except the concrete shell of the former powerhouse and the water tank. The former wharves have disappeared, but some of the piling still remains. The former ferry slip is in ruins. There are log dumps and booming grounds at the head of the bay. The post office is now at **Mats Mats**, but it retains the name of Port Ludlow.

At the extreme southwestern portion of Port Ludlow are two islands known as **The Twins**. The small bay south of The Twins is used as an anchorage for small craft in rough weather.

**Channels.**—The deepest channel on entering Port Ludlow is eastward of **Klas Rock** and between **Snake Rock** and the western **Colvos Rock**; the width between the 5-fathom curves is 500 yards, with depths of 64 to 100 feet in midchannel. This channel has been dragged to a depth of 40 feet, and, except for a 22-foot rock lying 225 yards

southeastward of **Basalt Point** and about 0.6 mile northward of **Snake Rock**, a 1-foot shoal extending 175 yards from the western shore 0.4 mile southward from **Basalt Point**, and a 28-foot spot 200 yards southeastward of **Klas Rock**, it is clear to within 125 yards of **Colvos Rock Light** and 50 yards of **Snake Rock**. The channel between **Colvos Rocks** and **Tala Point** is 800 yards wide between the 18-foot curves. A natural range for entering through this channel is composed of the northeastern gable of the community house, a large rectangular gray house with three tiers of windows near the beach, for a front mark and a water tank 186 feet high for a rear mark. The channel depth ranges from 21 to 27 feet, with 24 feet on the range.

**Directions, Port Ludlow.**—From northward, the course should be shaped to pass 0.2 mile eastward of **Klas Rock**; pass to the westward of **Colvos Rock Light** at a distance of 200 yards. Then steer  $182^\circ$  giving **Snake Rock** and the western shore a berth of about 0.2 mile; haul southward and westward into the port, favoring the northern point when rounding into the basin, and anchor as desired.

If entering by the eastern channel, steer the range  $230^\circ$ , across the bank between **Colvos Rocks** and **Tala Point** until abeam of the latter, and then steer southwestward to the wharves or anchorage.

**Chart 6450.**—**Useless Bay**, to the eastward of **Double Bluff**, is open to the southwestward. The shores are in part bluff and in part low, with a fringe of marsh nearly around the bay. Flats and shoal water extend well off the shore, with a maximum distance of 0.5 mile at the head of the bay. **Deer Lagoon**, large and shallow, extends inland from the head of the bay.

**Hansville**, about 2.5 miles eastward of **Foulweather Bluff**, is a small village with a post office, stores, and service stations. It has a wharf with 8 feet of water at the end and a float. Gasoline and water are piped to the wharf. Provisions and transient accommodations are available. There is a crane of about 1-ton capacity for launching small boats. Minor repairs can be made.

**Norwegian Point**, low and rounding, lies about 0.2 mile northwestward of **Hansville**. The bight between **Foulweather Bluff** and **Norwegian Point** is known as **Skunk Bay**.

**Point No Point**, on the western shore of the sound about 3.5 miles eastward of **Foulweather Bluff**, is a low sandspit. **Point No Point Light** ( $47^\circ 54.7' N.$ ,  $122^\circ 31.5' W.$ ), 23 feet above the water and visible 10 miles, is shown from a white square tower on the end of the point; a fog signal is at the light. Boulders extend about 200 yards from **Pilot Point** about 2.2 miles southward of **Point No Point**.

**Scatchet Head** and **Possession Point**, at the southern end of **Whidbey Island**, are both prominent, especially from southward, the white bluffs being visible for a considerable distance. The white appearance of the bluff on **Possession Point** is accentuated by the removal of growth resulting from a landslide. A lighted bell buoy is 0.4 mile southward of the point. Shoals extend 0.5 mile offshore immediately westward of **Scatchet Head** and over 0.2 mile offshore from the head to **Possession Point**. **Cultus Bay**, just west of **Possession Point**, bares completely at low

water. There is a small sport-fishing center on the eastern shore equipped to handle and service small craft.

**Possession Sound** and tributaries are described later.

**Egdon** is a small village with a post office about 3 miles southward of **Point No Point**.

**Chart 6445.**—**Apple Cove Point** is a low sandspit projecting 220 yards from the high, wooded land about 6 miles southward of **Point No Point**. There are some houses on the point. The point is steep to but a shoal makes out nearly 0.5 mile southeastward from it. Just off the point is a light on a dolphin. Heavy tide rips caused by strong northwesterly winds and a strong ebb current are encountered in the vicinity of the light.

**Appletree Cove** is the open bight on the western side of the sound about 1.5 miles southward of **Apple Cove Point**. It affords anchorage in 30 to 60 feet inside the line of the entrance points, with some shelter from winds drawing in or out of the sound, but not from northward and southeastward.

**Kingston** is a town with a post office, situated on the northern side of the cove. It has a combination landing wharf and ferry slip. The automobile and passenger ferry runs between **Kingston** and **Edmonds**.

There is an electric powerplant with a prominent lighted sign about 3.2 miles southward from **Apple Cove Point** and just southward of **President Point**. Shoal water extends nearly 0.2 mile from high water off the powerplant.

**Edwards Point** is a high, wooded point on the eastern side of **Puget Sound** about 8.5 miles east-southeastward of **Point No Point**. It is a turning point for the steamers running from **Seattle** northward into **Possession Sound** and adjoining waters. A large oil storage and distributing plant is on **Edwards Point**. With its many large tanks on and below the bluff, the point is prominent from seaward. A wharf with a 256-foot berthing face extends to deep water. Dock lights, a lighted sign, and a fog signal are maintained by private interests on the wharf. Petroleum products in any quantity may be obtained.

**Edmonds**, about a mile northeastward of **Edwards Point**, is primarily a residential suburb of **Seattle**. There is a town wharf with a small-craft float on its south side. A ferry slip is on the end of the wharf. Ferry service is maintained to **Kingston**, on the west side of the sound. There are marine ways capable of handling boats 40 feet long. Gasoline and other petroleum products are available. A small-boat harbor is to be constructed (1957) south of the town wharf.

**Point Wells** is a low, sandy point projecting 450 yards from the high land about 1.2 miles southward of **Edwards Point**. It is distinguished by prominent oil tanks. It is a water terminal and storage plant for a large oil company. There is berthing space for several large vessels, and ample depths of water alongside both wharves. Northward and southward of these wharves shoals extend well offshore and care should be taken to avoid the shoal water when coming alongside or leaving the wharves. The lighted range on the point is used to clear the shoals northward of the wharves. A private fog sig-

nal is on the southerly wharf. **Richmond Beach** is a town about 0.5 mile southward of Point Wells.

**Port Madison** is on the western shore of Puget Sound, 12 miles southward of Point No Point between the northern end of Bainbridge Island and **Point Jefferson**. It is about 2.5 miles long in a westerly direction, with an average width of 2 miles. The depths range from over 500 feet at the entrance to 120 feet less than 0.5 mile from the beach, but the port affords anchorage closer inshore in 90 to 100 feet, sticky bottom. In the southwestern part it connects with Port Orchard through Agate Passage.

A naval restricted area marked by buoys is eastward of Point Jefferson; limits and regulations are given in § 207.750, Chapter 2. Within the area is a naval degaussing station which is available for check ranging and calibration of ships. Calibration requests should be made 72 hours in advance, if possible. The range base may be contacted by signals for check runs, or the degaussing office by telephone. Vessels of 30-foot beam and larger may use the range.

An anchorage for explosives is 1 mile westward of Point Jefferson in the northeastern part of Port Madison; limits and regulations are given in § 202.230, Chapter 2.

The northern shore is formed by broken white bluffs, with low beaches between, and bordered by sand and shingle beaches which bare at low water, in some cases for a distance of nearly 0.2 mile. The bluffs on the western shore are moderately low; the buildings of the Indian reservation near the entrance to Agate Passage are prominent. The town of **Suquamish** is on the western shore about 0.6 mile northward of Agate Point, the northern extremity of Bainbridge Island. **Indianola** (Kitsap Post Office) is a village on the northern shore of Port Madison. It has a store and a service station. Care must be taken in going to or from this place because of the shallow water just eastward of the outer end of the wharf.

**Miller Bay**, in the northwestern part of Port Madison, is used by shallow-draft pleasure craft. The channel, marked by private buoys, should not be used at low tide on account of the very irregular bottom. Anchorage in a depth of 6 to 7 feet, sticky mud bottom, may be had north of the second buoy. The controlling depth to this anchorage is about 1½ feet.

**Point Monroe**, the southern point at the entrance to Port Madison, is a low, narrow sandspit, curving westward and southward and marked by a light and fog signal. Several shallow-draft boats anchor in about 4 feet in the small cove between the sandspit and the shore to the southward. The entrance dries at low water.

The southern shore of Port Madison is composed of broken bluffs, except where it is indented by the narrow arm extending southward about 1 mile, on which is the town of Port Madison.

The entrance to the inlet leading to the town of **Port Madison** is about 0.8 mile westward of Point Monroe Light. The town is a popular summer resort and many cottages are along the shores of the inlet. There are moorings for visiting yachts, but no facilities for fueling. The channel in entering, with a least depth of 14 feet, is narrow, and local knowledge is necessary to keep in the best water.

An old ballast dump, nearly bare at low water, lies about 75 yards offshore about 400 yards in from the eastern entrance point. Care should be taken to avoid the cluster of sunken rocks about 100 yards off the eastern entrance point. There are several landings for launches in the inlet. Sheltered anchorage for small craft may be had in depths up to 21 feet, mud bottom.

The approaches to Port Madison have been examined with the wire drag and found free from obstructions.

**Meadow Point**, on the eastern shore, nearly opposite Point Monroe, is a low, grassy point, with a marshy lagoon within, and higher ground behind it. The city of Seattle maintains a bathing beach just southward of the point.

**Chart 6446.—Murden Cove** is an open bight on the western side of the sound about 3 miles southward of Point Monroe. An extensive flat which bares at low tide extends almost 0.5 mile from the head of the cove and outside of it the depth increases rapidly to 60 feet. **Skiff Point**, the northern entrance point, has low, yellow bluffs to the southward. A shoal extends about 250 yards from the point; this shoal is reported to be building out and should, therefore, be given a wide berth. **Yeomalt Point**, the southern entrance point, is a low, grassy sandspit, 150 yards wide, rising gradually to the general level of the high land. **Rollingbay** is a community of summer homes on the northern shore of the cove. Summer cottages extend along the shore northwestward from Skiff Point.

**Ferncliff** and **Yeomalt** are communities of summer homes 1 mile and 0.4 mile, respectively, northwestward of Yeomalt Point. The wharves are in ruins.

**Wing Point**, on the northern side of the entrance to Eagle Harbor, is a narrow, bluff point 30 feet high, covered with trees to the edge. A reef extends southeastward for 0.5 mile from Wing Point and is generally marked by kelp. The extremity of the reef is marked by a buoy. **Tyee Shoal**, 0.6 mile southeastward of Wing Point, with a least depth of 15 feet, is marked by a lighted bell buoy.

A spit, bare at low water, extends 300 yards northward from the southern point at the entrance to Eagle Harbor, and is marked by a lighted buoy off its northeastern edge. The spit also extends nearly 500 yards northwestward from the point with depths of 3 feet and less. A buoy is off the north end of the spit.

**Eagle Harbor** indents the eastern shore of Bainbridge Island, 5 miles southward of Point Monroe and opposite Elliott Bay. It is about 1 mile long with a width of 0.5 mile and affords excellent anchorage in 30 to 36 feet, muddy bottom. It narrows at the head to 300 yards and winds westward for 0.8 mile over flats which bare at low tide.

The entrance is deep but caution is necessary in entering because the channel is only 200 yards wide between the reef south of Wing Point and the sunken spit on the west side of the channel. The channel is marked by range lights.

To enter give Wing Point a berth of not less than 0.9 mile and round Tyee Shoal bell buoy about 0.2 mile. Steer the lighted range course 341°. Pass about 75 yards east-

ward of the lighted buoy and steer 299° to clear the northwestern end of the spit on the south side. When past the buoy marking the northwestern extremity, haul southwestward into the harbor, following the northern side at a distance of 350 yards and anchor as desired.

**Wing Point** is a small community on the northern shore of Eagle Harbor just inside of Wing Point.

A shipbuilding plant is on the northern side of the harbor about 0.8 mile from the entrance. It has marine ways capable of handling vessels of 3,000-ton displacement. The steel cradle is 325 feet long and can take a draft of 17 feet forward and 21 feet aft. The drydock is 64 feet wide, 240 feet long and 24 feet deep. There are wharf facilities. The ferry slip is just eastward of the shipyard.

**Hawley** is a small community of summer homes, 0.4 mile eastward of the shipyard. The wharf is in ruins.

**Winslow** is the largest town on Eagle Harbor. It is on the northern shore and has a landing wharf near the head with 8 feet alongside. Gasoline and fresh water may be obtained from the oil wharf with 8 feet alongside adjacent to the landing wharf. There is an automobile and passenger ferry to Seattle; telephone and telegraph communications are available.

**Creosote**, a town on the southern side of the entrance to Eagle Harbor, has a large creosoting plant. The main wharf has depths of 14 to 33 feet along the southern face. Fresh water is available. A light and fog signal are on a white house on a dolphin, eastward of the town, in 14 feet of water. Just northward of the light is a railway-car ferry slip. Large quantities of creosoted timber and pilings are shipped from Creosote to foreign and domestic ports. **Eagledale**, a small hamlet on the southern shore about 0.5 mile westward of Creosote, has a landing wharf built out 10 feet. It has a post office and limited supplies are available.

**Blakely Rock**, the highest of four rocks, is prominent in approaching Blakely Harbor; it lies 0.8 mile northward of Restoration Point, and at high water shows about 15 feet at its highest point. It is 300 yards in extent, with shoal water, well marked by kelp, extending over 250 yards northward. A light is on the south side of the rock.

**Blakely Harbor** is a small inlet on the eastern shore of Bainbridge Island near its southern end. It is about 1 mile in length and at the entrance nearly 0.5 mile wide, narrowing to the head. The depths range from 108 feet at the entrance to 21 feet near the head. The usual anchorage is near the entrance in 54 to 96 feet, sticky bottom, slightly favoring the southern shore. There are many old pilings and dolphins in the shoal waters near the shores.

**Port Blakely**, formerly an important lumber town, is on the northern shore near the head of the Blakely Harbor. There are no usable wharves in Blakely Harbor.

Directions are not needed for entering Blakely Harbor. Blakely Rock may be passed on either side but, if passing northward, it should be given a berth of not less than 0.3 mile.

**Restoration Point** is flat and about 10 feet above high water for 300 yards from the shore, then it rises abruptly

to a wooded knoll about 100 feet high, on which a number of large buildings are prominent.

**Decatur Reef**, partly bare at low water, extends 300 yards eastward of Restoration Point. The outer end of the reef is marked by a lighted bell buoy.

**Chart 6449.**—**Shilshole Bay** lies between Meadow Point and West Point. It is an open bight from which the Lake Washington Ship Canal is entered. The entrance to the canal, marked by a lighted bell buoy, lies about midway between the two points. Southeastward of the canal entrance, clay cliffs extend for about 0.5 mile. A small-boat harbor protected by a rock breakwater marked on each end by lights extends northward of the canal entrance. A fog signal is also on the southern end. The southern part of the harbor has a controlling depth of 15 feet and the northern part 10 feet. Lake Washington Ship Canal is described later.

**West Point**, at the northern entrance to Elliott Bay, is a low, sandy point which rises abruptly to an elevation of over 300 feet about 0.4 mile from its extremity. The edge of the shoal extending southwestward from the point is marked by a buoy. **West Point Light** (47°39.7 N., 122°26.1 W.), 27 feet above the water and visible 10 miles, is shown from a white square tower on the end of the point; the radiobeacon and the fog signal at the light are synchronized for distance finding.

**Alki Point**, the western extremity at the southern entrance to Elliott Bay, is a low point with a small prominent wooded knoll about 80 feet high, immediately behind it; eastward of the knoll, lowland extends for nearly 0.4 mile before rising to the high land extending southward from Duwamish Head. **Alki Point Light** (47°34.6 N., 122°25.2 W.), 39 feet above the water and visible 11 miles, is shown from a white octagonal tower attached to a building on the end of the point; a fog signal is at the light.

**Elliott Bay** indents the eastern shore of Puget Sound about 35 miles south-southeastward of Marrowstone Point. The entrance is between West Point on the north and Alki Point about 5 miles southward. The bay proper, lying east of a line between Magnolia Bluff and Duwamish Head, has a width of nearly 2 miles and extends east-southeastward for nearly the same distance. The bay is deep and free from dangers throughout. It constitutes the major portion of the outer harbor of the Port of Seattle.

**Magnolia Bluff**, largely bare, light-colored, and rising in places to nearly 300 feet, extends along the northern shore from West Point to Smith Cove.

**Fourmile Rock** is 60 yards offshore, 1.7 miles southeastward of West Point Light. A light and fog signal are on the rock.

**Duwamish Head**, 300 feet high, about 1.8 miles north-eastward of Alki Point, is bluff and steep on its northern face. A shoal extends about 60 yards northwestward from the head. A light and fog signal are 450 yards northward of the point.

**Seattle** is the largest and most important city in the Pacific Northwest. Its east and west limits extend from

Elliott Bay to Lake Washington. North and south it extends approximately from the latitude of Meadow Point to the southern end of Fauntleroy Cove. It includes Ballard which, until early in this century, was an independent city, and West Seattle which takes in the area south of Elliott Bay and west of the Duwamish River. Thickly populated suburban developments lie north and south of the city limits and along the eastern shore of Lake Washington. The Seattle Metropolitan Area includes all of King County.

The Port of Seattle includes an outer and inner harbor. The outer salt water harbor includes Elliott Bay; East, West, and Duwamish Waterways; Shilshole Bay, and the portions of Puget Sound adjacent to Ballard on the north and West Seattle to the south of the entrance to Elliott Bay. Seattle's fresh water inner harbor consists of Lakes Union and Washington which are connected with each other and with Puget Sound by the Lake Washington Ship Canal.

Seattle is second only to San Francisco on the Pacific coast in the volume of both foreign and domestic commerce which flows through its port. In recent years it has also developed into an important industrial center. It handles, almost exclusively, the commerce with Alaska. It is the terminus of several steamship lines operating to Alaska, across the Pacific, or through the Panama Canal, and it has railroad connections with all parts of the United States.

**Prominent features.**—The city covers several low hills rimming Elliott Bay and affords numerous landmarks for vessels approaching through the entrance to the bay. The most prominent buildings on the skyline are the Harborview Hospital, which from seaward presents a massive step-pyramid appearance, and the U.S. Public Health Service Hospital, about 1,500 yards to the southward. Most prominent among the buildings in the business section are, from north to south: The Northern Life Building with its brownstone construction and modern architecture; the Exchange Building, lower but massive, with its conspicuous flag tower; the Smith Building, 42 stories high with its distinctive pyramidal cap; and the clock tower on the King Street railroad station. When approaching at night the light, alternately flashing red, white, and blue on top of the Smith Building, and the large neon sign, PORT OF SEATTLE at the Bell Street Terminal, afford good marks.

The Duwamish River empties into the head of Elliott Bay through the East and West Waterways and is navigable for approximately 4.5 miles above its junction with the West Waterway. These waterways were developed as an extensive Federal project and the material dredged to form their channels was deposited between them to form Harbor Island, the center of a highly developed commercial and industrial area.

**East Waterway.**—The entrance to the East Waterway is marked by a light and fog signal on the outer end of the wharf on the western side of the entrance. The waterway serves a number of modern terminals including grain elevators, cold-storage plants, fuel- and vegetable-oil storage, and general cargo docks. Large vessels in foreign

and intercoastal trades berth and load in this waterway.

**West Waterway.**—The entrance is marked by a light and fog signal on the wharf on the eastern side of the waterway. There are a number of terminals and docks in West Waterway, most of which are used in the private business of their operators and are not open to the public. At the northwestern corner of Harbor Island is a large shipyard with three drydocks. Operating regulations for the waterway are given in § 207.750, Chapter 2.

A Federal project provides for a channel 34 feet deep over a width of 750 feet in East Waterway for 6,500 feet, thence of the same depth over a width of 400 feet to the West Spokane Street Bridge; a channel 34 feet deep over a width of 750 feet for 5,200 feet in West Waterway; a channel in the Duwamish River 30 feet deep to First Avenue South, thence 20 feet deep to Eighth Avenue South, thence 15 feet deep to a point about 5.2 miles above Elliott Bay; and three turning basins in the Duwamish River as follows: 30 feet deep near the head of East Waterway, 20 feet deep and 600 feet long by 350 feet wide just above First Avenue South, and 15 feet deep and 500 feet long by 250 feet wide at the head of the project. The channels in East and West Waterways are maintained at or near project dimensions. In November-December 1957 the controlling depths in Duwamish River were 30 feet to First Avenue South, thence 20 feet to Eighth Avenue South, thence 15 feet to about 1,200 yards above the Fourteenth Avenue South Bridge, thence 5 feet to Slip No. 7; and 1 to 3 feet in the lower turning basin.

**Chart 6447.**—Lake Washington Ship Canal extends from Puget Sound through Shilshole Bay, Salmon Bay, Lake Union, Portage Bay, and Union Bay to deep water in Lake Washington.

A double lock and fixed dam with movable crest and necessary accessory works are at the narrows at the entrance to Salmon Bay, approximately 1.2 miles from the deep water in Puget Sound. The large lock has a clear width of chamber of 80 feet, a maximum available length of 760 feet, a lift of 26 feet, and a depth on lower miter sill of 29 feet at mean lower low water. The small lock has a clear width of chamber of 30 feet, a maximum available length of 123 feet, a lift of 26 feet, and a depth on lower miter sill of 16 feet at mean lower low water. Ongoing vessels make the passage through the large lock in less than 30 minutes, and small vessels pass through the small lock in 5 to 10 minutes.

A Federal project provides for a channel 34 feet deep from Puget Sound to the locks with a passing basin of the same depth and a log basin 8 feet deep at the turn below the Great Northern Railway bridge; and a channel 30 feet deep from the locks to keep water in Lake Washington. The channel is maintained at or near project depths.

**Navigation regulations** for the Lake Washington Ship Canal are given in § 207.750, Chapter 2.

**Lake Union** is connected with Puget Sound and Lake Washington by the Lake Washington Ship Canal and can accommodate deep-draft vessels. It is fringed by a number of piers and wharves used mainly for marine repairs,

fitting out, and transshipment of lumber, fuel, and some industrial products. The buildings of the **University of Washington** are conspicuous just northward of the channel connecting Lake Union and Lake Washington.

**Chart 6449.**—**Lake Washington** is a large body of fresh water just eastward of Seattle. It has depths of up to more than 200 feet and can be navigated by deep-draft vessels for its entire length. The lake has been examined by the wire drag and is clear of snags except as noted on the chart.

A **measured nautical mile course** extends along the pontoon bridge that crosses the lake to Mercer Island. The targets are 15 inches square and located on both sides of the bridge so that the course, **091°55'**, can be run either north or south of the bridge. Another **measured course**, 5,110 feet long, extends off the western shore of the lake between **Wolf Bay** and Sand Point, on course **224°58'**.

There are numerous piers and wharves on the shores of the lake, most of which are private pleasure craft landings and moorings. The principal commercial installation is at **Port Quendall** on the eastern side of the lake opposite the southern end of Mercer Island. There is a lumber mill and creosoting plant here. The wharf is 457 feet long and has a depth of 26 feet along its face. There is extensive log storage both here and at the north end of the lake.

**Houghton**, at the northeastern side of the lake just south of Kirkland, is the former plant of the Lake Washington Shipyards. It has been largely dismantled but three large piers still remain and are used for dead storage. There are several oil piers in this area and several marinas catering to the needs of yachtsmen.

**Juanita Bay**, northward of Kirkland, is a summer recreational area. There are several small piers and on the eastern side of the bay are the ruins of a large pier.

The Naval Air Station at **Sand Point** is on the western shore of the lake just north of the Seattle city limits. A **prohibited area**, reserved for seaplane landings, and marked by special buoys, is 1.5 miles northward of Sandy Point; limits and regulations are given in § 207.750, Chapter 2. The eastern shore of the lake is built up with resort communities and suburban home developments.

**Anchorage.**—Anchorage is plentiful within the limits of the areas given in § 202.230, Chapter 2. In the Elliott Bay areas the water is deep, swinging room is limited, and vessels seldom anchor, usually going direct to the wharves. During heavy northerly weather, which is rare but occasionally occurs during the winter months, anchorage in the bay is uncomfortable. The city of Seattle maintains mooring buoys and floats.

**Bridges.**—Seven bridges cross the Lake Washington Ship Canal. The Great Northern Railway bridge, 0.8 mile above the Puget Sound entrance, has a bascule span with a horizontal clearance of 150 feet and an overhead clearance of 41 feet. The Ballard Highway Bridge, 0.8 mile eastward of the locks, has a bascule span with a horizontal clearance of 150 feet and an overhead clearance of 43 feet through the center of the span. The Northern Pacific

Railway bridge, 1.2 miles eastward of the locks, has a horizontal clearance of 150 feet and an overhead clearance of 15 feet. The Fremont Avenue Highway Bridge, 2.2 miles eastward of the locks, has a bascule span with a horizontal clearance of 150 feet and an overhead clearance of 29 feet. The George Washington Memorial Fixed Highway Bridge, 2.3 miles eastward of the locks, has a horizontal clearance of 525 feet; the center 150 feet has an overhead clearance of 135 feet, diminishing to 73 feet at the extremities of the maximum horizontal clearance. The University Highway Bridge, eastward of the northeastern tip of Lake Union, has a bascule span with a horizontal clearance of 175 feet and an overhead clearance of 43 feet through the center of the span. The Montlake Boulevard Bridge, across Portage cut, has a horizontal clearance of 150 feet and an overhead clearance of 44 feet through the center of the span. Operating regulations are given in § 203.795, Chapter 2.

A pontoon bridge crosses Lake Washington from Seattle to the north end of Mercer Island. Fixed overhead spans bridge the channels along each shore while a drawspan, 500 yards west of Mercer Island, admits passage of vessels. The west and east fixed spans have horizontal clearances of 190 feet and overhead clearances of 29 feet. The floating drawspan has a horizontal clearance of 200 feet. Mercer Island is connected with the east shore of the lake by a fixed bridge with a horizontal clearance of 200 feet and an overhead clearance of 38 feet. Operating regulations are given in § 203.800, Chapter 2.

Four bridges cross the Duwamish River over the improved section of the waterway. The West Spokane Street Highway Bridge, 500 yards southeast of the south end of the West Waterway, has a double bascule span with a horizontal clearance of 150 feet and an overhead clearance of 40 feet; the overhead power cable at these bridges has a permit clearance of 200 feet. The Northern Pacific Railway bridge, 200 yards above the West Spokane Street Bridge, has a bascule span with a horizontal clearance of 150 feet and an overhead clearance of 4½ feet. The First Avenue South Highway Bridge, 2 miles above the West Spokane Street bridge, has a bascule span with a horizontal clearance of 120 feet between leaves when open and an overhead clearance of 40 feet at the center of the span; the overhead power cable at this bridge has a permit clearance of 160 feet. The Fourteenth Avenue South Highway Bridge, 1.1 miles above the First Avenue South Bridge, has a bascule span with a horizontal clearance of 125 feet and an overhead clearance of 32 feet through the center of the span. Overhead power cables are 400 and 1,500 yards above this bridge with permit clearances of 90 and 134 feet, respectively. Operating regulations for the bridges are given in § 203.790, Chapter 2.

**Routes.**—Vessels bound for the Strait of Georgia from Seattle can use the following routes: via **Rosario Strait**—a midchannel course through Puget Sound and Admiralty Inlet, thence east of Partridge Bank, Smith Island, Davidson Rock, Belle Rock, Peapod Rocks, Clark Island, and thence between Sucia Islands and Alden Bank to the Strait of Georgia; via **Haro Strait**—from Admiralty Inlet,

thence west of Partridge Bank and east of Hein Bank, thence through Haro Strait and Boundary Pass to the Strait of Georgia.

These routes are available for vessels of any draft in clear weather. In thick weather, strangers are advised to take a pilot. A range should be steered when possible so as to insure making the compass courses good.

Between Admiralty Inlet and the entrance to Rosario Strait, the current on the flood has a tendency to set a vessel eastward toward Whidbey Island; it also sets strongly through Deception Pass and up Rosario Strait. Through Rosario Strait the currents run with considerable velocity. Heavy tide rips and swirls are found off Black Rock, Obstruction Pass, Peapod Rocks, and Lawrence Point.

In crossing from Admiralty Inlet to the entrance of Haro Strait the tidal currents setting to and from Rosario Strait and San Juan Channel, with estimated velocities of 2 to 3 knots, should be kept in mind. From Henry Island to around Turn Point heavy tide rips are found on the ebb. Particularly heavy and dangerous tide rips occur on the ebb between East Point and Patos Island and for 2 miles northward in the Strait of Georgia. The flood from Rosario Strait, which is felt as soon as the passage between Orcas and Sucia Islands is open, is apt to set a vessel toward East Point. The ebb in this vicinity sets to the eastward even before the Strait of Georgia is well open.

Tides at Seattle have a mean range of  $7\frac{1}{2}$  feet. The range between mean lower low water and mean higher high water is  $11\frac{1}{2}$  feet. A range of about 18 feet may occur at the time of maximum tides. Daily tide predictions for Seattle are given in the Tide Tables.

As a rule the tidal currents in the harbor have little velocity. At times, however, with a falling tide an appreciable current will be found setting northwestward along the waterfront.

See Appendix for storm warning displays.

Pilotage is compulsory. Licensed pilots can be obtained for the sound or for the inside water to Alaska. See discussion of Port Angeles.

Towage.—Towboats ranging in size from 15 to 1,500 horsepower are available in Seattle.

Quarantine.—Vessels subject to quarantine usually proceed to their docks where they are boarded by quarantine officers for inspection. Any vessel having on board suspected quarantinable or communicable diseases are required to make radio report to the quarantine office. The quarantine anchorage is just northward of Harbor Island. Fumigation with cyanide can be arranged for in Seattle. A U.S. Public Health Service hospital is in the city.

Customs.—Seattle is the headquarters of the Washington State customs collection district and a port of entry; marine documents are issued.

Immigration officials are stationed at Seattle.

Other local offices of the following Federal agencies are in Seattle, see Appendix for addresses: Coast and Geo-

detic Survey, Navy Branch Hydrgraphic Office, Coast Guard, Federal Communications Commission, Weather Bureau, and Corps of Engineers, U.S. Army.

Harbor Regulations are enforced by a port warden of the city of Seattle Harbor Department, who also acts as Chief of the Fire Department, 301 Second Avenue South.

Terminal facilities consist of an extensive system of wharves, both municipal and private, some of which are equipped with the most modern facilities for handling cargo. The port of Seattle has constructed and operates a number of wharves especially equipped for handling various commodities such as lumber, grain, fish, fruit, dairy products, vegetable oil, etc., which are the principal items in the commerce of the port.

Supplies of all kinds and in any quantity can be obtained.

Repairs of all kinds of hulls and machinery can be made. There are numerous shipbuilding and repair yards with drydocks or marine railways of various sizes. The largest drydock available, exclusive of those at the Bremerton Navy Yard which are available for private use when not required by the Government, is 518 feet long, 89 feet wide inside, and has a depth of 26 feet over the keel blocks. It is of the floating sectional type and has a lifting capacity of 15,000 tons.

Communication facilities are unlimited. Seattle is served by three transcontinental railway lines and is the terminus of a number of freight and passenger steamship lines. It is a port of call for many lines of intercoastal vessels and of vessels in coastwise shipping to California, Oregon, and Alaska. The city is served by nine commercial airlines. There are three airports at Seattle and two terminals on the waterfront for seaplane service. There are complete telephone, telegraph, and radio facilities, including two-way radiotelephone communications between ships in and near Seattle harbor and points on the interconnected Bell System land-line telephone network.

Chart 6450.—Possession Sound joins Puget Sound at the southern point of Whidbey Island and extends in a general northerly direction for about 10 miles to its junction with Saratoga Passage and Port Susan. From the entrance it extends for 3.5 miles with an average width of 2 miles, and then expands to an irregular basin about 6 miles in diameter. The eastern part of this basin is filled with extensive flats, a large portion of which are bare at low water, and rise abruptly from deep water. These flats are intersected by several shifting channels, forming the mouth of the Snohomish River. These channels are under improvement by the Government and are used by light-draft river steamers that navigate the deeper waters of the river. The waters of the sound are generally deep, and the only anchorage used by large vessels is off the town of Everett, close inshore, in about 10 to 15 fathoms.

Meadowdale, known locally as Haines Wharf or Browns Bay, is the residential area on the eastern side of the sound about 4 miles southward of Possession Point. There

are two piers, both catering to sport fishermen, about 0.5 mile apart. The northern and largest has a face of 160 feet with a depth of 6 feet and extends out 450 feet.

**Glendale** is a village on the west side of the sound about 2.2 miles northward of Possession Point. Provisions and the usual petroleum products for small craft may be obtained. There are accommodations for transients during the summer season. Two former wharves are in ruins.

**Chart 6448.**—**Elliot Point** on the eastern side of Possession Sound about 4 miles northeastward of Possession Point, is a low spit projecting over 200 yards from the high land. **Mukilteo Light** ( $47^{\circ}56.9' N.$ ,  $122^{\circ}18.3' W.$ ), 33 feet above the water and visible 11 miles, is shown from a white square tower on the point; a fog signal is at the light.

**Mukilteo** is a small town eastward of Elliot Point. An automobile ferry runs between Mukilteo and Columbia Beach, on Whidbey Island. A Government wharf for deep-draft vessels is 0.4 mile eastward of Mukilteo Light.

**Everett** is on **Port Gardner** at the eastern end of Possession Sound, 4 miles northeastward of Elliot Point. Lumber, pulp, and paper are its principal products.

The general anchorage area in Port Gardner is westward of the jetties; limits and regulations are given in § 202.230, Chapter 2.

**Tides.**—The mean range of the tide at Everett is about  $7\frac{1}{2}$  feet, while the range between mean lower low water and mean higher high water is about 11 feet.

See Appendix for storm warning display.

**Pilotage.**—Pilots are not stationed at Everett, but may be obtained from the Puget Sound Pilots' Association, Seattle, by telephone or radio.

**Towage.**—Towboats ranging in size from 90 to 1,200 horsepower are available from either of two tugboat companies.

**Quarantine.**—Vessels bound for Everett which are subject to quarantine inspection usually proceed to their docks where they are boarded by quarantine officers for inspection. Fumigation may be arranged for through the Seattle office. The U.S. Public Health Service maintains an outpatient office at Everett. Their hospital is in Seattle.

**Customs.**—Everett is a port of entry.

**Harbor regulations** are enforced by the manager of the port of Everett who is the harbormaster and port warden.

**Terminal facilities.**—There are four deep-water wharves on Port Gardner with depths up to 38 feet. One is used for public transportation purposes, one is owned by the Great Northern Railway and is leased for storage purposes, and two are used by pulpmills. There are the usual facilities for handling dry cargo. Equipment for a maximum lift of 25 tons is available. Oil is delivered by barge to wharves having about 12 feet of water at their ends. The Everett Port Commission maintains floats for berthing small boats up to a length of about 50 feet. A pile breakwater affords shelter.

**Supplies.**—Water, provisions, and ship chandlery can

be obtained. Gasoline and diesel oil are available for small vessels.

**Repairs.**—There are good machine shops, and drydocks for vessels under 100-ton displacement.

**Communication.**—Everett is served by three lines of transcontinental railroads and is a port of call for coastwise freighters. Many foreign-bound vessels call to load lumber. There are telephone and telegraph facilities. It is on the Pacific Highway. Bus service is maintained to Vancouver, British Columbia, and Seattle. A county airport is about 6 miles southward of the center of the city, west of the Pacific Highway.

**Snohomish River.**—The Snohomish River borders the city of Everett on the north and east and enters Port Gardner after flowing southward across the flats west of the city and inside of the controlling dike. It and connecting sloughs are navigated only by light-draft local craft. Many sawmills are along the river and a large amount of lumber is barged out. **Logging regulations** are given in § 207.770, Chapter 2.

A Federal project provides for a channel 15 feet deep and 150 feet to 425 feet wide from deep water in Port Gardner to the 14th Street dock; thence a settling basin 20 feet deep, 700 feet wide and 1,200 feet long; thence a channel 8 feet deep and 100 feet wide to the outlet of the river; and a channel in East Waterway 30 feet deep and 700 to 900 feet wide. In October 1956 the controlling depth was 8 feet to the outlet of the river. In March 1955 the controlling depth in the East Waterway was 27 feet.

A light and fog signal are on the southwest corner of the dock, a light is on the south end of the dike and buoys mark the channel along the dike to the river entrance.

The river and sloughs are crossed by several highway and railway drawbridges. Operating regulations are given in § 203.805, Chapter 2.

**Caution.**—The flats of the river are reported as extending to the southward to a line joining pier 1 to the eastern end of Gedney Island. Vessels backing away from pier 1 are warned to use caution. The changeable and shoaling channel across the flats should not be attempted without local knowledge.

The flats at the mouths of **Ebey, Steamboat, and Union Sloughs** eastward of **Priest Point** are log-booming grounds. Operating regulations for the drawbridges crossing these sloughs are given in § 203.805, Chapter 2.

**Gedney Island**, known locally as **Hat Island**, is 3.5 miles northwestward of Elliott Point. It is about 1.5 miles long in an easterly direction and 0.5 mile wide. The island is high, wooded, and prominent. From its eastern point a shoal extends eastward, the 5-fathom curve being at a distance of 0.8 mile. Foul ground extends 0.2 mile from the south side of the eastern half of the island. About midway along the southern side a sand and gravel company maintains a wharf.

A tug with tow passing through the restricted fishing area northeast, east, and southeast of Gedney Island occupied by gill net gear shall sound one long blast, followed by two short blasts, of a whistle or horn, and during dark-

ness or fog shall, in addition, indicate its intended course by directing a searchlight beam on such course.

**Columbia Beach**, 0.5 mile southward of **Randall Point**, is the **Whidbey Island** terminus of the **Mukilteo** ferry. There are no other facilities.

**Clinton**, on **Randall Point**, is a village with a post office, several stores, and a wharf with 15 feet reported at its outer end. It has a float for small craft. Gasoline and oil are available and minor repairs to small pleasure craft can be made.

**Sandy Point**, the southern point at the entrance of **Saratoga Passage**, is a low spit, rising abruptly to an elevation of 100 feet, with bluffs on each side; the end of the point is marked by a light. A group of houses and a private pier built out to 7 feet, equipped with a float, are a short distance west of the light.

**Camano Head** is the southeastern point of **Camano Island**. A shoal, with a rock bare at low tide, extends nearly 0.2 mile southeastward from the point. A buoy marks the shoal.

**Tulalip Bay** is a small cove on the mainland at the junction of **Possession Sound** and **Port Susan**, on the northern side of which are the village of **Tulalip** and the agency buildings of the **Tulalip Indian Reservation**. The bay is shoal, with rocks extending more than 300 yards southward and westward from the point on the north side of the entrance. A buoy marks the edge of the shoal water westward of the point at the south side of the entrance. Several small wharves and landing floats, mostly dry at low water, are at **Tulalip**. A seaplane taxi service is maintained during the summer months. There are log booming grounds near **Mission** in the southern part of the bay. **Mission Beach**, immediately southward of the bay, has several boathouses and float landings.

**Chart 6450**.—**Camano Island** is between **Port Susan** and **Saratoga Passage**; it is irregular in shape and 14 miles in length, the southern portion consisting of a long, narrow tongue, terminating in **Camano Head**, 300 feet high. At its northern end it is separated from the mainland by **Davis Slough**, and **South Pass** and **West Pass** of the **Stillaguamish River**, all dry at low water. A highway bridge crosses **Davis Slough** and **West Pass**. There is a good system of highways on the island.

**Port Susan**, on the eastern side of **Camano Island**, has a total length of about 11 miles in a northwesterly direction, and a width of 2 miles at its entrance; it expands to a width of 5 miles at its head, terminating in flats, bare at low water, that extend over 3 miles. There are no important settlements. Deep water is throughout until nearing the head, where anchorage may be had off the extreme western edge of the flats in about 10 fathoms. Care should be used in approaching and anchoring, as the flats rise abruptly from deep water. A channel, dry at low tide, has been dredged over the flats to the **South Pass** of the **Stillaguamish River**; this is buoyed, privately maintained, and used by light-draft vessels at high water.

**Stanwood** is in a dairying and farming district on the north side of the **Stillaguamish River** at the junction of the **South** and **West Passes**.

**Saratoga Passage**, on the western side of **Camano Island**, is about 18 miles long in a northwesterly direction. At its entrance, between **Sandy Point** and **Camano Head**, it is 1.2 miles in width, widening to its upper end, where it expands into a basin 4.2 miles in diameter, connecting eastward with **Skagit Bay**. The depths decrease uniformly from 100 fathoms at the entrance to 17 to 18 fathoms at the head. There are few outlying dangers, and a mid-channel course is clear to the head.

There is considerable traffic in these waters, confined, as a rule, to small local steamers that take advantage of the shelter afforded in making their trips between ports on the waters of **San Juan Archipelago** and points on **Puget Sound**. There are several towns and settlements, but the majority are of little commercial importance. The principal products are lumber and fish.

**Langley**, on the eastern shore of **Whidbey Island**, about 1.2 miles westward of **Sandy Point**, is a banking town serving a farming community. There is a landing wharf built out to 11 feet with a float attached. Small oil barges call here. Gasoline is available by truck delivery to the wharf. Tugboats often anchor off the beach between **Langley** and **Sandy Point**.

**Saratoga**, about 3 miles northwestward from **Langley**, is a small village with a store and automobile tourist camp.

**Mabana**, a village with a post office on the western shore of **Camano Island**, 2 miles northwestward of **Camano Head**, has a store and a landing wharf built out to 6 feet. Gasoline is available at the wharf.

**East Point** marked by a light, on the eastern shore of **Whidbey Island**, 6 miles northwestward of **Sandy Point**, is a low sandspit about 300 yards long.

**Elger Bay**, a resort on the western shore of **Camano Island** across **Saratoga Passage** from **East Point**, is an open bight about 0.8 mile long and 1 mile wide. Tugboats anchor here in westerly and northwesterly winds. A number of houses are along the shore at the head of the bay. There is no wharf and supplies are not available.

**Lowell Point**, with a bare bluff at the southern end, is the point on the western side of **Elger Bay**.

**Holmes Harbor**, the entrance to which is about 8 miles above **Sandy Point** on **Whidbey Island**, extends in a southerly direction for 5 miles, with an average width of 1.2 miles. The depths range from 30 to 40 fathoms at the entrance, to 17 and 18 fathoms at the head, where anchorage may be had in muddy bottom. Limits and regulations for the anchorage area are given in § 202.230, Chapter 2.

**Rocky Point**, the eastern point at the entrance, is low, but rises rapidly to a hill 500 feet high. **Hackney Island**, known locally as **Baby Island**, low and small, has several unoccupied houses on it. It lies 0.2 mile northwestward of the point with which it is connected at low water. From this island a shoal, bare at extreme low water, extends 0.2 mile northwestward; a buoy marks the edge of the shoal.

In entering, round **Rocky Point** at a distance of 0.8 mile and follow a midchannel course to the head. The harbor is little used.

**Greenbank**, a small farming settlement, is on the western side of **Holmes Harbor** at the entrance. It has a post

office, store, and service station. **Freeland** is a thriving community at the head of Holmes Harbor. It has several stores, service stations, and a post office. There is a large herring trap on the west side near the head of the bay. A small wharf, bare at low water, used in conjunction with the herring trap, lies just south of it. There is a log dump at the head of the bay.

**Camano** is a small settlement on the eastern side of Saratoga Passage, about 3.5 miles northwestward of Lowell Point. It has a store, a service station, a hotel, and telephone facilities. Gasoline is available only to craft that can get in close to shore as there is no wharf. A light is on **Onamac Point**, 0.8 mile northward of Camano. **Madrona** is a small resort about 2 miles northward of Camano. There is a small pleasure pier built out to about 6 feet at **Madrona Beach**.

**Penn Cove** indents the western shore of the basin at the head of Saratoga Passage and extends west-southwestward for about 3.5 miles, with an average width of a mile. The head of the cove is about 1.5 miles eastward of Point Partridge, the western extremity of Whidbey Island.

**Snatelum Point** is the southern point at the entrance to Penn Cove; a narrow sunken spit extending northward 0.5 mile, with  $\frac{1}{4}$  fathom near its end. The spit is marked by a buoy at its northern extremity. **Long Point** is about 0.9 mile westward of Snatelum Point.

**Blowers Bluff** is the northern point at the entrance to Penn Cove; it is the southern point at the entrance of Oak Harbor. It is bare, light-colored, high, and rounding. Rocks lie offshore 200 yards at places along the bluff. The shoal extending off the southwestern end of the bluff reaches almost one-third the distance across Penn Cove. Vessels should favor the southern shore when passing this shoal; otherwise, a midchannel course may be followed with safety. The cove affords a good anchorage, muddy bottom, in 8 to 14 fathoms inside the entrance.

**Coupeville**, the county seat of Island County, is on the southern shore of Penn Cove about 2 miles from the head. It has two hotels, telephone service, stores, a garage, and a wharf built out to 12 feet. Gasoline and fresh water are piped to the wharf and diesel oil, brought in by barges, may be secured ashore. A sunken rock, with a reported depth of 9 feet at low tide, is about 200 yards northeastward of the wharf nearly in line with the tangent at the entrance to Penn Cove on the north side. Vessels generally approach the wharf from the northwestward. Shallow-draft vessels with local knowledge can pass inside the rock to approach from the eastward.

**San de Fuca** is a small town on the northern shore about 0.5 mile from the head. It has a store, service station, and a wharf built out to 10 feet. Gasoline and diesel oil can be had by truck delivery. **Coveland** is a small settlement at the head of the Cove.

**Chart 6404.**—**Oak Harbor** indents the northern shore of Saratoga Passage westward of Crescent Harbor. It is a shallow semicircular cove about 1 mile in diameter with a winding narrow dredged channel, limiting depth 9 feet, leading to its head. **Maylor Point**, the eastern point of the

entrance, is foul with several rocks, awash at low water, 0.5 mile southeastward from the point. These rocks are marked by a buoy 550 yards to the southwestward of the outermost rocks. The town of **Oak Harbor** located on the northern shore of the harbor serves a farming community. There is a long wharf extending from the town in a southerly direction with a least depth of 4 feet of water at its face. Oak Harbor is located within a restricted area and waterborne commerce is no longer of importance. The chart is an adequate guide for entering.

**Crescent Harbor**, immediately west of Oak Harbor, is a semicircular bight 2 miles in diameter, lying between **Forbes Point** and **Point Polnell**, each of which is marked by a light. The latter is wooded and rather bold, and is connected to the main island by low ground, giving the point the appearance of an island when seen at a distance. There is a shoal extending westward 0.9 mile. Shoals, marked by a lighted buoy, extend 0.6 mile eastward from Forbes Point. With these exceptions the harbor is clear, affording anchorage in 10 to 11 fathoms, muddy bottom, but is exposed to the southward. A large pier extends from the west side of the harbor with a depth of 26 feet for the outer two-thirds. The chart is an adequate guide for entering.

The entire Oak Harbor-Crescent Harbor area is restricted; limits and regulations are given in § 207.750, Chapter 2.

**Chart 6450.**—The southern entrance to **Skagit Bay** is between Point Polnell and Demock Point. The bay is about 12 miles long in a west-northwesterly direction. The greater portion of it is filled with flats, bare at low water, and intersected by numerous channels discharging the water of the Skagit River.

A channel varying in width from 0.2 to 0.6 mile and marked by buoys follows the western shoreline of Whidbey Island to the north end of the bay. Shoal water extends for a distance of 100 to 300 yards from the western shore of the island.

**Demock Point**, rounding, and rising rapidly to an elevation of several hundred feet back of the point, is at the southern entrance of Skagit Bay about 1.8 miles southeastward of Point Polnell. A fishing resort with a small wharf is near the point.

**Utsalady** is a small village on the northern shore of Camano Island about 1.2 miles northeastward of Demock Point. It has a store and service station. Vessels may anchor just eastward of Utsalady in a small inlet between the shoal water of the flats and the shore in 3 to 6 fathoms, muddy bottom, with shelter from southerly winds.

**Strawberry Point**, the eastern extremity of Whidbey Island, is marked by a light.

The **South Fork** channel leading into **Skagit River** winds through the flats northward of Camano Island where it is marked by a light and buoys. The channel is used, to some extent, by log tows. Due to the shoaling, however, it has largely been abandoned by boat traffic to Mount Vernon and the North Fork is used instead. A Federal project provides for obtaining a reliable entrance channel through the delta by means of a dike at the mouth of

South Fork; regulating dikes and a mattress sill near the head of North Fork; closing subsidiary channels in the delta; and for increasing the available depth at **Skagit City Bar** by combined dredging operations and training bars. Little work on either new construction or maintenance has been done recently.

The controlling elevation of the flats at the mouth of South Fork is about  $2\frac{1}{2}$  feet above mean lower low water and the controlling depth at low tide depends on the river stage, probably not exceeding 1 foot during periods of minimum flow. The diurnal tidal range at the mouth of the river is  $11\frac{1}{2}$  feet. The extreme range at this point is estimated to be 20 feet. The bar at the mouth of South Fork bared  $2\frac{1}{2}$  feet in 1945 and the mouth of the North Fork bared  $2\frac{1}{2}$  feet in April 1944.

A highway bridge across the South Fork at Conway (Fir Station), 4.8 miles above the mouth, has a swing span with a horizontal clearance of 115 feet on both sides of the center pier and an overhead clearance of 10 feet. A highway bridge across the river at Division Street, in Mount Vernon, 10.1 miles above the mouth, has a swing span with a horizontal clearance of 105 feet on both sides of the center pier and an overhead clearance of 11 feet. A highway bridge, 14.8 miles above the mouth, due north of Mount Vernon, has a swing span with a horizontal clearance of 108 feet on both sides of the center pier and an overhead clearance of 10 feet. The Great Northern Railway Bridge, 15.5 miles above the mouth, has a swing span with a horizontal clearance of 80 feet on both sides of the center pier and an overhead clearance of 5 feet. Operating regulations are given in § 203.810 and § 203.811, Chapter 2.

There are several wharves at **Mount Vernon**. All commercial water traffic is by barge.

From the northernmost point of Camano Island a channel leads eastward across the flats and connects through **West Pass** and **South Pass** with the head of Port Susan. The channel is used only by small launches with local knowledge. Skagit Bay, northern part, has been described in the previous chapter.

**Chart 6401.**—The entrance to **Hood Canal** is at the lower end of Admiralty Inlet, between **Foulweather Bluff** and **Tala Point**, about 10 miles southward of Marrowstone Point. It extends in a general southerly direction for about 44 miles and then bends sharply northeastward for 11 miles, terminating in flats bare at low water. The head of Case Inlet, in the southern part of Puget Sound, is less than 2 miles from the head of Hood Canal. The shores are high, bold, and wooded, but logged off to a considerable extent, rising to a much greater height, particularly on the western shore, than in other parts of the sound. The water is deep as a rule, except at the heads of the bays and at the mouths of the streams. The chart is a sufficient guide for the purpose of navigation.

The Olympic Loop Highway follows the western shore of Hood Canal, and a connecting highway to Port Orchard follows the southern shore of the southern part of the canal around **The Great Bend**. There are road connec-

tions with Port Orchard and with the Puget Sound highway system from all the settlements on the eastern shore of the canal. Water traffic is in general confined to tugboats with log rafts, small boats, and pleasure craft.

Along the shores are numerous small farming or lumber settlements, some with post offices and wharves or landing floats. Hood Canal is a favorite vacation resort, but most of the travel is by automobile. Numerous tourist camps are located along the shores, particularly on the western side.

The tidal currents in Hood Canal at times attain velocities exceeding  $1\frac{1}{2}$  knots. At times there are heavy tide rips northward of and around **Foulweather Bluff**, sufficiently heavy to be dangerous to small boats and to break up log rafts. This is most pronounced when the ebb current from the main body of Puget Sound meets that from Hood Canal off the point, and particularly so with the ebb against a strong northerly or northwesterly wind. Off **Point Hannon** and **Hazel Point**, tide rips occur at times sufficiently strong to be troublesome to tugboats with log tows. Current observations taken at a station in mid-channel eastward of **Hazel Point** show that directions of both flood and ebb vary considerably at that location. At times, southwesterly winds from Hood Canal and northerly winds from **Dabob Bay** cause a chop dangerous for small boats. Under these conditions smoother water is found near either shore.

Sailing directions are not considered necessary. The dangers are few and generally close inshore. A number of low sandspits from 100 to 300 yards long are difficult to see at night, but many of them have been made into resorts and the buildings nearby show up well against the background of trees. Flats off the mouths of streams extend as much as 0.5 mile offshore and are extensive at the heads of some of the bays. When rounding **Point Hannon**, keep **Snake Rock Light** well open past **Tala Point**, or keep the power plant at **Termination Point**, which is lighted at night, open past the southern end of **Hood Head**. A mid-channel course is clear until reaching **The Great Bend**, where the canal turns eastward. Here the northern shore just eastward of **Ayres Point** should be favored to clear the flats extending from the eastern part of **Annas Bay**. The chart is the best guide.

**Foulweather Bluff**, the eastern point at the entrance to Hood Canal, has been described previously.

**Chart 6421.**—**Twin Spits** are two long, low, sand points, 0.5 mile and 1 mile southward of **Foulweather Bluff**. When waiting for smooth weather to round **Foulweather Bluff**, tugboats with log tows often anchor in 8 fathoms, 1 mile southeastward of the southern spit, in a bight known locally as **Races Cove**, with **Colvos Rock Light** slightly clear of the end of the southern point of **Twin Spits**.

**Hood Head**, on the western side of Hood Canal and 3 miles southward of the entrance, is practically an island, having only a long, narrow strip of low, sandy beach connecting it with the western shore. The head is 210 feet high, steep and wooded, and is a prominent feature when viewed from the entrance.

**Local magnetic disturbance.**—Differences from normal variation of more than 2° have been observed astride the entrance to Hood Canal and at Point Hannon.

**Point Hannon** is at the eastern extension of Hood Head; it is marked by a light. A low sandy spit with shoal water extends about 200 yards eastward of the light.

A 6-foot shoal, marked by some kelp, extends more than 300 yards southward of Hood Head. **Bywater Bay** is a small cove between Hood Head and the western shore.

**Shine** is a village on **Termination Point**, 1.7 miles southwestward of Point Hannon. There is a lighted transformer substation on the point.

In 1958 a floating highway bridge was under construction across Hood Canal from a point 0.1 mile southwestward of Termination Point to a point 0.3 mile southwestward of Salisbury Point westward of Port Gamble.

**Sisters** are two rocks a little over 200 yards apart, 0.5 mile southward of Termination Point. The rocks are awash at about half tide. A light is on the southern rock, 0.4 mile from the northern entrance point to **Squamish Harbor**, a small, open bight just southwestward of Termination Point. Towboats frequently anchor near the head of the harbor in about 6 fathoms, muddy bottom.

**Case Shoal**, partly bare at low water, is about 0.6 mile from and parallel with the western shore of **Squamish Harbor**. It is about 1 mile long and its northern end is 0.5 mile from the northern shore of the harbor.

**Port Gamble** is a small inlet on the eastern shore of the canal 5 miles from the entrance. It is 2 miles in length, with an average width of over 0.5 mile and a contracted entrance.

A Federal project provides for a channel 30 feet deep and 200 feet wide through the narrow entrance to Port Gamble. In February 1958 the controlling depth was 28 feet. A lighted range, astern when entering, about 1 mile north of the entrance, marks the center of the channel. Two lights are on the east side of the channel.

**Port Gamble** is a town on the western shore at the entrance. It is a mill port which ships considerable lumber. There are hotels, hospital, telephone, and telegraph facilities. The large mill wharf has ample depths for ocean vessels, and fresh water is piped to the berthing face. A ballast pile, nearly bare at low tide, is southward from the mill. The town landing wharf, suitable for small vessels, is on the northern side of the town. Westward of the wharf, just below the hotel, is a small-craft mooring basin equipped with floats. An 8-foot shoal is about 85 yards northeastward from the north end of the town landing wharf. There are rocks baring at low tide on the southern side of the wharf. Diesel oil and gasoline are piped to the oil wharf, and provisions are obtainable. Supplies of all kinds may be obtained from Seattle on short notice.

Excellent anchorage may be had in the bay in 24 to 54 feet, muddy bottom.

**Directions.**—Vessels should hold a midchannel course on entering until 200 yards or more past the southern light, and then head for the wharf, keeping the long eastern face open to avoid shoal water on the western side of the channel. In entering the bay care should be

taken not to work too far to the eastward when passing the mill wharf. A sandspit, partly bare at low water, extends from the point in front of **Indian Village** almost to the edge of the dredged channel, or about halfway to the mill wharf.

**Caution.**—Several vessels have grounded on the sandspit 1.5 miles northward of the town. The entrance lights are easily confused with lights in the Indian Village.

**Lofall**, on the eastern shore about 8 miles southward of the entrance to Hood Canal, is a settlement with a post office, store, and service station. A passenger and automobile ferry crosses the canal from Lofall to South Point. A good road connects the town with the Puget Sound highway system.

**Chart 6422.**—**Thorndike Bay** is a small bight on the west side of Hood Canal about 4 miles southward of **Squamish Harbor**. An **explosive anchorage** is southward of the bay; limits and regulations are given in § 202.230, Chapter 2.

**Bangor Wharf** on the east side of the canal, 12.7 miles southward of the entrance, is the property of the U.S. Navy and is restricted to use by vessels under Government jurisdiction; limits and regulations governing the **restricted area** surrounding it are given in § 207.750, Chapter 2. A **Naval operating area** extends north and south of the wharf; limits and regulations are given in § 204.222, Chapter 2.

**Bangor** is a village on the eastern side of the canal about 14.5 miles southward of the entrance. There is a store and service station. The former wharf is in ruins. It is connected to the highway system of Puget Sound. **King Spit**, a low, sandy point at the southern side of the town, affords some protection from southerly weather for boats at the wharf, and for small boats anchored just northward of the spit.

**Chart 6450.**—**Seabeck**, about 21 miles from the entrance of the Hood Canal, is a settlement and summer resort at the head of **Seabeck Bay**, a small cove on the eastern shore. It has a store and post office. There is a wharf with a depth of 14 feet alongside, equipped with an elevator for launching and raising small craft. Petroleum products are available. Shoal water extends 0.5 mile from the head of the bay. Good anchorage, well protected from southerly and southeasterly weather, is afforded in the bay in 5 to 10 fathoms. Shoal water extends more than 200 yards off **Misery Point**, at the western side of the entrance to the bay.

**Oak Head**, about 1.8 miles northward of Misery Point, is the southernmost point of **Toandos Peninsula**. **Hazel Point**, 1.8 miles northeastward of Oak Head, is the southeastern point of the peninsula, and the turning point where the canal bends sharply from southward to southwestward. **Tskutsko Point**, 1 mile westward of Oak Head, is the southwestern point of Toandos Peninsula, and is at the east side of the entrance to Dabob Bay.

**Fisherman Harbor** is a cove on the southern end of Toandos Peninsula, just eastward of Oak Head. It is about 200 yards wide, 0.8 mile long, and has a restricted

entrance which is practically bare at low water. A sandspit extends partly across the entrance from the western shore. It affords sheltered anchorage for small boats. **Coyle**, a small settlement, is on the eastern shore of the cove.

**Brinnon** is a village on the southern side of **Dosewallips River**, about 3.5 miles westward of Oak Head, at the entrance of **Dabob Bay**. It has tourist facilities and a post office. There is a wharf to the north of the village which is used for unloading logs.

**Dabob Bay**, the largest inlet in the canal and separated from it by the **Toandos Peninsula**, extends 9 miles in a northerly direction. The entrance is between **Tskutsko Point** and **Sylopash Point** just northward of the mouth of the **Dosewallips River**. **Jackson Cove**, between **Wawa and Pulali Points**, and **Quilcene Bay**, westward of **Bolton Peninsula**, indent the western shore. There is a **Boy Scout camp**, with a landing wharf, on the western shore of **Jackson Cove**. The western shore of **Dabob Bay** is particularly steep and bold, reaching an elevation of over 2,600 feet in less than 2 miles from the coast. There is a **Naval operating area** in the bay; limits and regulations are given in § 204.222, Chapter 2.

**Quilcene** is a village with a post office at the mouth of **Big Quilcene River**, on the western side and near the head of **Quilcene Bay**. It is on the **Olympic Loop Highway**, and has stores, garages, a hotel, tourist camps, and service stations. **East Quilcene**, at the mouth of the **Little Quilcene River**, is a small settlement with no transient facilities. There is a log dump at the head of the bay.

**Pleasant Harbor** is a small cove on the western shore of **Hood Canal** about 3 miles westward of **Misery Point**. It is about 300 yards wide, 0.5 mile long, and has a narrow, shallow entrance. Inside is sheltered anchorage for small boats with a maximum depth of 6 fathoms. A large log dump and log boom are in the harbor.

**Duckabush**, just westward from **Quatsap Point**, about 5 miles southwestward of **Oak Head**, is a settlement on the western shore, at the head of a shallow bay which is mostly dry at low water. There are no facilities, the settlement being practically abandoned.

**Triton Head**, on the western shore, is about 8.2 miles southwestward of **Oak Head**. It is low, rocky, and timbered, with a reef, bare at low water, extending about 200 yards northward from the point. **Triton Cove** is a small cove formed by the head and the western shore, which affords anchorage for small vessels, with some protection from southerly winds. **Oyster beds**, marked by stakes and brush, are about 0.8 mile northward from **Triton Head** on the flat which extends off the mouth of **Fulton Creek**.

**Chart 6460**.—**Holly**, on the eastern shore of **Hood Canal**, is a settlement on the southern side of a small bight about 10 miles southwestward of **Oak Head**. It is a summer resort with a store and service station. The former wharf is in ruins. It is connected to the **Puget Sound Highway** system. Shoal water extends about 300 yards from the shore northward and eastward of the wharf ruins. It is reported that a boulder, baring at extremely low tides, projecting 3 to 4 feet above the sur-

rounding shallow bottom, lies about 400 yards from shore northward of the wharf ruins. Shoal water extends about 0.3 mile north-northwestward from the northerly point of the cove in which **Holly** is located. **Anderson Cove** is the shallow cove directly northward of **Holly**. It is used for rafting logs.

**Eldon** is a western shore settlement on the southern bank of the **Hamma Hamma River**, about 12.5 miles southwestward of **Oak Head**. It has a store and tourist camps. The flats from the **Hamma Hamma River** extend nearly 0.5 mile from the shore. An abandoned logging wharf, in ruins, is at the southern end of the flats. There are log booming grounds in the cove to the southward.

**Lilliwaup**, a village with a post office, is on the southern shore of **Lilliwaup Bay**, a small shallow cove on the western shore of **Hood Canal** about 18 miles southwestward of **Oak Head**. It has a tourist camp. Small-scale logging operations are carried on nearby to the southward. At the southern entrance to the cove is a private wharf with a seaplane hanger at its inner end.

**Dewatto** is a small settlement on the southern side of **Dewatto Bay**, a small, shallow cove on the eastern shore opposite **Lilliwaup**. It is connected with the highway system of **Puget Sound**. There is a log boom in the bay.

**Hoodsport** is the largest town on **Hood Canal**. It is on the western shore about 21 miles southwestward of **Oak Head**. It has hotels, stores, schools, telephone connections, garages, tourist facilities, and a State fish hatchery. Diesel oil, gasoline, and water are piped to a small wharf which bares at low water. The flats to the southward bare at low water for about 300 yards offshore. A road leads to **Lake Cushman**, a summer resort about 9 miles to the northwestward.

**Potlach** is a summer resort on the western side of the canal about 2 miles southward of **Hoodsport** and opposite **The Great Bend** where **Hood Canal** turns northeastward. It has a post office and telephone connections and is on the **Olympic Loop Highway**. A large powerplant with a standpipe can be seen on the western shore 0.5 mile southward of the resort.

**Union** is a town on the southern shore of **The Great Bend**. There is a float landing and a small wharf equipped with derrick for launching and hoisting small craft. Boats should approach the landing from the north-eastward and beware of snags. Gasoline may be obtained at the landing. The depth alongside the float is reported to be sufficient for small boats at all stages of the tide. The town has a hotel, a post office, two stores, and a tourist camp.

**Annas Bay** is immediately westward of **Union** and is a broad, open bight, the eastern half being flat and bare at low water. This flat extends about 0.2 mile into the canal immediately westward of **Union** and is formed by the **Skokomish River** which empties at the head of the bay. At the western end of the bay are the ruins of a sawmill and wharf. There are no settlements of importance eastward of **Union**.

**Hood Canal** terminates in **Lynch Cove**, with flats, mostly bare at low tide, about 2.2 miles from the head. **Union River** empties into **Lynch Cove**. Gasoline may be obtained

at **Happy Hollow** about 3 miles from the head. There are oysterbeds on the flats.

Many resorts, auto camps, and summer cottages have been built along the shores of Hood Canal. Many of the resorts have small piers and boat landings.

**Chart 6445.**—**Port Orchard** is an extensive body of water westward of Bainbridge Island. Its general length is about 15 miles with an average width of over 0.8 mile. At its northern end it connects with Port Madison through **Agate Passage**. At its southern end Port Orchard connects with Puget Sound through **Rich Passage**. The depths in the main body of Port Orchard range from 36 to 150 feet with few dangers, and these as a rule, close inshore. The shores are moderately low and wooded. Towns, villages, and numerous cottages line the shores of Port Orchard.

Vessels are requested to exercise caution when piloting in the vicinity of the rubber seaplane mooring buoys in Port Orchard. The buoys are unlighted and painted with black and orange vertical stripes.

**Current** observations taken in midchannel about 1 mile southward of **Tolo** indicate that the tidal current in that locality is very weak.

**Agate Passage** is the northern entrance to Port Orchard and connects it with Port Madison. The channel extends about 1 mile in a northeasterly direction and averages about 380 yards in width. The controlling depth is about 20 feet. The passage is straight; the shores are wooded and fairly steep-to; the shoreline is for the most part rocky and fringed with kelp to Point Bolin. The currents have velocities up to 6 knots; the flood sets southwestward and the ebb northeastward.

The passage is obstructed by a shoal near the middle of the northern end with depths of 9 to 10 feet, and there are other depths of 14 to 18 feet almost in midchannel. It has been examined by wire drag and the dangers are shown on the chart.

The northern entrance is marked by a light on the western side of the channel opposite **Agate Point**; also, by a buoy on the western side of the channel. The southern entrance is marked by a buoy on the western side of the channel.

A fixed highway bridge spans the passage just southwestward of **Agate Point**. For a width of 300 feet over the channel the overhead clearance is 75 feet.

**Seabold** is a small residential community about 0.5 mile southward of the southern entrance to **Agate Passage**. There are no facilities.

**Sandy Hook** is a residential development about 0.8 mile northward of **Point Bolin**, the southern point of **Agate Passage**. There is a private wharf with a float. The former wharf is in ruins.

**Liberty Bay**, also known as **Dogfish Bay**, is a narrow inlet extending about 4 miles in a northerly direction from the northwestern part of Port Orchard. The bay averages 0.5 mile in width, the southeastern half being narrow and tortuous. The shores are low and wooded; the shoreline is mostly sand and gravel. There are mud flats at the head of the bay and in the small bights on the southern side of the bay. Mud is the predominating bot-

tom characteristic. The current north of **Keyport**, in the narrow entrance to the bay, has an average velocity at strength of about  $\frac{3}{4}$  knot. Velocities exceeding 1 knot occur at times.

5 **The Keyport Torpedo Station** with two wharves is on the western side of the entrance to **Liberty Bay**. Wharf No. 1 is built out to 19 feet, and No. 2 is built out to 26 feet. There are several prominent buildings on the reservation.

10 **Torpedo warning.**—A red flag is hoisted on the south wharf at the torpedo station and one displayed on the southern lighter indicate that torpedo firing is in progress and vessels are to keep well to the east of the channel clear of the range marked by white buoys, keeping a sharp lookout for torpedoes. Limits and regulations for the restricted area are given in § 207.750, Chapter 2.

**Keyport** is on the southern side of the passage leading to **Liberty Bay**. An overhead electric transmission line with a permit clearance of 90 feet crosses the passage at

20 **Keyport**. There is a wharf with a float for small craft. **Lemolo** is a small village on the eastern side of the bay. There are no marine facilities.

A rock covered at low tide is 175 yards southeastward of the dock on the eastern side of the bay about midway between **Lemolo** and **Poulsbo**.

**Pearson** is a residential village on the southern shore of the bay. The ruins of a former wharf extend from a low point.

**Scandia**, about 0.3 mile northwestward of **Pearson**, is a small village. The former wharf is in ruins.

30 **Poulsbo**, a town on the east shore at the head of the bay, has several wharves and floats with from 8 to 12 feet of water. Numerous fishing craft base here. Provisions are available and petroleum products may be obtained at a small oil dock. There is a boatyard where repairs can be made to small craft. Oysters are cultivated on the flats at the head of the bay.

**Manzanita** is a settlement on the western side of Bainbridge Island in a small cove about 1.5 miles southward from **Seabold**. **Manzanita Bay**, southward of the town, affords an excellent anchorage for small craft in 27 feet, mud bottom. There are several private wharves and floats in the bay.

45 **Battle Point**, a sandy spit, is on the eastern side of Port Orchard about 1.7 miles southward of **Point Bolin**; it marks the turn in the direction of the channel from southwest to southward. A light is off the end of the spit. There is a small lagoon southeastward of the point.

50 **Brownsville**, on the western shore of Port Orchard, is on the northern shore of **Burke Bay**, about 1.2 miles southwestward of **Battle Point**. The town has a landing wharf built out to 10 feet. All of **Burke Bay** bares at low water, but it may be entered by small boats at about half tide.

55 **Chart 6446.**—The southern approach to Port Orchard from Puget Sound is southward of Bainbridge Island through **Rich Passage**. This is the principal entrance to Port Orchard, and the one in general use. The approach to the passage is between **Restoration Point** and **Blake**

60

Island. It is deep and free from dangers, except for Bainbridge Reef.

**Orchard Point**, the southern point at the entrance to Rich Passage, is marked by a light and fog signal. A general anchorage area is in the vicinity of the point; limits and regulations are given in § 202.230, Chapter 2.

**Rich Passage** is about 3 miles long, with a rather sharp bend near its western end, and varies in width from 0.8 mile at its eastern end to a little more than 0.2 mile at the western end. It has been examined by means of the wire drag and the dangers are shown on the chart. **Orchard Rocks**, 500 by 350 yards in extent, are on the northern side of the channel just inside the eastern entrance. A small area near the center of the reef is bare at low tide; the highest point covers at about half tide and is marked by a white echo board facing northeast and southwest. The rocks are marked by a lighted buoy 400 yards southward from the echo board. The reef off **Point Glover** is marked by a light and fog signal. **Waterman Point**, at the western entrance, is marked by a light and fog signal. An unlighted range, bearing  $319\frac{1}{2}^\circ$ , leads over the best water off Point Glover. A lighted buoy marks the southern edge of the shoal extending from **Point White**, the north point at the western entrance to the passage.

**Currents.**—Continuous hourly observations for about 1 month at a station in midchannel about midway between Point Glover and Point White, and similar observations for shorter periods at various other points in the passage indicate the following:

At this station the strongest currents which have been observed are about 4 knots on the flood and 5 knots on the ebb. The average maximum velocity of the flood current is about  $2\frac{1}{2}$  knots and of the ebb 3 knots.

Near the time of slack water, the average period when the current velocity does not exceed  $\frac{1}{4}$  knot is about 20 minutes. For strong currents these periods will be decreased and for weak currents they will be increased.

In the channel between Pleasant Beach and Point Glover the average velocity of the flood at strength is about  $1\frac{1}{4}$  knots and of the ebb about  $2\frac{1}{4}$  knots.

North-northwestward of Orchard Rocks the average velocity of the flood stream is about  $\frac{1}{2}$  knot, and the velocity of the ebb about 2 knots.

The flood stream through the passage is of simple and regular character. The stream lines are nearly uniform in trend from shore to shore, except off the bight just northwestward of Middle Point and in the large cove on the northern shore opposite Point Glover, where eddies occur. These eddies, however, are both of limited extent, neither extending outward to the usual steamer track. This regularity tends to increase the actual or available cross section of the flood stream and consequently to diminish its strength.

The funnel-shaped configuration of the passage is not favorable to the production of regular stream-line motion on the ebb current and extensive eddies and countercurrents occur.

Between Middle Point and Point Glover, an extensive eddy extends from shore almost to midchannel, and will

frequently be encountered by vessels on the track between Orchard Rocks and Point Glover buoys.

An eddy fills the cove on the northern shore opposite Point Glover, but does not extend outward to the steamer track.

An eddy occurs about 0.2 mile south-southwestward of Point White and a little northward of midchannel at the western entrance to the passage.

A weak countercurrent occurs inshore along the southeastern side of Point White.

These eddies and countercurrents on the ebb greatly diminish the effective cross section of the passage, and so increase the ebb velocities in the channel.

**Directions, Port Orchard.**—Strangers should not attempt to navigate Port Orchard, and particularly Rich Passage, in thick weather on account of the strong tidal currents. In clear weather, however, the navigation of these waters presents no difficulty. Enter between Restoration Point and Blake Island, giving either shore a berth of not less than 0.5 mile, and steer so as to pass 300 yards southward of Bainbridge Reef lighted bell buoy. From a midchannel position between that buoy and Orchard Point Light, steer  $310^\circ$  heading for Middle Point, to pass 200 yards southward of Orchard Rocks lighted buoy. When the buoy is abeam, steer  $000^\circ$  for 0.75 mile until nearly up to buoy, then haul on to the range, bearing  $319\frac{1}{2}^\circ$  holding a little southward of it. When abeam of Point Glover Light follow midchannel courses to Waterman Point Light. From this point a  $225^\circ$  course for 2.3 miles leads to a position with Point Herron Light abeam, distance 0.3 mile.

**Caution.**—**Rich Passage**, because of activities of the Puget Sound Navy Yard, has a very large volume of traffic. Many ferries a day each way, numerous tugs with hawser tows, and various types of Naval craft, all contribute to create a considerable collision hazard in the passage, particularly at the sharp bend off Point Glover. Strong tidal conditions prevail in this vicinity, and Naval authorities call attention to the fact that deep-draft out-bound Government vessels making the sharp turn are usually unavoidably set well over toward Buoy No. 8, necessitating a two-blast, starboard-to-starboard meeting with inbound vessels. There is, accordingly, a well-established local custom to regard navigation at this bend as a special circumstance situation subject to the provisions of Articles 27 and 29, Inland Rules. Outbound vessels should give notice of their approach by sounding one long blast of the whistle when within half a mile of Point Glover, or approximately at Point White Buoy No. 10, as provided in Article 18, Rule V, Inland Rules, to be answered with a similar long blast by any inbound vessel nearing the bend. To avoid accident, inbound vessels should approach the bend with great caution, preparing to pass an outbound vessel in accordance with the latter's proposed signals, two short blasts signifying intention of the outbound vessel to pass starboard to starboard and one short blast signifying her intention to pass port to port.

The appropriate passing signal should be given by the outbound vessel and answered by the inbound vessel as soon as practicable after sighting each other.

There are many towns and villages along the shores of Port Orchard; many of the former landing wharves have fallen into ruins.

**Fort Ward** is a Naval post on Bainbridge Island near the eastern entrance to Rich Passage, just inside Beans Point. There is a wharf built out to 18 feet. A rocky patch with 11 feet over it is 150 yards southward of the wharf. It is dangerous to vessels approaching the wharf from southward.

**Pleasant Beach** is a summer resort on the northern shore of Rich Passage about a mile northwestward of Fort Ward.

**Lynwood Center** is a thriving community on Bainbridge Island at the northern extremity of Rich Passage. It has no marine facilities.

**Waterman**, a village on the southeastern shore of Port Orchard about a mile southwestward from Rich Passage, has a store and service station. The former wharf is in ruins.

**Gibson**, a small residential community on the eastern shore of Port Orchard about 0.8 mile northwestward of Point White, has a passenger ferry wharf. The ferry operates between here and Bremerton, mornings and evenings, during workdays only.

**Crystal Springs** and **Westwood** are residential communities on the eastern shore, 0.5 mile and 1.1 miles, respectively, northward of Gibson. There are several small private wharves along this shore.

**Illahee** and **Gilbertson** are small settlements on the western shore opposite Crystal Springs and Fletcher Bay, respectively. Illahee has a usable wharf, stores, and a service station. Gilbertson has no facilities; there are ruins of a wharf. About 1 mile south of Illahee at **Illahee State Park**, is a public wharf with floats for pleasure craft only.

**Fletcher Bay** is a village on the eastern shore of Port Orchard about 1.2 miles southward of Battle Point. Small boats can enter the bay at  $\frac{3}{4}$  tide and find anchorage in 12 feet, mud bottom; the swinging area is limited. The bar across the entrance to the bay bares at half tide.

**Chart 6440.—Sinclair Inlet**, about 3.5 miles long and averaging a mile in width, makes in southwestward beyond Port Washington Narrows, and is the principal inlet in Port Washington. A **Naval restricted area** is in the inlet; limits and regulations are given in § 207.750, Chapter 2.

**Point Herron**, at the junction of Port Orchard, Sinclair Inlet, and Port Washington Narrows, is marked by a light and fog signal southward of the point.

**East Bremerton (Manette P.O.)** is on the eastern side of the entrance to Port Washington Narrows. A fixed highway bridge with a horizontal clearance of 220 feet and an overhead clearance of 80 feet crosses Port Washington Narrows to Bremerton, about 0.3 mile northward of Point Turner. There are several wharves at East Bremerton.

**Annapolis (Retsil P.O.)** is a village on the southern shore of Sinclair Inlet directly south of Point Herron. There is a ferry wharf from which passenger ferry service is maintained to Bremerton. Eastward of the ferry

wharf is a public wharf and float suitable for small craft only. The float grounds at low water. A **Veterans Home** is on the bluff above the town. Its buildings are prominent.

The town of **Port Orchard** is on the southern shore of Sinclair Inlet opposite the Navy Yard. It has a ferry wharf and float landing with a depth of 11 feet, an oil wharf with 10 feet alongside at which small boats can obtain gasoline, and several small private landings. Passenger ferry service is maintained with Bremerton.

A marine railway and machine shop are available for repairs; boats up to 55 feet long can be hauled out.

A flat, largely bare at low tide, extends 0.4 mile from the shore of the bight eastward of Port Orchard. A buoy marks the edge of the shoal. Shoal water extends about 100 yards outside the line between the ends of the city wharf ruins and the long wharf eastward of it.

**Puget Sound Navy Yard** is on the northern shore of Sinclair Inlet on the western side of the entrance to Port Washington Narrows.

**Warning signal.**—A triple combination air horn has been installed on the 250-ton erecting crane at the outer end of Pier 6. Vessels are warned to run at slow speed when within 0.8 mile of the pier if a signal is blown.

**Bremerton**, the principal city on Port Orchard, is on the northern shore of Sinclair Inlet, adjoining the Navy Yard; East Bremerton is included in the city limits. Communication with Seattle is maintained by frequent ferry service and by highway with Tacoma.

**Chart 6446.—Port Washington Narrows**, a passage about 3 miles long with an average width of 0.2 mile, connects Sinclair and Dyes Inlets. Tidal currents in the narrows attain velocities up to 4 knots at times. See tidal current tables and tidal current charts for details. There are four unlighted ranges for navigating Port Washington Narrows northward of the bridge. On the ranges, 14 feet can be taken through the narrows; with local knowledge a slightly greater depth can be carried by deviating slightly from the ranges.

An oil wharf, built out to 15 feet, is on the western shore of Port Washington Narrows about 0.2 mile above the bridge. Gasoline and diesel oil can be obtained. An overhead power cable crosses the narrows 700 yards above the bridge with a permit clearance of 90 feet. About 6.8 mile above the first bridge, a new fixed highway bridge was under construction in 1958; design clearances are 220 feet horizontally and 80 feet overhead. An overhead power cable close westward of this bridge has a permit clearance of 80 feet. **Anderson Cove** is a small bight on the south shore about 1.5 miles above the bridge. As there is little or no water, small boats anchor off the cove. There is a small-boat mooring and service station here. **Sheridan**, on the eastern shore of the narrows about 2 miles above the entrance, has a landing wharf. **Phinney Bay**, about 0.4 mile wide and 0.8 mile long, makes into the western shore opposite Sheridan. A yacht club maintains a moorage on the west side of the bay. **Rocky Point** is on the western side of the northern entrance of the narrows. There are tide rips off this point.

**Dyes Inlet** is about 3 miles long and averages a mile in width. A number of towns are on the shores of the inlet. **Tracyton**, a village with a post office, several stores and service stations, is on the eastern shore of the inlet near the northern end of the narrows. It has a concrete ramp at the foot of the main cross street for launching small boats. On the south side of the village is a boatyard where small craft are built. **Fairview**, on **Windy Point** about 1.2 miles northwestward of Tracyton, is a settlement of beach cottages. **Silverdale**, a town on the western side of the head of Dyes Inlet, has a wharf built out to 10 feet, two small sawmills, and several stores. Provisions and petroleum products may be obtained. **Chico** is a small residential town on the western side of the inlet. The former log dump wharf is in ruins.

**Ostrich Bay** is an inlet in the southwestern part of Dyes Inlet. **Erland** is a small settlement on the western shore at the entrance. A sunken rock is reported in Ostrich Bay 500 yards southward of **Elwood Point** inside the breakwater extending southerly of the point.

A depth of 6 feet can be carried from Ostrich Bay into **Oyster Bay** on midchannel courses. There is 6 feet or more in Oyster Bay. **Mud Bay**, a narrow slough eastward of Ostrich Bay, bares at low water.

**Chart 6460.—East Passage**, on the eastern side of Vashon and Maury Islands, extends from Alki Point southeastward for 12.5 miles to Point Robinson thence southwestward a distance of 6 miles to Browns Point. The waters throughout are deep and free from dangers, which in no case extend as much as 0.5 mile from shore.

From Alki Point to **Point Williams**, a distance of 3 miles, the shores are thickly settled. **Fauntleroy Cove** is between Point Williams and **Brace Point**, 1 mile southward, and is included in the city limits of Seattle. There is an automobile ferry from **Fauntleroy** to Vashon Heights and Southworth.

From Orchard Point the shores trend southward and then eastward, forming, with the south shore of Bainbridge Island, a bay semicircular in form and about 3.5 miles in diameter. A general anchorage area is in the bay; limits and regulations are given in § 202.230, Chapter 2.

**Manchester, Colby, South Colby, Harper, and Southworth** are small towns on the shores of this bay, between Orchard Point and Point Southworth at the entrance to Colvos Passage. Manchester is a village with several stores and service stations. It is also a focal point for sport fishing. The former ferry wharf is no longer used and is not being maintained. The float at the end of the wharf used by small craft is in poor condition. About 0.5 mile to the northward is a Federal Government oil storage depot with a large wharf. The former ferry slip at Harper is no longer being used. A ferry slip 300 yards northwestward of Point Southworth is used for passenger and automobile ferry service with Vashon Island and Fauntleroy. South Colby and Southworth each has a store and service station. All have post offices with the exception of Colby.

**Blake Island**, about 1 mile in extent, 249 feet high, and covered with trees, is in the southeastern part of this bay,

off the northern entrance to Colvos Passage. Heavy tide rips, strongest with a flood current, and strong southerly winds are encountered at the northern entrance to Colvos Passage southward of Blake Island. Shallow, irregular bottom extends about 0.5 mile off the northern shore of the island. A light is on the northeastern point of the island. Just southward of the northeastern point of the island are the ruins of a wharf. An **explosives anchorage area** is eastward of the island; limits and regulations are given in § 202.230, Chapter 2.

**Yukon Harbor**, about 2 miles southwestward of Blake Island, affords anchorage in 6 to 10 fathoms, with protection from southerly winds.

**Vashon Island** is 11 miles long in a northerly direction and has an average width of about 3 miles. **Maury Island**, actually a peninsula of Vashon Island at its southeast extremity, is connected to it by a narrow neck of land surmounted by a highway. It is about 5 miles long with an average width of 1 mile.

On these islands the land is of moderate elevation, rolling, and in places rugged, and the country throughout is heavily wooded except for the numerous clearings where farming is in progress. The transmitting towers of Seattle broadcasting stations are on the islands; two groups of towers are on Vashon Island and two on Maury Island. The shores on all sides have numerous settlements. The county wharves, formerly used to ship farm produce, are no longer kept in repair, and shipments are now by truck.

**Point Vashon**, the northwestern extremity of Vashon Island, is 280 feet high, steep, and wooded. Shoal water extends 0.2 mile northward from the point and nearly as far along the northern shore as **Dolphin Point**, 1 mile eastward. A light and fog signal are 300 yards northward of Point Vashon.

**Vashon Heights Landing**, 0.5 mile eastward of Point Vashon, has a combination ferry slip and landing wharf built out to 14 feet. An automobile ferry runs to Fauntleroy.

**Glen Acres and Dilworth**, on the northern and southern shores of **Point Beals**, 2.5 miles southeastward of Dolphin Point, are small settlements. The tall radio towers of station KOMO are on the point.

The town and post office of **Vashon** are on high land 1.5 miles southwestward of Point Beals.

A **measured nautical mile**, on course **159°58'**, is eastward of Point Beals. The range markers are steel towers with round red and white targets.

**Point Pully**, about 7.8 miles southward of Alki Point, is a sharp low spit, projecting 300 yards from the high land which in 1 mile rises to an elevation of 430 feet. On the low part of the point is **Three-tree Point**, a grassy knoll 30 feet high, with several trees on it. A light and fog signal are on the point.

**Point Heyer**, a sandspit behind which the ground rises rapidly, is about 2.5 miles southward of Point Beals. A shoal extends 0.2 mile southeastward from the point. A radio tower on this point is about 450 feet high. **Ellisport** is a village just southward of Point Heyer. It has no facilities. **Portage** is a village with a post office extending over both sides of the low isthmus that connects

Vashon and Maury Islands. Just northward of the isthmus is an oil wharf where oil and other fuels are delivered by barge at high tide. Several tanks are here. Boats may obtain gasoline, but there are no service pipelines to the end of the wharf. Two radio towers, about 526 feet high, are about 0.6 mile southward of the isthmus.

**Point Robinson**, the easternmost extremity of Maury Island, is a low spit projecting 140 yards from the wooded high land. It is the turning point in the East Passage. **Point Robinson Light** (47°23.3' N., 122°22.4' W.), 40 feet above the water and visible 12 miles, is shown from a white octagonal tower on the point; a fog signal is at the light.

There are no landings on the southeastern shore of Maury Island. Two abandoned sand and gravel bunkers, now in ruins, are about 1.5 and 2.5 miles, respectively, southwestward of Point Robinson.

**Des Moines** is a town about 4 miles southeastward of Point Pully. It has bus connections with Seattle and Tacoma. The town of **Zenith** adjoins Des Moines on the south. The Masonic Home and water tank in Zenith are prominent landmarks.

**Redondo**, on **Poverty Bay**, about 6.8 miles southeastward of Pully Point, is a village with a post office, store, service station, and restaurant. A wharf for small craft, with a float, is equipped with an elevator for launching small boats. **Lakota** is a residential community without supply facilities 15 miles southward of Redondo. **Dumas Bay**, a cove just to the westward of Lakota, has several small wharves which bare at low water.

**Quartermaster Harbor** is between Maury and Vashon Islands, opposite Commencement Bay. The shores are low and wooded, with numerous clearings, and at the head of the harbor a narrow isthmus connects Vashon and Maury Islands. It almost covers at extreme high tide. The harbor is irregular in shape, with a total length of about 5 miles and an average width of 0.5 mile. It affords excellent anchorage about 2 miles inside the entrance in 5 to 10 fathoms, muddy bottom. The harbor is easy of access, and a mid-channel course may be followed with safety.

A shoal just inside the entrance, between **Neill Point** and **Point Piner**, extends 300 yards from the eastern shore and is marked at its outer end by a buoy. Just northward of Neill Point and also for 1 mile along the western shore opposite **Manzanita**, shoal spots extend 400 yards offshore, with depths of 2¼ to 2¾ fathoms. Depths of 4¼ fathoms are near midchannel westward of Manzanita, and also near midchannel westward of Dockton.

Many settlements are along the shores of the harbor, but the landing wharves, for the most part, are in disrepair. Under the high bluffs on the western side from Neill Point northward are the following summer resorts: **Harbor Heights**, **Indian Point**, **Magnolia Beach** and **Shawnee**; on the eastern side are **Roschilla** and **Manzanita**. The harbor is visited by many pleasure craft.

**Burton** is a town on **Burton Peninsula** which projects eastward from the western side about 3 miles from the entrance. It has a post office, several stores, and a wharf and float with a reported depth of 3 feet at the end. There is moorage for small pleasure craft and small repair

items may be obtained. Gasoline and water is piped to the wharf.

**Dockton**, in the bight on the eastern side about 2.5 miles from the entrance, is a village with a post office and store. The wharf is in poor condition and is no longer used. There are ruins of two other wharves. There are several piling where log rafts are temporarily secured. The County Park, on the east side of the bight, has a public wharf and float for small pleasure craft.

**Newport** is on the western shore just northward of the Burton Peninsula and **Quartermaster** is on the northern shore at the head of the harbor. These places have only a few houses.

In the upper part of the harbor, northward of the Burton Peninsula, are several private wharves and floats.

**Colvos Passage**, on the western side of Vashon Island, is about 11 miles in length in a general southerly direction, with an average width of 1 mile. The passage is nearly straight and free of dangers. The northern entrance is about 4.5 miles southward of Alki Point, and the southern entrance is about 4 miles westward of Browns Point and abreast Point Defiance. The passage is used principally by local passenger steamers, and by tugs from upsound points with logs for the sawmills. A midchannel course can be followed with safety.

The Colvos Passage is marked by four lights between Point Southworth at the northern entrance and Point Dalco at the southern entrance.

The current in Colvos Passage nearly always sets northward, and at times advantage is taken of this fact by vessels bound from Tacoma to Seattle. The current in the middle of Dalco Passage and along the southwest shore of Commencement Bay sets westward or northwestward almost continuously.

To obtain full advantage of the peculiar currents in Colvos Passage and connecting waterways, use should be made of the Tidal Current Charts, Puget Sound, Southern Part.

**Point Southworth**, on the western side of the northern entrance, is high and wooded.

**Fragaria** and **Olalla**, on the western shore of Colvos Passage, are small residential communities. Only isolated piling remains of their former wharves. Each has a store and service station and Olalla has a post office. A rock baring at half tide is reported to lie 400 yards northward of the former wharf at Olalla.

**Cove** and **Lisabeula**, on the eastern shore, are summer resort areas. Cove has a float for small boats at which gasoline and water are available. The former wharf is in ruins. There are several piling formerly used as moorings for log rafts. The wharf at Lisabeula is still standing but is in poor condition and is not used. Other resort areas on the eastern shore are: **Sylvan Beach**, **Cedarhurst**, **Colvos**, **Paradise Cove**, **Camp Scalth** and **Spring Beach**.

**Tahlequah** is a small residential community, with a store, on the southern end of Vashon Island between Neill Point and **Point Dalco**. An automobile ferry operates between Tahlequah and Tacoma.

**Gig Harbor** is an inlet about 1 mile long and 0.2 mile wide, on the west side of the southern entrance to Colvos

Passage abreast Port Defiance. A light is on the southern end of the sandspit at the eastern side of the entrance. A low sandspit, 220 yards long, projects southwestward from the eastern point, constricting the entrance to less than 100 yards in width; a narrow 10-foot channel in the middle has currents of considerable velocity. Inside the entrance the basin has from 4 to 6 fathoms in it. The surrounding land, partially cleared of timber, slopes gently toward the shores, and is thickly settled.

The town of **Gig Harbor** extends along the western shore and the head of the harbor. It serves an extensive agricultural district and is the home port of many fishing boats. Log rafts are made up in the harbor. The town has two boatyards, each equipped with marine railways. The larger of the two can handle boats of 100 feet maximum length and 9 feet draft. The second boatyard is smaller and specializes in yacht construction and repair. There are several landing wharves in the harbor, including two at which fuel, oils, and fresh water may be obtained. Communication with Tacoma is by telephone and by highway over The Narrows Bridge. Bus connections are made with Port Orchard and Bremerton.

**Directions, Gig Harbor.**—On entering, hold midway between the spit on the eastern side and the western shore until just inside the entrance. Then swing right toward the eastern shore until past the short spit extending from the western shore, and steer a midchannel course into the harbor.

**Chart 6407.—Commencement Bay (Tacoma Harbor)** has its entrance about 18 miles southward of Alki Point and 56 miles from Point Wilson. The bay is about 2.5 miles in length and has an average width of nearly 2 miles. The waters are deep throughout, ranging in depth from 570 feet at the entrance to 100 feet at the head where they shoal abruptly to mudflats, bare at low water. The bay is easy of access and free of dangers.

**Tacoma**, the second city in size and importance on the sound, is on the southern and southwestern shores of Commencement Bay. It has an extensive commerce, both foreign and domestic, exporting large amounts of non-ferrous metals, wheat, flour, machinery, lumber, and general merchandise; it also has part of the Alaska trade.

**Browns Point** is at the northern entrance to Commencement Bay. **Browns Point Light** ( $47^{\circ}18.4' N.$ ,  $122^{\circ}26.6' W.$ ), 38 feet above the water and visible 11 miles, is shown from a white tower on the point; a fog signal is at the light. In the bight just northward of the point is a small settlement.

**Dash Point** and the village of the same name are about 1 mile northward of Browns Point. There is a post office and store at the foot of the long pier which extends out from the north side of the point to a depth of 20 feet.

**Point Defiance**, the western entrance of Commencement Bay, terminates in a very prominent abrupt dirt bluff, 160 feet high. A light and fog signal are westward of the point. **Point Defiance Park** is wooded for a mile from the end of the point.

From the flats at the head of Commencement Bay, the city waterfront extends northwestward to within 1.5 miles

of Point Defiance. Here are numerous industrial plants with wharves to accommodate deep-draft vessels.

The most prominent of these is a large ore smelter 2 miles southeastward of Point Defiance; it has a very high chimney. The predominant landmark, however, is a radio tower 952 feet above the water about a mile southwest of the town of **Ruston**.

A measured nautical mile, on course  $132^{\circ}05'$ , is off the western shore, just below Ruston.

The flats at the head of the bay have been improved by dredging several basins and channels and by the construction of wharves, warehouses, railway terminals, and various industrial plants.

**City Waterway** is the westernmost of the basins at the head of the bay. A Federal project provides for a channel 29 feet deep and 500 feet wide from deep water in the bay to the South Eleventh Street Bridge, thence 22 feet deep and 500 feet wide to the South Fourteenth Street Bridge, thence 19 feet deep and varying from 500 to 250 feet wide to the end of the waterway. In March 1958 the controlling depths were 29 feet to South Eleventh Street Bridge, thence 22 feet to South Fourteenth Street Bridge, and thence 16 feet to the end of the waterway. A light and fog signal are on the eastern side of the channel at the entrance to the waterway.

Three bridges cross the City Waterway. The South Eleventh Street highway and railroad bridge, 0.5 mile above the mouth, has a lift span with a horizontal clearance of 200 feet and an overhead clearance of 62 feet down, and 137 feet, up. A railroad bridge, 0.7 mile above the mouth, has a swing span with a horizontal clearance of 100 feet and an overhead clearance of 14 feet. A railroad bridge, 0.8 mile above the mouth, has a swing span with a horizontal clearance of 100 feet and an overhead clearance of 10 feet. Operating regulations are given in § 203.785, Chapter 2.

**Middle Waterway** is northeastward of the City Waterway. The area on the west, north and east sides of the outer wharf has been dredged to 32 feet. The upper part of the waterway has shoaled and is not navigable.

**St. Paul Waterway**, northeastward of the Middle Waterway, is used for log storage.

**Puyallup Waterway**, northeastward of the St. Paul Waterway, discharges the water of the **Puyallup River**. The waterway has shoaled to such an extent that it cannot be used commercially. The highway and railroad bridge crossing the waterway, 0.7 mile above the mouth, has a lift span with a horizontal clearance of 150 feet and an overhead clearance of 25 feet, down, and 136 feet, up. The railroad bridge, 0.8 mile above the mouth, has a swing span with two openings with a horizontal clearance of 120 feet and an overhead clearance of 11 feet. Operating regulations are given in § 203.810, Chapter 2. Several other bridges cross the Puyallup River upstream, but this section is used only by small boats with local knowledge.

**Milwaukce Waterway**, northeastward of the Puyallup Waterway, has been dredged to 35 feet. A light and fog signal are on the western side of the entrance to the waterway. Various commercial interests have leased the wharves in this waterway.

**Sitcum Waterway**, northeastward of the Milwaukee Waterway, is shoal and used for log storage.

**Port-Industrial (Wapato) Waterway** is northeastward of the Sitcum Waterway. A Federal project provides for a channel 30 feet deep from deep water in the bay to the end of the waterway. In March 1958 the waterway was at or near project depth. A light is on the northwest corner of Pier 1 on the westerly side of the entrance to the waterway. A fog signal is on Pier 4 opposite the light. The highway bridge crossing the waterway at East Eleventh Street has a bascule span with a horizontal clearance of 150 feet and an overhead clearance of 13 feet at the center.

**Hylebos Waterway**, the easternmost of the basins, discharges the water of the Hylebos Creek. A Federal project provides for a channel 30 feet deep and 200 feet wide from deep water in the bay to the bend below Lincoln Avenue, thence 30 feet deep and 150 feet wide to a turning basin of the same depth at the inner end. The channel is maintained at or near project depth. A light is off the edge of the shoal on the north side of the channel at the entrance. A fog signal is on the outer end of Pier 1, U.S. Naval Station. The highway bridge crossing the waterway at East Eleventh Street has a bascule span with a horizontal clearance of 150 feet and an overhead clearance of 20 feet for a middle width of 98 feet. The signal for opening is four long blasts of the whistle.

**Anchorage.**—The depths as a rule are too great for convenient anchorage, but vessels occasionally anchor under the northern shore about 1 mile eastward of Browns Point. Vessels may anchor in about 60 feet 450 yards north-northwestward of the outer end of Puyallup Waterway west jetty. The city maintains one mooring buoy just eastward of the entrance to the City Waterway. It is in charge of the harbormaster.

**Dangers.**—The waters surrounding the Naval Station at Tacoma are included in a **Naval restricted area**; limits and regulations are given in § 207.750, Chapter 2.

**Tides.**—The mean range of tide at Tacoma is 8 feet. The range between mean lower low water and mean higher high water is 12 feet. A range of about 19 feet may occur at the time of maximum tides. The tidal currents in the harbor have little velocity.

See Appendix for **storm warning** displays.

**Pilotage.**—Pilotage is compulsory for all vessels except under coasting trade on the west coast of the United States, including Alaska and British Columbia. Pilots may be obtained from Puget Sound Pilots' Association, Seattle, on short notice.

**Towage.**—Towboats are available at Tacoma.

**Quarantine.**—Vessels subject to quarantine inspection usually proceed to their docks, where they are boarded by the quarantine officer. If vessels require fumigation after discharging cargo at Tacoma, the service is performed at the port. Advance notice of 24 hours should be given to the quarantine officer at Tacoma or the senior surgeon of the Public Health Service at Seattle. The U.S. Public Health Service maintains an outpatient office in Tacoma. Hospital cases are sent to Seattle.

**Customs.**—Tacoma is a port of entry; marine documents are issued.

**Immigration** officials are stationed at Tacoma.

The Coast Guard has a patrol boat stationed at the municipal dock on the western side of City Waterway near Eleventh Street.

**Harbor regulations.**—The harbor regulations are enforced by a harbormaster. His office is at the Fire Department Headquarters, 823 A Street.

Anchorage for vessels is authorized in any part of Commencement Bay, outside the outer harbor line, which is not used by vessels arriving at or departing from any dock.

It shall be unlawful for any vessel in fog mist, falling snow, or heavy rainstorm, whether by day or night, to travel in excess of 6 nautical miles per hour on any of the waters of Tacoma Harbor. It shall be unlawful for any vessel in clear weather to travel in excess of 8 nautical miles per hour within 500 feet of the outer harbor line on any such waters.

**Terminal facilities.**—Wharves sufficient to accommodate the largest vessels are available. Storage is available for all types of cargo.

**Supplies.**—Coal, fuel oils, provisions, and ship chandlery can be had in any quantity.

**Repairs.**—Only minor repairs can be made. The nearest large drydock is at Seattle. There are marine ways for hauling out vessels up to 175 feet in length; also extensive shipbuilding plants. Wrecking and salvage facilities are available.

**Communications.**—Tacoma is served by four important railroads, by three commercial airlines, and by bus lines to all parts of the country. Many foreign and coastwise vessels call. Small freight vessels serve Puget Sound towns. There are complete telegraph and telephone facilities.

**Chart 6460.**—Southward of Point Defiance the sound has numerous inlets, passages and islands. At many of the villages the landing wharves have fallen into ruins, all transportation following the highways. These waters are navigated by log tows and by pleasure craft. Deep-draft vessels call at Olympia for lumber and other forest products. The depths are generally great and there are only a few dangers. The shores are well wooded and moderately low. The beaches are sand and gravel, with boulders in places, and are often backed by steep, bare sand and gravel bluffs. Olympia, the State capital at the head of Budd Inlet, is the only city, but there are a number of smaller settlements. The chart is a sufficient guide for safe navigation in daytime. Strangers bound through these waters at night are advised to take a pilot.

From Point Defiance, the sound extends in a general southerly direction for about 15 miles to the flats at the mouth of the Nisqually River. **The Narrows** is the narrow passage southward of Point Defiance; it is about 5 miles long and 0.8 mile wide and clear of dangers.

**Currents.**—In The Narrows current velocities exceed 5 knots at times. At the north end of The Narrows the

current sets northward most of the time on the east side of the passage and southward most of the time on the west side.

Daily current predictions for a midstream position near the north end of The Narrows and details of the current movement at other locations are contained in the Tidal Current Tables, Pacific Coast. These tables and the Tidal Current Charts, Puget Sound, Southern Part, should both be consulted for details of the complicated currents of this area.

From Point Defiance the eastern shore of The Narrows consists of high bold bluffs, until near Days Island Anchorage. A railroad, emerging from a tunnel about 1.8 miles southeastward of Point Defiance, follows the beach to the Nisqually River.

From Point Defiance to the head of the sound the western shore is broken by a number of inlets and passages which afford communication to small settlements devoted to lumbering or agriculture.

**Point Evans**, 2 miles southward of Point Defiance on the west side of the narrows, is marked by a light. An overhead powerline with a permit clearance of 200 feet crosses the narrows 200 yards southward of the point. A highway suspension bridge crosses the narrows 1 mile southward of the point with a horizontal clearance of 2,565 feet and an overhead clearance of 173 feet for a center distance of 463 feet decreasing to 159 feet at the piers.

**Days Island Anchorage** is about 4.5 miles southward of Point Defiance. The town of **Titlow Beach** extends over the island and to the eastward. The former ferry slip and wharf are no longer used and are in poor condition. Gasoline and other petroleum products for small craft are obtainable at two marinas; one on Days Island and the other just to the eastward on the mainland. The former has a crane for launching boats not in excess of 15 tons or 46 feet in length. Hull and engine repairs can be made. The latter has a launching ramp but no repair facilities. See Appendix for **storm warning** display. There is moorage available at both marinas. A 2¼-fathom shoal lies 230 yards westward of the former ferry slip.

A small-boat channel, 1 foot deep, leads into **Days Island Lagoon**. The channel favors the Days Island side and under the bridge it is 30 yards from the island shore. It is of little value to strangers, being used only by local boats. Local boats anchor in 3 feet in the lagoon. There is a small-boat mooring and service station adjacent to the ferry docks. Anchorage for small boats may be obtained eastward of the northern end of Days Island. A small freight vessel plies between Tacoma, Days Island, Carr Inlet, and Hale Passage.

Hale Passage, entering on the western shore opposite Days Island, is described later.

**Gibson Point**, the southern extremity of Fox Island and the northern entrance point to the Carr Inlet, is marked by a light.

**Toliva Shoal** is nearly in midchannel about 8 miles southward from Point Defiance. It consists of two rocks with 1¼ fathoms over them and is marked by a lighted bell buoy. The shoal may be passed on either side, giving the buoy a berth of 300 yards.

Three miles southward of Days Island Anchorage, the shores consist of bright bare bluffs which are prominent from southward. A bunker for loading sand and gravel is just southward of some old pilings which mark the sites of former sand and gravel bunkers.

**Balch Passage**, between **McNeil** and **Anderson Islands**, is the channel most generally used by vessels bound to Olympia. It is 2 miles long, with an average width of 0.6 mile, and connects at its western end with **Drayton Passage**.

The Federal penitentiary, on the southeastern side of **McNeil Island** about 0.8 mile southwestward of **Hyde Point**, is prominent when approaching. It has a wharf built out to 16 feet which is lighted by a row of lights. Fresh water is piped to the end of the wharf. **Bee** is an automobile ferry landing on the south side of **McNeil Island** 1 mile westward of the penitentiary. The ferry connects with **Stellacoom** and **Anderson Island** landing.

**Eagle Island**, small, low and wooded, is near the middle of **Balch Passage**, 0.2 mile from **Anderson Island**, and is marked on its northern end by a light. On the shore of **Anderson Island** southward of **Eagle Island** is a small private landing. Just westward of this wharf is **Yoman** post office with a float landing.

**Eagle Island Reef**, 300 yards westward of **Eagle Island**, bares 1 foot at its southern part and has a depth of ½ fathom at its northern part. A buoy is off the northern extremity of the reef.

**Drayton Passage**, westward of **Anderson Island**, is about 3 miles long in a northerly direction and about 1 mile wide; it connects with **Pitt Passage** and **Balch Passage**, at its northern end, and at its southern end it connects with the western part of **Nisqually Reach**. With the exception of a spit extending 0.2 mile from the western shore about 1 mile northward of the southern entrance and marked by a light, the waters are deep and free of dangers. Estimated current velocities of 1 to 2 knots occur at the southwestern end of the passage.

**Filucy Bay**, on the western shore opposite **Balch Passage**, is about 1.5 miles long and irregular in shape; it is 0.4 mile wide at the entrance. **McDermott Point**, the spit at the southern side of the entrance, is marked by a conspicuous tower. Good anchorage in 7 to 8 fathoms, muddy bottom, is afforded 0.2 mile inside the entrance. There are numerous houses around the shores of this bay.

**Longbranch**, a village in the small cove opposite the entrance to the bay, has a post office, service station, stores, and a garage. The wharf, with 9 feet at the end, has a float for small craft. There is a log dump in the cove.

**Amsterdam Bay**, on the eastern shore of **Drayton Passage**, about 0.8 mile northward of **Treble Point**, the southwestern extremity of **Anderson Island**, is a small and shallow cove. There is 1 foot in the entrance and about 2 to 3 feet inside the bay. The channel into the bay is close to the northern shore.

**Stellacoom** is on the mainland about 9 miles southward of Point Defiance. The town is of little commercial importance; a limited amount of provisions can be obtained. It has rail and telegraph facilities and a wharf from which a ferry service is maintained to **Anderson**

and McNeil Islands. The State asylum for the insane is near here. Indifferent anchorage may be had along the water front close inshore, but it is not recommended as the holding ground is poor and the currents have considerable velocity. Off Steilacoom there are tide rips which, with a wind opposing the current, are dangerous to small boats. **Chambers Creek**, 1 mile northward of Steilacoom, has small lumber mills and a sand and gravel works. Except for the towing of log rafts, shipments are made by rail and truck.

**Ketron Island**, about 1 mile long, narrow, and about 200 feet high, is in the southern part of the channel, 10 miles southward of Point Defiance and eastward of Anderson Island. The island is wooded and the shores are bluff, except at the northern end where there is a wharf for small craft. The island is privately owned. **Cormorant Passage**, 0.5 mile wide, separates the island from the mainland southward. The passage is clear but is little used.

**Nisqually Reach** trends southward and westward around Anderson Island. The southern shore is formed by the **Nisqually River** flats which at low water are bare for nearly a mile offshore. The edge of the flats is bold with deep water close-to. The reach may be considered to extend about 6 miles from Ketron Island to the southern end of Drayton Passage, the narrowest part, 0.8 mile wide, being off the southern extremity of Anderson Island. The edge of the flats is marked by a buoy southward of the end of Anderson Island.

**Oro Bay**, in the southeastern part of Anderson Island, is an irregular bight between **Cole** and **Lyle Points**, the greater part of which is shallow; it affords an indifferent anchorage in about 10 fathoms, but is affected by the currents and affords no protection in northeasterly weather. A small shallow arm extends about 1 mile northwestward on the western side of the bay. A wharf built out to 7 feet on the western side of this arm serves **Vega**, a small village with a post office. An anchorage for small vessels is available about 200 yards eastward of the wharf at **Vega**. A long submerged spit extends from the southern entrance point of the arm almost to the small bight on the opposite shore. Care should be taken to clear this shoal in entering.

A wharf of the Du Pont powder works, built out from the mouth of **Sequalitchew Creek**, 13 miles southward of Point Defiance, has a depth of 23 feet alongside. The plant of the powder works is a short distance inland and cannot be seen from passing vessels.

**Nisqually Flats**, bare at low tide, begin just westward of the powder wharf and extend west-southwestward for about 3 miles, the western edge being about 0.4 mile westward of **Nisqually Head**. The edge of the flats is steep-to. The wharf of the **Giant Powder Works**, about 1.5 miles northwestward of Nisqually Head, has a depth of 24 feet alongside. There is a depth of 20 feet on the shoreward side of the slough channel about 70 yards north of the wharf.

From Nisqually Reach the sound extends northwestward for about 3 miles, where it branches into a number of inlets which are described under separate headings.

**Devils Head**, the western point at the southern entrance to Drayton Passage, is 280 feet high and heavily wooded. From this point, the shore, broken by two small shallow bights of no importance, extends northwestward for about 5 miles and then trends northward, forming the eastern shore of Case Inlet.

**Johnson Point**, 90 feet high, marks the western end of the main body of Puget Sound. A light is on the sandspit at the extremity of the point.

**Henderson Inlet**, known locally as **South Bay**, immediately westward of Johnson Point, extends about 4.5 miles in a southerly direction; the southern part is an extensive flat. The average width of the inlet is about 0.5 mile. Good anchorage is afforded inside the entrance in 5 to 6 fathoms, muddy bottom. A spit makes out about 0.2 mile northward from the western point at the entrance; on the western shore, 0.8 mile southward of the entrance point, a long sandspit projects. The low shores are timbered but there are some clearings. On the western shore about 2 miles southward of the entrance is a railroad log dump with booming grounds. There are oysterbeds in the southern part of the bay.

**Local magnetic disturbance**.—Differences of as much as 3° from normal variation have been observed along Henderson Inlet.

**Itsami Ledge**, 1 fathom deep, is 1 mile southwestward of Johnson Point, and 0.5 mile northward of the western point at the entrance to Henderson Inlet. It is surrounded by kelp and marked by a light. This is a danger in entering Henderson Inlet or Dana Passage, and vessels should pass northward of the light.

**Directions, Tacoma to Budd Inlet**.—From Tacoma to Point Defiance, vessels usually give the shore a berth of 0.2 to 0.5 mile, and if meeting the ebb current from The Narrows, round Point Defiance close aboard; or, if going with the flood, stand out and take a midchannel course. From Point Robinson vessels steer about 232°, giving **Point Piner** and **Neill Point** a berth of about 0.3 mile, and then head for Point Defiance. Vessels from northward, through Colvos Passage, can hold a midchannel course.

From Point Defiance, vessels can hold a midchannel course for 7.8 miles until up with Toliva Shoal, which may be passed on either side, giving the buoy a berth of over 300 yards. Then steer about 249° from Toliva Shoal buoy and follow the southern shore of McNeil Island at a distance of 0.25 mile; Eagle Island may be passed on either side. The passage northward of Eagle Island is the wider, and a midchannel course through it should be held until well past Eagle Island Reef buoy and until Drayton Passage is well open. A midchannel course through Drayton Passage clears all dangers. Round Devils Head at a distance of 0.3 mile and steer 305° to pass 0.3 mile northward of Johnson Point Light.

Or, if bound through Nisqually Reach, a general midchannel course should be steered from Toliva Shoal buoy, rounding Lyle Point, the southern end of Anderson Island, at a distance of 0.4 mile, passing halfway between the point and Nisqually Flats buoy, and then steering a general midchannel course until up with Johnson Point.

Round Johnson Point at a distance of 0.3 mile and pass

northward and westward of Itsami Ledge Light; keep in midchannel through Dana Passage, giving the southern shore a berth of not less than 0.2 mile until up with the Dofflemyer Point, then follow the directions for Budd Inlet.

**Chart 6462.**—Dana Passage, between Brisco Point, the southern extremity of Hartstene Island, and the mainland, is about 2 miles long and nearly 0.5 mile wide at its narrowest part. A light is on the end of Brisco Point. The passage connects at its western end with Budd and Eld Inlets, and northward with Peale and Squaxin Passages leading to Totten and Hammersley Inlets and Pickering Passage. With the exception of Itsami Ledge near its eastern end, the passage is clear and a midchannel course may be safely followed. The currents in Dana Passage frequently attain velocities of 3 knots or more.

**Boston Harbor**, a village in the cove of the same name just east of Dofflemyer Point, has a launching ramp and mooring float for small craft. Supplies for sport fishermen may be obtained.

**Budd Inlet (Olympia Harbor)**, 26 miles from Tacoma, is about 6 miles in length with an average width of 1 mile, extending southward from Dana Passage and terminating in flats bare at low water. The entrance is between Cooper Point and Dofflemyer Point, the latter being marked by a light and fog signal. The depths in the entrance to Budd Inlet range from 27 feet to 36 feet. The shores are comparatively low and wooded, and the depths shoal less abruptly on the eastern than on the western side of the inlet. The southern half of the bay is obstructed by flats and shoals that bare at low water for 0.8 mile, through which channels have been dredged to the Olympia waterfront.

**Olympia**, the capital of the State of Washington, is at the head of Budd Inlet. It is rapidly growing in importance as an overseas port. Lumber and logs comprise over 90 percent of the waterborne traffic of the port.

**Prominent features.**—The capitol dome is the most prominent object in this vicinity. It is conspicuous from the entrance of the inlet.

**Channels.**—A Federal project provides for a channel 30 feet deep and 500 feet wide from deep water in the inlet to the port terminal with widening at the bend of the channel and a turning basin of the same depth adjacent to the port terminal. In November 1956 the controlling depths were 27½ feet to the turn, thence 29 feet for a width of 300 feet to the turning basin and 29 feet in the turning basin. The channel is marked by lights, buoys, and ranges.

**Anchorage.**—Good anchorage may be had anywhere inside the entrance in muddy bottom.

**Dangers.**—**Olympia Shoal** is about 0.4 mile off the western shore, 3 miles inside the entrance. It bares and is marked on its eastern side by a light and fog signal. The channel to the westward of the shoal is marked by lights. A shoal with 5 to 15 feet over it extends 700 yards from the eastern shore between Olympia Shoal and the entrance to the dredged channel.

A restricted area for berthing of Maritime Commission vessels is on the easterly side of the inlet; limits and regulations are given in § 207.900, Chapter 2.

**Bridge.**—A fixed bridge with a horizontal clearance of 68 feet and an overhead clearance of 13 feet at the center of the span, crosses the head of the inlet about 100 yards below the Deschutes Basin dam. An overhead power cable at the bridge has a permit clearance of 29 feet.

A measured course for small boats of 1.0206 nautical miles on bearing 357°15' is between Olympia Shoal Light (47°05.5' N., 122°54.8' W.) and Olympia Channel Light (47°04.5' N., 122°54.8' W.).

**Directions.**—No detailed directions are necessary. A midchannel course through Budd Inlet clears all dangers until approaching Olympia Shoal; then change course so as to pass between the lights marking the channel to the westward of the shoal. When off Butler Cove, proceed on the ranges marking the dredged channel to the terminal.

**Tides.**—The mean range of the tide at Olympia is 10½ feet while the range between mean lower low water and mean higher high water is 14½ feet.

See Appendix for storm warning display.

**Pilotage.**—Pilotage is compulsory for all vessels except under coasting trade on the west coast of the United States, including Alaska and British Columbia. Pilots may be obtained from Puget Sound Pilots' Association, Seattle, on short notice.

**Towage.**—Several towing companies maintain headquarters at Olympia. The largest tug has 200 horsepower.

**Quarantine.**—Vessels subject to quarantine inspection usually proceed to their docks, where they are boarded by the quarantine officer. If vessels require fumigation after discharging their cargo the service is performed at the port. Advance notice of 24 hours should be given to the quarantine officer at Olympia or the senior surgeon of the Public Health Service at Seattle. The U.S. Public Health Service maintains an outpatient office in Olympia. Hospital cases are sent to Seattle.

**Customs.**—Olympia is a port of entry. A deputy collector of customs maintains an office at the port terminal, which is open only on Thursdays and Fridays. If needed at other times, service is furnished from Tacoma by request. There are neither customs nor bonded warehouses in Olympia.

**Terminal facilities.**—The eastern side and end of the main dredged channel is the only part of Olympia Harbor with wharves open to public use. The port terminal is the principal wharf; it is 2,000 feet long, with berthing space for its full length and a depth of 35 feet alongside. The industrial plants, chiefly lumber mills, are in the shallower portions of the harbor along the western and southeastern shores. The products from this location are moved by either lighters to vessels or by trucks or cars to the port terminal. The oil wharf northward of the port terminal has a depth of 32 feet at its face. Landing floats for yachts are maintained just westward of the end of the main channel.

**Supplies.**—Water, provisions, and a moderate amount of ship chandlery can be obtained. Diesel oil and gasoline are available at two oil wharves.

**Repairs.**—There is a marine way and a gridiron large enough to take care of small local boats. Emergency repairs can be handled by local machine shops, a welding works, and a boiler works.

**Communications.**—Olympia is served by two trans-continental railways and several foreign and domestic steamship lines operate on regular schedules. There are complete telephone and telegraph facilities. The municipal airport is 4.5 miles southward of the city.

**Deschutes Basin,** at the head of Budd Inlet, is a fresh water lake 1.5 miles long. It is closed to navigation by a dam and spillway at Fifth Avenue. **Deschutes River** empties into the southern end of the basin at the town of **Tumwater.**

**Eld Inlet,** known locally as **Mud Bay,** immediately westward of Budd Inlet, is of little commercial importance. Somewhat narrower than Budd Inlet, it extends about 6 miles in a general southwesterly direction with two slight bends. It affords good anchorage anywhere inside the entrance in 24 to 42 feet, soft bottom. A midchannel course is clear to the flats at its head. In entering, **Cooper Point,** the eastern point at the entrance, should be given a berth of not less than 0.2 mile. Logs are towed from here to Olympia, Tacoma, or Seattle. Extensive oyster-beds are cultivated near the head of the bay.

**Chart 6460.**—**Hale Passage,** between **Fox Island** and the mainland, enters on the western shore about 5 miles southward of Point Defiance. It is about 4 miles in length and varies in width from 1 mile at its eastern end to less than 0.4 mile at its western end where it joins with Carr Inlet. Near the western end the passage is crossed by a fixed highway bridge with a horizontal clearance of 103 feet and an overhead clearance of 31 feet. A shoal is about 0.8 mile eastward of the northern end of Fox Island and near the middle of the passage; it is boulder-strewn and bares at low water. A 1-fathom kelp-marked shoal is 200 yards eastward of Grave Island. A good small-boat anchorage is available on either side of Grave Island. The tidal current attains velocities of from 2 to 3 knots at times. The eastward (ebb) current is stronger than the westward. Current predictions may be obtained from the Tidal Current Tables, Pacific Coast.

**Sylvan (Fox Island P.O.)** is a village in the small cove near the northeastern end of Fox Island. It has a store and service station. The former town wharf on the east side of the cove is in ruins. There are several small private wharves. **Grave Island,** in the center of the cove, has a boys' camp, the buildings of which are prominent. A structure resembling a lighthouse is on the extreme northern end of the island. The former ferry slip, about a mile to the southeast of Sylvan, is in ruins.

There are fruit farms along the north shore of **Hale Passage** and on **Fox Island.** **Warren** is a small village on the northern shore of Hale Passage abreast the northwestern end of Fox Island. The wharf is in poor condition but the float at its end is still being used (1957). There are several other residential communities in this

area. **Cromwell, East Cromwell, Sunny Bay, and Arletta;** none of which have any supply facilities.

**Wollochet Bay** is a small inlet about 2 miles long and 0.2 mile wide, extending northward from **Hale Passage** about 1 mile inside the eastern entrance. The upper part of the bay is narrow and shoal. It affords an anchorage in midchannel about 0.3 mile inside the entrance in 11 to 12 fathoms, sticky bottom. A small private pier is about 0.5 mile from the head of the bay. **Wollochet,** on the eastern point at the entrance, is a village with no supply facilities. The wharf is unused and in poor condition. The head of the bay is used for oyster culture.

**Carr Inlet** enters the western shore of the sound about 8 miles southward of Point Defiance. From the entrance, between **Fox** and **McNeil Islands,** it extends about 6 miles west-northwestward and then trends northward for 8 miles, terminating in flats at the head. Good anchorage is afforded at and near the head in 6 to 15 fathoms, soft bottom, and in several small coves on its southern and eastern shores. From the entrance, a midchannel course may be followed with safety.

**Gertrude** is a village on the southern side of Carr Inlet on the shore of **Still Harbor,** which is a bight on the northern side of **McNeil Island** southward of **Gertrude Island.** It has a landing in 10 feet of water. The bottom in the middle of **Still Harbor** is uniform, with depths of 8 to 9 fathoms, sand and mud bottom. The bottom slopes gradually to a flat of sand and gravel at the head of the bay eastward of the wharf at Gertrude.

**Wyckoff Shoal,** partly bare at low tide, extends 0.8 mile westward from the northwestern part of **McNeil Island.** A winding channel of 2 fathoms, between **Wyckoff Shoal** and **McNeil Island,** is used with local knowledge.

**Pitt Passage,** westward of **McNeil Island,** connects **Drayton Passage** and Carr Inlet. It is obstructed about midway of its length by **Pitt Island** and its surrounding rocks and shoals. Only the passage east of **Pitt Island** is used by small craft with local knowledge. In this passage the ebb (northward current) is stronger than the flood and attains a velocity of 2½ knots or more at times.

**Delano Beach** is a residential community on the southern shore of Carr Inlet in the bight westward of **South Head.** The bight is shallow, a large part of it baring at low tide. There are no facilities.

**Lakebay** in **Mayo Cove** on the southwestern shore of Carr Inlet, is a village with a post office, store, and service station. There is a wharf, in poor condition, with a float. There are several small private wharves. The cove is shoal except in the middle near the entrance. The channel to the wharf is difficult to navigate, and strangers are advised to proceed cautiously or to obtain local advice. **Home,** a village on the western side of **Von Geldern Cove,** is known locally as **Joes Bay.** It has a store and service station. The wharf is in poor condition but the float alongside is maintained. The outer edge of the sandspit extending out from the eastern shore of the cove is only

75 yards distant from the wharf. A farming colony occupies the shores of the cove.

**Glencove** is a small settlement in Glen Cove on the western side of Carr Inlet, about 5 miles north-northwestward of South Head. It is a summer recreational area with a private wharf and float. At the head of the cove are log dumps and booming grounds.

**Elgin**, a village on the western side of Carr Inlet, at **Huge Creek**, is the site of a State fish hatchery. There are no facilities.

**Wauna**, a village with a post office, is at the head of Carr Inlet, where the spit enclosing **Burley Lagoon** joins the mainland. A county road extends along the spit and across the entrance to the lagoon over a fixed highway bridge to Rosedale and Gig Harbor. The bridge has a horizontal clearance of 140 feet and an overhead clearance of 18 feet. The former wharf is in ruins. **Burley** is a village at the head of Burley Lagoon. **Purdy** is on the eastern shore at the head of Carr Inlet.

**Rosedale** is a residential community on the cove on the eastern side of Carr Inlet, eastward of **Raft Island**, which is 180 feet high. It has no facilities. There is an extensive shoal area around and between Raft and **Cutts Islands**. The shores of these islands are strewn with boulders.

**Horsehead Bay**, about 1 mile in length and 0.1 mile in width, in a southerly direction, is directly northward of **Green Point**, at the western extremity of Hale Passage. This is a residential area with several private wharves. There are no public facilities.

**Case Inlet** extends northwestward for about 4 miles and then trends northward for 10 miles more, terminating in flats at the head, which is only 2 miles from the head of Hood Canal. Its average width is 1.5 miles, narrowing at the head. The depths are irregular, varying from 10 to 30 fathoms, but there are no outlying dangers. The western shore southward of Pickering Passage is formed by **Hartstene Island**. **Herron Island**, steep and bluff on its western face, is near the eastern shore about 4 miles from the entrance. A bar extends across the northern end of the passage between Herron Island and the eastern shore of the inlet. A depth of 21 feet can be carried over the bar by rounding the northeastern tip of Herron Island at a distance of 300 to 500 yards. A low-water spit extends 200 yards off the northeastern tip of the island. At the northern end of Hartstene Island is the entrance to Pickering Passage. Good anchorage may be had anywhere northward of Hartstene Island, in 6 to 15 fathoms, muddy bottom, and a midchannel course through the islet is clear of all dangers.

There are numerous farms and several small settlements whose chief industries are oyster culture, farming, and some logging. The flats near the head of the inlet are largely covered with oysterbeds. Communication is had by highway.

**Ballow** is a small village with float landing on the western shore of the inlet, about 2.2 miles northwestward of **Wilson Point**, which is on the western side at the southern entrance to the inlet. **McMicken Island** is 0.5 mile

northward of the village and is connected with the shore by a flat, bare at low tide.

**Herron** is a residential community on the eastern shore about 0.5 mile north of Herron Island. There are no supply facilities.

**Pickering Passage** indents the western shore of Case Inlet, about 2 miles northwestward of Herron Island. The passage extends in a general southerly direction for 8 miles, connecting at its southern end with Peale Passage and Totten Inlet. The width varies from 9.2 to 0.5 miles, the shores generally low and wooded, and the depths vary from about 6 to 15 fathoms. Except for the shoals extending eastward from the mouth of Hammersley Inlet, the passage is free of outlying dangers, and a midchannel course can be followed with safety. In Pickering Passage the flood current sets from Case Inlet toward Hammersley Inlet and the ebb in the opposite direction. The strongest currents are near the southern end where velocities reach  $2\frac{1}{2}$  knots at times. Numerous small farming settlements, generally consisting of 2 or 3 houses and a float landing or small wharf, are along the shores of the passage. The settlements are served by highway. An automobile ferry provides communication with Hartstene Island at **Grant**, about 3.5 miles northward of Hammersley Inlet.

**McLane Cove**, at the north end of Pickering Passage, opposite the north end of Hartstene Island, is undeveloped. There is a log dump on the east side.

**Dutchers Cove** is a small bay on the eastern side of Case Inlet about 2.5 miles northward of Herron Island.

**Stretch Island** is near the western shore of Case Inlet, just northward of the entrance to Pickering Passage. There is no through channel westward of this island. The northern part of this island is partly cleared of trees and laid out in orchards. There is a winery and several grape juice factories. There is a private landing wharf built out to 12 feet on the northern end of the island. A fixed highway bridge connects to the mainland with a horizontal clearance of 16 feet and an overhead clearance of  $9\frac{1}{2}$  feet. **Grapeview** is a village on the west side of Case Inlet opposite the northern extremity of Stretch Island. It has a post office, store, and service station.

**Reach Island**, 0.2 mile northward of Stretch Island, has been subdivided for homesites and is known as **Treasure Island**. It is separated from the western shore by a shallow channel known locally as **Fair Harbor**. The channel is spanned by a fixed bridge with a horizontal clearance of 21 feet and an overhead clearance of 15 feet. A rock baring 5 feet is near the middle of the passage back of Reach Island. The through channel is westward of the rock and has a controlling depth of 1 foot. To avoid the rock when it is covered favor the western shore.

**Vaughn** is a thriving village on the north shore of **Vaughn Bay**, which lies on the east side of the inlet about 4 miles from the head. It has a post office and several stores. The former wharf is in ruins. A channel 2 feet deep leads to the deeper water in the bay. Follow the northern shore for 200 yards after entering in midchannel off the end of the spit; then cross the bay parallel with the

spit at a distance of 200 yards, heading toward the southern shore, and then follow the southern shore at a distance of 200 yards, steering toward the head of the bay. Around the shores are numerous houses and orchards. There are extensive log booming areas at Vaughn.

**Rocky Bay** is the shallow bay northward of Vaughn Bay. A float landing, in 10 feet of water northward of the point dividing the two bays, is used at low tide when Vaughn Bay cannot be entered. A channel 3 feet deep leads to the lagoon back of the sandspit near **Windy Bluff**, the point between Vaughn and Rocky Bays. It is necessary to come around the small sand island northward of the spit. Oysterbeds are planted on the eastern side of the bay northward of the spit.

**Eberhardt Cove** is the local name of the small cove on the western side of Case Inlet about 0.7 mile northward of Reach Island.

**Allyn** is a village with a post office on the western side of Case Inlet near the head about 0.5 mile northward of **Sherwood Creek**. A draft of 7 feet can be carried to the oyster wharf at Allyn by following the eastern shore at a distance of 125 to 150 yards when past the oysterbeds on the eastern side of the inlet; when abreast the wharf cross over to it. Oyster culture and fruit raising are the principal industries.

**Victor** is a small village near the head of Case Inlet on the eastern shore. It has a store and a service station.

**Peale Passage**, about 4 miles long, between Hartstene and Squaxin Islands, extends in a general northwesterly direction from Dana Passage, connecting at its northern end with Pickering Passage. It has a controlling depth of about 13 feet in midchannel. Strangers should not attempt the passage. The current at times attains a velocity of 1½ knots in the narrow part of the passage. It sets northward on the flood.

**Squaxin Passage**, southward of Squaxin and Hope Islands, is about 1 mile in length and extends in a general westerly direction. It leads to the entrance of Totten and Hammersley Inlets. A light on Hunter Point marks the southwestern entrance point of the passage. The northern shore is foul; a shoal with 19 feet over it is 150 yards off the western shore of Hope Island abreast Steamboat Island. The passage is narrow, and although the chart is a good guide, strangers should proceed with caution. The southern shore should be favored, and at the western end, the northern point of Steamboat Island should be favored to avoid the shoal mentioned above. Tide rips are said to occur in the passage. The usual velocity of the current at strength is about 1½ knots. The passage between Hope and Squaxin Islands has a least depth of 9 feet in the middle. A reef, bare at extreme low water, southeastward of Hope Island, is easily avoided in Squaxin Passage by keeping the northern point of Steamboat Island well open of the southern point of Hope Island.

**Steamboat Island** is connected with **Carlyon Beach** on the mainland by a roadway on piling. The roadway is in poor condition and used as a footwalk only. The island is practically a part of the mainland. The north-

western end of the island terminates in a long sandspit. On the eastern side of Carlyon Beach is a large building with a float landing.

**Totten Inlet** extends southwestward from the western end of Squaxin Passage. It is about 8 miles long and varies in width from 0.2 to over 1.8 miles. A depth of 30 feet can be carried to a point off the entrance to Skookum Inlet. A 3½-fathom shoal is about in midchannel at the entrance, 620 yards southwestward of the southern end of Steamboat Island. A spit extends westward for about 100 yards from Steamboat Island. In entering, favor the western shore to avoid the spit and shoal. The inlet shoals gradually to about the longitude of **Burns Point**, 100 feet high, on the southern shore, where it bares at low tide. **Oyster Bay**, southward of Burns Point, is an extensive mudflat; oysters are grown in this area, and there are log booms. Southward of the entrance to Skookum Inlet, along the shores of Totten Inlet, are rock or concrete walls enclosing the oysterbeds. The walls are a danger to navigation, and the oyster industry discourages boatmen entering these waters. Local knowledge is required in piloting boats beyond the rounding point on the western shore, which is about 3 miles from the head, to the oyster-processing wharves which lie on the northern side of the inlet. Good anchorage may be had anywhere inside the entrance to the mouth of Skookum Inlet.

**Skookum Inlet** is a small shoal inlet with a narrow entrance which indents the western shore of Totten Inlet about 3.5 miles from the entrance. **Deer Harbor** and **Wildcat Harbor** are small coves indenting the north and south shores respectively, of Skookum Inlet, just inside the entrance. Deer Harbor is a residential area with a small privately owned wharf on the western side of the cove. There are no facilities. Wildcat Harbor is undeveloped but there are several houses, some with small wharves or floats, on the eastern point. Oyster culture is the only commercial activity in the inlet.

**Chart 6461.—Hammersley Inlet** indents the western shore of the sound about a mile northward of the western end of Squaxin Passage. It is about 6 miles in length, expanding at its head into **Oakland Bay**, which is 3.5 miles long in a northeasterly direction, and from 0.2 to 0.5 mile wide. The inlet averages 0.2 mile in width and is obstructed by shoals, particularly at its mouth, where there is an extensive bar. The shoals have been partly removed. A Federal project provides for a channel 13 feet deep and 150 feet wide from the entrance of the inlet to Shelton. In January 1950 the controlling depth in the project channel was 6½ feet, but a channel 10½ feet deep and 100 feet wide was available by deviating from the established channel. It is navigated only by light-draft vessels, and by tugboats with log rafts; local knowledge is required. Tidal current velocities may reach 5 knots at times in the constricted parts of the inlet. Current predictions may be obtained from the Tidal Current Tables, Pacific Coast. Vessels enter on the flood, usually after half tide, and leave on the ebb, usually before maximum strength. **Hammersley In-**

let is considered dangerous for strangers. Vessels with sharp rise of bilge should avoid the inlet as there is danger of turning over in the strong current in case of grounding.

**Arcadia** is a small settlement on the southern point of the entrance of Hammersley Inlet. It has a public ramp for launching small pleasure craft but no other facilities. A light is on the point southeastward of Arcadia.

**Libby Point**, on the northern side, 2 miles from the entrance, is marked by a light. **Gosnell Creek** is opposite this point. **Church Point**, on the northern side of the inlet, about 3.5 miles from the entrance, is marked by a light.

**Shelton**, at the head of the inlet, is a town of some commercial importance. Extensive logging and lumber interests are centered here. It is on a branch of the Northern Pacific Railway; lumber is shipped by rail only. Railway trestles used as log dumps extend across the flats. An oil wharf on the northern shore extends out to a depth of 12 feet. Several floats, just southward of the wharf, accommodate small craft. Communication with Olympia is by rail and bus; there is complete telephone and telegraph service. Launch fuels and some supplies can be obtained. Oysters are cultivated in the shoal portions of **Oakland Bay**.

## 14. HAWAII

**HAWAII**, 2,000 miles southwestward from California, is a chain of islands, reefs, and atolls that stretches 1,400 miles farther westward across the North Pacific Ocean. At the eastern end of the chain are the eight large islands of Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau, which extend 340 miles from 19°31' N., 154° 49' W., to 21°50' N., 160°15' W. At the western end is Kure Island, an atoll centered at 28°25' N., 178°20' W. Palmyra Island (5°53' N., 162°05' W.), 900 miles south-southwestward from the large islands, also is a part of HAWAII. The total land area of the group is about 6,450 square statute miles, of which the island of Hawaii comprises 62 percent. The capital of HAWAII is Honolulu, on the island of Oahu.

The large islands are mountainous and of volcanic origin. The highest mountains, Mauna Kea and Mauna Loa on the island of Hawaii, reach elevations of nearly 14,000 feet. It is said that the islands were formed at various periods, the westerly ones being the oldest and the easterly ones the youngest. This difference in age accounts for the difference in appearance from offshore. The island of Hawaii, youngest of the eight, shows very little evidence, comparatively speaking, of erosion, while Kauai, the oldest, is considerably cut up by gorges and ravines. Nearly all of the numerous streams on these islands may be classed as mountain torrents, although small boats can navigate a few of them for short distances. Most of the streams are found on the north and east coasts, where the rainfall generally is heaviest.

The 20-fathom curve rarely extends more than a mile from shore and usually is only a short distance off the coral reef which in some places fringes the coastline of the islands. In general, the bottom pitches off rapidly from a narrow coastal shelf to great depths. The few off-lying dangers usually are indicated by breakers or by a change in the color of the water.

**Agriculture** is the major industry of HAWAII. The principal products are cane sugar, pineapples, coffee, and livestock. The tourist business is also a large source of income.

**Anchorage**s are numerous, except on the northerly and easterly sides of the islands, the first requirement under ordinary conditions being shelter from the trade winds. During kona weather most of the anchorages on the southerly and westerly sides of the islands are unsafe.

**Harbors and Ports.**—The principal ports are Honolulu, Hilo, Kahului, Port Allen, and Nawiliwili; these are operated primarily by the Board of Harbor Commissioners and offer protection in most weather. Minor harbors of some importance are Kawaihae, Kaunakakai, Kaunakakai, and Kamalo.

**Boundary Lines of Inland Waters.**—At all buoyed entrances from seaward to bays, sounds, rivers, or other estuaries of HAWAII for which specific lines are not described, **Inland Pilot Rules** apply shoreward of the outermost buoy or other aid to navigation of any system of aids; **International Pilot Rules** apply outside the aids. Specific lines are described in **Part 82, Chapter 2**.

**Tides.**—The periodic tides around HAWAII are small, the average rise and fall being 1 to 2 feet. In general, the tides along the northern coasts occur about 1 to 1½ hours earlier than the tides along the southern coasts. Daily predictions of times and heights of the high and low waters will be found in the Tide Tables, West Coast of North and South America.

The effect of strong winds, in combination with the regular tidal action, may at times cause the water to fall considerably below the plane of reference of the chart. The water may also rise considerably above mean higher high water due to similar causes.

A heavy surf, particularly from northerly directions, gives the impressing of higher tides on exposed beaches. There is generally little increase in the actual height of the tide level under these conditions.

On the south side of Oahu, where the trade winds generally blow directly off the land, it has been observed that a shift to kona winds or to a calm will raise the tide level a few tenths of a foot.

**Currents.**—**Oceanic currents** in the vicinity of HAWAII are variable. They are believed to depend generally upon the velocity and direction of the wind. Their relation to wind, however, is complex and there are many reports of strong northeastward currents setting against the prevailing trade winds. In the vicinity of the larger islands, and as far west as Necker Island, there is a prevailing westward oceanic drift. Further information on ocean currents around HAWAII is contained in H.O. Publication No. 569, Atlas of Surface Currents, Northwestern Pacific Ocean.

**Tidal currents** are generally rather weak and consequently subject to modification by winds and oceanic movements. They are mainly reversing in the channels between the larger islands, but in more open waters, particularly near the islets westward of the main group, they are rotary, shifting direction continuously in a clockwise movement. They are usually semidaily but the two floods, or two ebbs, of the day are likely to be unequal in velocity and duration.

**Seismic sea waves.**—The destructive effect of the great seismic sea waves which have visited the Hawaiian Islands from time to time should not be minimized. The loss of life and property can be lessened if shipmasters

and others acquaint themselves with the behavior of these waves so that intelligent action can be taken when they become imminent. See Chapter 1 for details about these waves.

A system is in operation for warning the Hawaiian Islands area of the approach of seismic sea waves. It consists of a number of seismograph stations for quickly detecting and locating submarine earthquakes, a network of wave-detecting and reporting stations scattered throughout the Pacific, a high priority communication system, an operating center at Honolulu, and a system for broadcasting warnings when such a tidal wave is impending.

Military authorities in Honolulu will issue warnings to all military bases that might be affected. Local base commanders will put into effect any precautions deemed necessary. Elsewhere warnings will be broadcast by civilian authorities. Disaster committees have been set up on all the major islands to alert the population and to assist in evacuation and rescue as needed. In Honolulu and Hilo, former air raid sirens now operated by the police department will be used. On Oahu, Civil Air Patrol plans equipped with sirens will fly the shoreline and sound the alarm. This service will later be extended to the other islands. On all the major islands police cars equipped with sirens will patrol the coastal areas. Local commercial broadcasting stations will interrupt all programs to give the latest information and instructions. Should a warning occur when a radio station is closed down it will come on the air immediately and remain on until the all clear is sounded. When an alarm is given, all persons are warned to turn on their radios to a local broadcasting station for information and instructions. If they have no radio and cannot find access to one nearby they should seek high ground. Telephones are apt to be flooded with calls and therefore cannot be relied on during a warning.

When a warning is received, persons should vacate waterfront areas and seek high ground. The safest procedure for ships will depend upon the amount of time available and this may not always be known. A ship well out at sea would ride such waves safely, and hence if time is available to put to sea, that would be the safest action. During the 1946 wave, the master of a ship lying offshore near Hilo felt no unusual waves though he could see great waves breaking on the shore. Crews of fishing boats in the Hawaiian area also reported no unusual conditions at that time. On the other hand, the crew of a ship in harbor may have a difficult time averting serious damage.

In general, the destructive force of the waves is greater on the sides of the islands facing the oncoming waves. The waves may attain great heights in funnel-shaped bays and at capes or other places where a submarine ridge projects seaward toward the oncoming wave. Unusual heights may also be attained at any place where two waves traveling different paths arrive at the same time so as to reinforce one another. There

is much to be learned about such waves and the best course is to avoid them in any way possible.

**ROUTES.**—Between the islands, proceed on rhumb lines as direct as safe navigation allows.

**Honolulu to Panama.**—Rhumb lines through 21°14' N., 157°39' W., and 21°18' N., 157°00' W.; thence great circle to 8°40' N., 88°00' W., off shoals reported south of Guardian Bank; thence rhumb lines through 7°05' N., 81°45' W.

**Honolulu to San Diego, Los Angeles, San Francisco, and Strait of Juan de Fuca.**—See routes in Chapter 3.

**Honolulu to Seward.**—Rhumb lines through 21°19' N., 157°36' W., and 59°30' N., 149°30' W.

**WEATHER.**—The Appendix includes climatological tables for Honolulu, Hilo, and Lihue. Also listed are the Weather Bureau office, storm warning displays, and radio stations which transmit weather information.

**General.**—The climate of the Hawaiian Islands is unusually pleasant for a tropical area, the result principally of the marked marine influence and the persistent trade winds. Considering the latitude of the islands there is relatively little uncomfortable heat. The discomfort that is occasionally experienced usually occurs when the trades are temporarily displaced by light variable or southerly winds which are accompanied by comparatively higher humidities. The outstanding climatic features of the islands are the dominant trade-wind influences throughout all seasons, the remarkable variation in rainfall over adjacent areas, and the uniform temperature regime which varies slightly throughout the year.

During the summer season the trades blow with a high degree of persistency. As a result uncomfortable periods are usually delayed until fall and thus follow by weeks or possibly as much as two months the period when the highest temperatures occur. Rains most frequently fall at night.

Thunderstorms are infrequent and practically never severe. Hail seldom occurs. Occasionally local storms are accompanied by winds of sufficient force to do limited damage, but severe storms such as hurricanes or tornadoes are rare. So-called thick weather is almost unknown to the extent of seriously interfering with shipping and is usually confined to mist and rain rather than being in the form of fog. Except for rare one or two day disruptions of interisland airplane schedules, interference to shipping or travel because of bad weather is almost unknown.

**Pressure and general circulation.**—The strongest influence in the pressure pattern underlying the general circulation of air over the Hawaiian Islands area is the persistent and semipermanent high-pressure cell known as the Pacific HIGH. The clockwise circulation around this cell, coupled with a slight deflection of the surface winds away from the high pressure, result in the northeast trades that are the dominant winds of the area.

**Winds.**—The trade wind influence is dominant in all seasons throughout the greater part of all the islands. In some local areas winds deviate from the general pattern

because of topography. In coastal areas where mountains to the east project high above sea level as they do in the Kona districts of the island of Hawaii the trades are cut off, resulting in prevalent southwesterly winds with land and sea breezes in evidence. Such effects may be rather general in some areas and extremely local in others.

**Tropical storms.**—The ocean rectangle included between 15° and 30° N. and 150° and 180° W. can hardly be characterized as subject to tropical storms, although a few moderate to severe storms of this character have occurred in the area.

There are at least three classes of tropical storms. One type includes a very scanty number from low latitudes and east longitudes which cross the 180th meridian on an eastward course. Late in the year, from October through about December, typhoons occasionally form very far to the eastward of their usual zone of prevalence and move strongly northward. The second type appears to form, though rarely, somewhere to the southward or southward of the long stretch of the Hawaiian Islands and to travel northward. The third type forms off the west coast of Mexico and moves to the west or northwest. Unlike the other storms, all of which are likely only during the period of October through April, these occur mostly in summer or early fall. So far as is known, this type of tropical storm is quite rare and any effect upon the Hawaiian Islands, other than increasing the strength of the trade winds, is still more rare.

**Kona weather.**—The word "Kona" is of Polynesian origin and means leeward. It refers to the southerly winds and accompanying weather on the normally leeward slopes of the principal Hawaiian Islands which, because of the wind shift, have temporarily become the windward slopes.

The Konas, which occur most frequently during the months of October through April, provide the major climatic variations of the Hawaiian Islands. During these storms heavy rainfall and cloudiness can be expected on the lee sides of coasts and slopes which, under the usual wind pattern, receive less cloudiness and may have almost no rain. Near gales may occur, especially near points where the air tends to funnel into sharp mountain passes located near the coasts. At such times leeward anchorages may become unsafe for smaller craft.

**Precipitation.**—The complicated rainfall pattern over the islands results chiefly from the effects of the rugged terrain on the persistent trade winds. Frequent and heavy showers fall almost daily on windward and upland areas while rains of sufficient intensity and duration to cause more than temporary inconvenience are infrequent over the lower sections of leeward areas.

In the districts where the trade winds are dominant, rains are decidedly heavier at night than during the day. This applies generally to the greater part of the islands. Daytime showers, usually light, often occur while the sun continues to shine.

Considerably more rain falls from November through April over the islands as a whole than from May through October. It is not unusual for an entire summer month to go by without measurable rain falling at some points

on the Maui isthmus; at times considerably longer dry periods may occur in that locality.

**Temperature.**—Elevation is the major control factor in determining temperatures, although location, whether in a leeward or windward position, is also a noticeable factor. The highest temperatures reached during the day in leeward districts are usually higher than those attained in windward areas. The daily range is also greater over leeward districts where, because of less cloudiness, the maximum temperatures are higher and the minimum temperatures usually lower.

August and September are the warmest months and January and February are the coldest. At Honolulu there is an average monthly range between a low of 72° in January and February and a high of 78.5° in August. The extreme range of temperature at Honolulu for the 34 year period of record is from a low of 57° for January to a high of 88° recorded in August and September. This spread of only 31° between the extreme high and extreme low temperatures is small when compared with ranges at Pacific coast ports.

**Humidity.**—All coastal areas are subject to the relatively high humidities associated with a marine climate. Humidities, however, vary considerably, with high percentages over and near the windward slopes to low percentages on the leeward sides of the higher elevations.

At Honolulu the normally warm months of August and September are usually comfortable because of the persistency of the northeasterly trades which bring moderate humidities. Unpleasant weather is more likely later during the autumn or early winter when the trades may diminish and give way to southerly winds. During these periods known locally as "Kona weather" ("Kona storms" when stormy) the humidity may become oppressively high.

**Pilots and towboats** are available at Honolulu, Hilo, Kahului, Port Allen, and Nawiliwili.

**Customs.**—Honolulu, Hilo, Kahului, and Port Allen are customs ports of entry. Ships may be entered or cleared from other ports by advance arrangement with customs, quarantine, and immigration officials.

**Supplies.**—Fuel oil and other supplies are available in quantity at Honolulu. Most supplies are also available at Hilo and Kahului and, if not, can be shipped from Honolulu. Gasoline, water, ice, and minor items of ship chandlery are available at the smaller ports.

**Repairs.**—Honolulu has a medium-size floating dry-dock and good facilities for engine repairs. Hilo and Kahului have marine railways and machine shops for smaller vessels. There are facilities for hauling out small craft and for minor machine repairs on other islands.

**Communications.**—Telephone service is available from island to island and to the mainland. Most of the large islands have hard-surfaced highways between important communities.

Honolulu is a port of call for transpacific passenger and cargo vessels. Cargo ships sail frequently between Hawaii and mainland ports; sailings from Honolulu to the Orient are less frequent. Several airlines carry passengers and freight from Honolulu to the mainland and to Australasia

and the Orient. Most of the inter-island passenger traffic is by air.

**Standard time.**—The standard time used in most of HAWAII is 10 hours slow of Greenwich mean time. Johnston and Midway Islands use a standard time which is 11 hours slow of Greenwich.

**Chart 4115.**—The island of Hawaii, the largest of the Hawaiian Archipelago, is at the southeast end of the group. The island is roughly triangular in shape and has a greatest length of 83 miles north and south and a greatest width of 73 miles. **Mauna Kea** and **Mauna Loa**, the two mountains that dominate the island, rise to heights of nearly 14,000 feet, and from their summits the land descends gradually with occasional cinder cones and lesser peaks dotting the slopes. Lava flows are numerous and some reach the coast.

The volcano of **Kilauea**, 20 miles eastward of Mauna Loa and 9 miles from the southeast coast, creates the impression of being a crater in the side of its towering neighbor, but is in reality a mountain with an elevation of more than 4,000 feet. Kilauea and Mauna Loa are the only active volcanoes in the islands.

In the west central part of the island, **Mount Hualalai** rises to an elevation of 8,269 feet. **Mount Kohala**, elevation 5,505 feet, rises from the **Kohala Peninsula** at the northwestern end of the island.

**Anchorage.**—Under ordinary conditions the first requirement for anchorage is shelter from the northeast trades, and there is little shelter on the northeast and southeast sides of the island. Anchorages are numerous along the west coast of the island, but in some places the coast is steep-to and anchorage is not practicable.

**Currents.**—The currents generally follow the trades, but occasionally they set against the wind. A current sets northwestward along the coast from Cape Kumukahi to Upolu Point; another sets southwestward from Cape Kumukahi around Ka Lae and northward to Upolu Point. The latter flow is accompanied by an inshore counter current which sets southward from the vicinity of Hanamalo Point around Ka Lae and thence northeastward to the vicinity of Keaouhou Point. Northward of Hanamalo Point an inshore current, having considerable velocity at times, sets northward. Currents are reported to set strongly northeastward along the coast in the vicinity of Makolea Point and there are many reports of strong north-going currents at Mahukona. At Kawaihae currents are weak. Southwestward currents of about ½-knot velocity have been observed in Honokaope and Kiholo Bays. Offshore from Makolea Point the current is reported to set eastward toward the coast.

**Weather.**—The easterly trade winds seem to divide at Cape Kumukahi, one part following the coast northward around Upolu Point where it loses its force, and the other part following the southeast coast around Ka Lae. On the west coast of the island of Hawaii, except at Mahukona, the sea breeze sets in about 0900 and continues until after sundown, when the land breeze then springs up. Vessels bound eastward to ports on the windward side of the island may pass close to Upolu Point

and keep near the coast where the wind is generally much lighter than offshore.

During the trades the northeast coast is frequently clouded over in the early morning, with clear weather 1 or 2 miles offshore; but when the breeze picks up, about 0900, the clouds are driven inland.

The rainfall of the island varies greatly in different localities. The greatest amount is along the windward side. The Kona District highlands get a moderate amount, and a little reaches the Kau District and the west coast.

**Communications.**—A highway encircles the island and another leads from Hilo to Waimea by way of the pass between Mauna Kea and Mauna Loa. Interisland air and limited steamer service are available. Telephone service is available to all parts of the island, and radio and radio-telephone communication is maintained with the other islands and with the mainland of the United States.

From Upolu Point, the northernmost point of the island of Hawaii, the coast has a general southeastward trend for about 80 miles to Cape Kumukahi. This coast has been only partly surveyed but is mostly bold. All dangers can be avoided by giving the coast a berth of 2 miles. Hilo Bay is the only sheltered harbor or anchorage along this stretch. At some of the landings local vessels load and unload cargo by means of wire cables. The lights of the various sugar mills define the coast fairly well at night. It is reported that the current always sets northwestward along this coast.

**Chart 4140.**—The numerous bluffs in the vicinity of **Upolu Point** appear quite similar from seaward. The buildings and radio poles of a commercial airport are prominent on the western part of the point; an aviation light is on top of the station building. The Loran tower 2.3 miles southwestward of the point is marked by a flashing red light shown from the top, 335 feet above the water, with two fixed red lights exhibited between the top and the ground. See Appendix for **storm warning** display. The country back of the point is cultivated in sugarcane. Among the occasional clumps of trees are generally situated the camps and villages. The camps are high on the bluffs and at night their lights are visible for a considerable distance.

**Kauhola Point**, 5 miles eastward of Upolu Point, is low and is marked by a light, 115 feet above the water and visible 17 miles, shown from a cylindrical concrete tower. A dangerous reef extends 0.3 mile from the point and is generally marked by breakers. Vessels should give this point a berth of 2 miles. A fair anchorage, used by local vessels, is available in **Keawaeli Bay** (Awaeli), on the west side of the point, in depths of 9 fathoms, with **Kauhola Point Light** bearing 090° and distant 0.3 mile. Protection is afforded vessels forced to leave anchorage on the west coast during strong kona storms. Bound eastward from this anchorage, vessels should steer 010° for 1.2 miles to clear the reef. **Halauala** (Kohala), the principal village of the vicinity, is 1 mile from the light. The stack here is prominent.

**Keokea Bay**, 1.6 miles southeast of **Kauhola Point**, is

an abandoned shipping point which cannot be recommended as an anchorage when the trade winds are blowing.

**Niuli Plantation**, about 1 mile southeast of Keokea Bay, is operated by the Kohala Sugar Co. Sugar is trucked to Mahukona.

**Akokoa Point**, 2.8 miles southeastward of Kauhola Point, marks the easterly limit of the sugar plantations in the Kohala District. Southeastward of Akokoa Point the country has the appearance of a large tableland, rising gradually to the **Kohala Mountains**, which are heavily wooded to their summits.

The coast between Akokoa Point and Waipio Gulch, a distance of 10 miles, consists of numerous precipices, ranging in height up to 1,300 feet, and deep gorges that extend back inland. Waterfalls are numerous. The faces of the precipices have a general brownish appearance, although in places they are covered with vegetation from top to bottom.

**Pololu Gulch**, 1 mile south of Akokoa Point, is the westernmost gorge. Rice is cultivated in the valley. About 250 yards offshore from the gulch are two small detached rocks. **Honokane Gulch**, 0.5 mile from Pololu Gulch, is used somewhat for taro raising.

**Chart 4115.—Honokaneiki Gulch**, 9.2 miles southeast of Upolu Point, opens into a narrow bay which affords fair protection and landing facilities for small boats. A rock, awash at low water, is 0.5 mile offshore in a north-eastward direction from the gulch. The rock slopes to a depth of 23 feet 80 yards to the northward and the whole area is surrounded by depths of 12 to 14 fathoms.

About 300 yards offshore and 0.8 mile southeast of Honokaneiki Gulch are two small rocky islands, the larger having a height of 230 feet. Between Akokoa Point and the two islands the bottom is fairly regular and slopes gradually from the coast to the 20-fathom curve, about 0.7 mile offshore. During offshore winds anchorage can be found in depths of 7 to 20 fathoms.

A rounding point, formed by a landslide, projects 300 yards beyond the cliff line 6 miles southeast of Akokoa Point. Small boats sometimes land on the shingle beach 200 yards west of a house near the westerly end of the point. The landing is known as **Laupahoehoe**, but should not be confused with Laupahoehoe Point and village, 26 miles southeastward.

**Waimanu Valley**, 14.5 miles southeast of Upolu Point, cuts through the highest cliffs in the vicinity and ranks second in size among the gulches along this coast. The bay off the valley can be used as an anchorage in favorable weather. Depths of 7 fathoms are found 0.2 mile offshore just off the middle of the gulch.

Between Waimanu Valley and Waipio Gulch is a landslide that extends 300 yards beyond the cliff line. The slide occurred about 1910, leaving a bare, yellow scar on the face of the bluff that is quite prominent from offshore.

**Waipio Gulch**, the largest along this coast, is 3 miles southeast of Waimanu Valley. The gulch is a remarkable opening in the bluffs and is easily recognized by its sheer sides. **Waipio** is a small village near the mouth of the

gulch. Taro is grown in the vicinity. In favorable weather anchorage can be found in depths of 7 to 9 fathoms 0.3 mile offshore, either off the mouth of the gulch or under the bluffs to the eastward, but not beyond Honokaape Landing.

**Honokaape Landing** is 0.8 mile from Waipio Gulch. A small breakwater at the landing, which was built for the barging of rock for the Hilo breakwater, has been damaged by seas and offers practically no protection.

From Waipio Gulch eastward the precipices become lower until at Kukuihaele Landing, 2 miles distant, the coast is a comparatively low bluff 30 to 300 feet high. Between Waipio Gulch and Hilo, the land is cultivated with sugarcane to an elevation of about 2,000 feet. Continuing upward toward Mauna Kea, the slopes are wooded to an elevation of about 2,600 feet, thence the mountains present a barren appearance. During the winter months Mauna Kea is frequently snow-capped.

**Chart 4162.—**A light, 154 feet above the water and visible 18 miles, is shown from a white pyramidal concrete tower at **Kukuihaele Landing**, 19 miles southeast of Upolu Point. An abandoned cable house stands at the edge of the 250-foot cliff 400 yards west of the light. The shore at the base of the cliffs is strewn with boulders. A prevailing eastward current is reported in this vicinity.

**Honokaa Landing**, 5 miles east-southeastward from Kukuihaele Landing, is marked by three storage tanks on a low bluff. Close to southeastward of the landing is a high trestle over a gulch. The lone stack of a mill 1 mile southward of the landing can be seen among a large clump of trees. A reef that usually breaks extends 170 yards northward from the landing and is marked by several bare rocks. No shelter is available during normal weather, as the landing is open to the north and east. An occasional ship uses the landing to discharge oil or load molasses.

**Chart 4161.—Paauhau Landing**, 26 miles southeast of Upolu Point, is marked by the masonry of the abandoned inclined railway that leads to the top of the bluff. A mill with a tall stack is on the bluff 700 yards southeast of the landing. The deep gulches on either side of the mill are spanned by trestles. The shore at the foot of the bluff consists of rocks and ledges over which the sea breaks constantly. The small concrete landing at the foot of the masonry incline offers little protection from the northeast trades.

**Chart 4115.—Paauilo** is a village 31 miles southeast of Upolu Point, and 1 mile inland. A mill with a stack is near the top of the bluff on the seaward side of the village. All wire landings between Paauilo and Hilo have been abandoned.

**Ookala**, about 10 miles southeastward of Paauhau, is on the edge of the bluff on the south side of a deep gulch which is spanned by a high trestle. A mill stack can be seen but most of the buildings are hidden by the trees.

**Kaawalii Gulch**, about 1.5 miles southeast of Ookala, is V-shaped. A pumping station with a stack is close to the

beach. In this locality the country back of the coastline changes slightly in appearance. Hummocky fields are noticeable.

**Laupahoehoe Point**, 38.5 miles southeast of Upolu Point, is low and flat and makes out about 0.3 mile from the deep gulch. A light, 55 feet above the water and visible 13 miles, is shown from a white skeleton tower on the point. The outer end of the point is a mass of black lava rock, which is broken up into detached ledges extending 250 yards out from the light. The sea usually breaks with considerable force over the ledge. At the inner end of the point is the village of **Laupahoehoe**. The boat landing, which is little used, is in a 30-foot opening in the rock on the southeast side of the point. The landing affords some protection for small boats but its use is not recommended when considerable swell is running.

**Papaalooa**, 1.5 miles southeast of Laupahoehoe, can be identified by a waterfall directly under a mill and stack on the edge of the bluff. A horizontal string of bright lights makes a good mark at night.

**Maulua Bay**, 1.7 miles southeast of Papaalooa, is a 0.3-mile indentation in the coast at the mouth of a gulch which is spanned by a high bridge. In favorable weather, small boats could be beached on the shingle at the head of the bay. Only slight protection is afforded from the northeast trades. The village of **Ninole** is 1.5 miles southeast of the bay.

**Honohina**, 6.5 miles southeast of Laupahoehoe Point, is a settlement on the plain between two gulches. No stacks or prominent buildings are to be seen from seaward. The land has lost its hummocky appearance and the cane-covered fields are more uniform, although still broken by gulches. Between **Honohina** and **Hilo** the bluffs gradually decrease in height and finally disappear.

**Hakalau Bay**, 8.5 miles southeast of Laupahoehoe Point, lies at the mouth of **Hakalau Gulch**. Prominent from offshore are a high trestle spanning the gulch, a mill and buildings lying in the gulch at the base of the south bank, and several buildings on the highland just south of the gulch and quite close to the edge of the bluff. At night a row of prominent lights extends from the highland down to the gulch.

**Wailea**, a settlement about 1 mile southward of Hakalau Bay, is a short distance inland and just north of **Kolekole Gulch**.

**Honomu** mill, 2.3 miles southeastward of Hakalau Bay, is situated in the mouth of a gulch. The mill stack is not prominent. From Honomu to Hilo waterfalls cease to be characteristic of the coast.

**Pepeekeo Point**, 54 miles southeast of Upolu Point, is the most prominent point in the vicinity. A light, 147 feet above the water and visible 18 miles, is shown from a white pyramidal tower on the point. The stack of a mill on the bluff south of the point should not be mistaken for the light. The cane-covered cinder cones 2 miles inland from the light are fairly prominent. **Kauku Crater**, 4.4 miles from the light, is 1,956 feet high and wooded. Cane fields extend from the coast to the foot of the crater.

**Onomea**, a settlement 2 miles south of Pepeekeo Point,

is above the slope at the head of **Onomea Bay**. A large building is a prominent feature. The bay is small, shallow, and foul, but with local knowledge some protection can be found for small boats when the trades are northerly. A natural arch marks the seaward end of the ridge on the north side of the bay. **Papaikou** is a large settlement 2 miles south of Onomea.

**Chart 4103.—Hilo Bay**, 60 miles southeast of Upolu Point and 20 miles northwest of Cape Kumukahi, is between Pepeekeo Point on the north and Keokea Point on the southeast. The two points are 7 miles apart and the bay indents the coast about 3 miles. **Keokea Point** is low and difficult to distinguish from other points in the vicinity; foul ground extends 0.5 mile off the point.

The westerly shore of the bay is bluff, but the southerly and the southeasterly shores are low. The outer bay is exposed to the northeast trades, but the inner harbor is protected by a breakwater on **Blonde Reef**. There is frequently a heavy swell which is deflected eastward by the western shore and causes considerable surge at the wharves behind the breakwater.

**Blonde Reef** has depths of 1 to 4 fathoms and extends 1.5 miles in a northwesterly direction from the southeast side of Hilo Bay. In general, the shoaling is abrupt on all sides of the reef. A lighted bell buoy is off the end of the breakwater which extends the length of the reef.

**Hilo**, the second city in commercial importance and population in the islands, is on the southwest side of Hilo Bay. The principal trade is with the mainland of the United States. Receipts include petroleum products, general merchandise, feed, rice, and lumber. Shipments include sugar, molasses, cane fiberboard, coffee, and cattle. Interisland shipping includes general merchandise, petroleum products, and fresh vegetables.

**Prominent features.**—A light, 145 feet above the water and visible 18 miles, is shown from a white pyramidal concrete tower on **Paukaa Point**, 2 miles north of Hilo. The sugar mill at **Alealea Point**, on the north side of the city, has a large stack. Just south of the mill is a high stone abutment. When the mill is operating at night it can be recognized by its lights.

**Green Hill (Halai)**, in the residential section on the southwest side of Hilo, is the highest point in the vicinity. The marine terminals are in **Kuhio Bay** behind the inner end of the breakwater. South of the terminals is a large commercial airport. The aviation light at the airport can be seen many miles at sea.

**Channels.**—From deep water on the north, the channel to the inner harbor leads between the breakwater and the western shore, then turns sharply eastward and follows along the south edge of Blonde Reef to the wharves in Kuhio Bay. Opposite Blonde Reef are bare **Kaulainaiwi Island** and wooded **Cocconut (Mokuola) Island** which are joined to the southern shore by a reef that makes out 150 to 200 yards on all sides. A Federal project provides for an entrance channel 35 feet deep and a harbor basin of the same depth in Kuhio Bay. The channel and basin are maintained at or near project depth. The channel is

marked by lighted and unlighted buoys and a lighted range.

**Anchorage** can be found anywhere under the lea of the breakwater where depths are suitable. Good anchorage is available west of Kaulainaiwi Island in depths of 4 to 6 fathoms over good holding ground. The harbormaster usually assigns deep-draft anchorages.

A large fleet of fishing sampans operates in the outer part of Hilo Bay. The movements of these boats are uncertain, and vessels approaching the bay should maintain a sharp lookout.

The approach to the bay should be made from northward, favoring the western shore and avoiding the northwestern part of Blonde Reef. Vessels have gone aground on the north side of the breakwater.

**Tide.**—The mean range of tide is about 1½ feet and the diurnal range is about 2¼ feet.

**Current.**—There is reported to be a north-northwestward current with a velocity of about 1 knot in the approach to the harbor. After heavy rains, currents set northward in the inner harbor from Waiakea Creek and Wailuku River.

**Weather.**—The prevailing winds are the northeast trades. At night and early morning a gentle breeze generally comes off the land. See Appendix for storm warning display.

**Pilotage** is not compulsory but certain fees are charged to vessels entering or departing with or without pilots.

**Towage.**—A 65-foot, 240-horsepower diesel tug, equipped with radiotelephone, and a 46-foot diesel launch are available.

**Quarantine** officials are stationed at Hilo. The nearest outpatient clinic of the U.S. Public Health Service is at Honolulu.

**Customs and Immigration.**—Hilo is a port of entry. Customs officials are stationed in the city. Immigration officials are stationed at Honolulu.

**Harbor regulations.**—Regulations are established by the Board of Harbor Commissioners of Hawaii. The harbormaster enforces the regulations and assigns anchorages.

**Terminal facilities.**—The piers in Kuhio Bay are operated by the Board of Harbor Commissioners. The east pier, numbered 1, has a transit shed and pipelines for water, molasses and bunker oil. The southwesterly structure has 3 numbered piers: pier 2 on the northeasterly side, has a transit shed and pipelines for water; pier 2½ is along the north side; and pier 3 on the southwesterly side, has pipelines for water, bunker oil and light fuel. Piers 1, 2 and 2½ will accommodate any vessel that can enter the harbor, while pier 3 is limited to vessels with a draft of 25 feet forward and 29 feet aft.

Hilo Bay is subject to heavy surge, particularly between October 1 and April 15. Large vessels make fast to mooring buoys when coming alongside Pier 1. This is necessary to assist in leaving the pier, and for breasting off when the surge at the pier is excessive. The use of wire mooring lines is not advised. Vessels should be equipped with a full set of 8-inch manila lines: four bow

lines, four stern lines, double springs, and two 800-foot breast lines with 4-fathom lashings of 3½-inch manila.

Most of the small fishing craft of the locality tie up in the mouth of Waiakea Creek at the moorings. Clearance under the highway bridge at the entrance is limited and the channel is not well defined.

**Supplies.**—Provisions, ice, lumber, and some ship chandlery can be obtained at the port. Fuel and water are available on the piers in Kuhio Bay.

**Repairs.**—Machine shops at Hilo are equipped to make extensive repairs. A marine railway at the port has a capacity of 100 tons.

**Communications.**—Hilo has barge service three times a week but no interisland steamer service. Passenger travel is almost entirely by air. Hilo is a port of call for transpacific vessels. Radiotelephone communication is available to the other islands and to the mainland.

**Chart 4115.—Leleiwi Point,** 5 miles eastward of Hilo, is marked by a mass of bare, black, lava rock about 20 feet high extending 100 yards seaward from the tree line. The point is particularly hard to identify at night as it is low and seldom shows any lights. The coast between Hilo and Leleiwi Point is low and covered with a dense growth of pandanus and guava trees, backed by a low, heavily wooded, flat plain. The shore is broken by low patches of black lava.

The coast between Leleiwi Point and Cape Kumukahi, a distance of 17 miles, is a series of low bluffs. The lava flow of 1840, which reached the sea 5 miles northwestward of Cape Kumukahi, is marked on its seaward end by two black hills about 50 feet high and close together. This lava flow is visible inland for a distance of about 5 miles.

**Olaa mill,** 6.5 miles southward of Leleiwi Point and 3 miles inland, is marked by a tall stack and a prominent elevated water tank. At night the lights of the mill can be seen some distance at sea. Between Olaa mill and Cape Kumukahi the land is low and level and is wooded for a distance of about 2 miles from the shore. Back of this the Olaa plantation rises to an elevation of about 2,000 feet, above which the forests may be seen. The plain northwestward of the cape is thickly covered with foliage and scattered coconut groves.

**Cape Kumukahi,** the easternmost point of the island, is a low mass of bare, black lava with a jagged top and is clearly defined from all sides. Sharp pinnacles mark the end of the point. **Cape Kumukahi Light** (19°31.2' N., 154°48.8' W.), 165 feet above the water and visible 19 miles, is shown from a white square, pyramidal skeleton tower on the end of the cape. A chain of old craters, or cinder cones, extends 7 miles southwesterly from the cape. The first cone, 1.4 miles west of the cape, is 245 feet high and surmounted by scattered coconut trees. The trade winds divide at the cape, part following the coast northwestward and the other part following the coast southwestward.

**Pahoa,** a plantation village 8 miles westward and inland from Cape Kumukahi, is marked by a large church with a spire.

From Cape Kumukahi to Ka Lae, a distance of about 63 miles, the coast has a general southwesterly trend. Vessels are advised to keep at least 1 mile offshore, as the coast, although mostly bold, has not been completely surveyed. There are no harbors or anchorages along this coast that afford shelter during all winds.

The country southwestward of Cape Kumukahi is heavily wooded and along the beach are numerous coconut groves. The shore in the vicinity of the cape is low, but grows higher southwestward. The rocks are of black lava formation. Characteristic of this coast are the lava flows, which reach from the hills to the water's edge, presenting a bare and rough appearance. The old craters that extend southwestward from the cape join the ridge which forms the divide between the **Puna** and **Kau Districts**.

At **Pohoiki**, an abandoned landing 4 miles southwestward of Cape Kumukahi, is an abandoned coffee mill with a small stack. Several large trees with dark green foliage are on the small point on the seaward side of the mill. Small boats can be beached on the shingle and gravel on the south side of the point.

**Honuauia Crater**, about 5 miles southwestward of Cape Kumukahi and 3 miles inland, is 844 feet high and quite prominent. The southeast side is blown out, but the remaining slopes are covered with cane fields and the rim is fringed with trees.

**Opihikao**, a village 7 miles southwestward of Cape Kumukahi, is marked by a prominent grass-covered mound, 125 feet high, near the beach about 1 mile northeastward of the village. Opihikao is among the coconut trees. A small church with a steeple is near the beach.

**Kaimu**, a village about 6 miles southwest of Opihikao, has a black sand beach that may be used as a landing place. The beach is steep and free from rocks. A small church is near the beach on the north side of the village, which consists of a few houses among the coconut trees.

**Kalapana**, 7 miles southwest of Opihikao, has a pavilion and two churches, one with a spire, the other with a square tower. The village is on the low ground north of **Hakuma Point**, a black, flat-topped headland 65 feet high, which is the most prominent in the vicinity and obscures the village from the southwest. About 0.3 mile northeastward of the village is a thick grove of pandanus trees.

**Kii**, 2 miles southwestward of Hakuma Point, consists of a few scattered houses between which are coconut trees. The coast in this vicinity is black lava, 20 to 50 feet high. The slopes behind Kii are covered with low vegetation for about 3 miles to the first hills, which are forest covered.

**Apua Point**, 13.5 miles southwestward from Hakuma Point, is low and bare. Shoal water extends 300 yards or more off the point. The point should be given a berth of at least 1 mile, as a vessel is reported to have touched bottom in this vicinity.

Between **Kupapau Point**, a prominent point 3 miles southwestward from Hakuma Point, and **Keauhou Point**, 2 miles west of Apua Point, the coastal plain and the lower slopes of the mountains are devoid of vegetation; higher up the mountains are wooded. Beginning 2 miles west of Kupapau Point is a series of bluffs several hundred feet

high and 1 to 3 miles back of the shore. The bluffs are marked by numerous lava flows. The volcano of **Kilauea** cannot be seen from seaward, but its location, when active, is indicated in daytime by the smoke that it discharges and at night by the glare on the clouds.

At Keauhou Point the bluffs are yellow, steeper, and near the beach. The plain at the foot of the bluffs is low, and on a dark night the beach is hard to see. About 2 miles westward of Keauhou Point is a yellow bluff which is about 300 feet high at its northeasterly end. This bluff is the most prominent landmark near the beach on this part of the coast.

About 1.5 miles west of Keauhou Point is **Keaoi Island**, which is low, close inshore, and separated from the mainland at its easterly extremity only by shoal water. Small boats find shelter behind this islet by entering from the west.

**Kau Desert**, the country southward of Kilauea volcano, is devoid of vegetation. The **Great Crack**, on the western side of the 1823 lava flow from Mauna Loa, marks the western limits of the desert. The Great Crack, which is visible from seaward, passes along the eastern side of **Puu Ulaula**. The hill is 1.5 miles inland and 994 feet high. A sharply defined, low, black cone is about 5 miles inland and on the easterly side of the lava flow at an elevation of about 1,800 feet.

**Pahala** mill, about 4 miles northward of Punaluu and 3 miles inland, has two tall stacks. The mill is lighted at night and is a good mark both day and night.

The country between the Great Crack and Punaluu is covered with sugarcane to an elevation of about 2,000 feet; thence the slopes are wooded to within about 6,000 feet of the summit of Mauna Loa. Here and there bare lava flows cut up the canefields. Cane in the Kau District extends as far west as Waiohinu.

**Chart 4162.**—**Punaluu**, 17 miles northeastward from Ka Lae, was formerly the shipping point for Pahala but the landing is no longer used. Small boats find some protection in depths of 6 to 11 feet close to the eastern shore of the small bight which forms **Punaluu Harbor**. The landing at the head of the bight is marked by the ruins of a warehouse. A prominent church with a steeple is 0.3 mile southwest of the landing.

The southwestern part of the bight is foul. A rock, awash at half tide, is 260 yards south-southeast of the landing; another, with 8 feet of water over it, is 40 yards farther offshore in the same direction. The entrance is between these rocks and the shore to the northward. A rock, with 3 feet of water over it, is 0.2 mile east of the entrance and 80 yards offshore. The northeast trades tend to haul more offshore in the vicinity of Punaluu Harbor, but in rough weather breakers extend completely across the entrance and passage is impossible.

**Chart 4115.**—The church and houses of **Hilea**, 1.7 miles west of Punaluu and 1.5 miles inland, can be seen from seaward. Back of the landing at Punaluu, and up to an elevation of about 3,500 feet, the slopes are broken;

above this they appear regular and gradual to the summit of Mauna Loa. The upper slopes of Mauna Loa can only be seen from several miles offshore.

**Puu Enuhe**, 3 miles northwestward of Punaluu, is the seaward end of **Enuhe Ridge**. The butte is a conspicuous flat-topped cone with an elevation of 2,327 feet. **Kaiholena**, **Pakua**, and **Makanau Buttes** are promontories on **Kaiholena Ridge**, which extends 3 miles northwestward from the village of Hilea. **Ninole Gulch** lies between the two ridges, making the region extremely rugged, with the buttes standing out boldly. The buttes are prominent from either the southwestward or northeastward.

**Kaumaikiohu Peak**, about 5 miles northward of Punaluu, is a prominent cone, 3,430 feet high, on the southeast boundary of the Kau Forest Reserve.

Between Punaluu Harbor and Honuapo Bay the shore is composed of masses of black lava rock which project out into deep water. About 1 and 3 miles southwestward of Punaluu are two conspicuous lava flows which reach the shore. Some of the slopes back of Honuapo Bay are covered with cane.

**Chart 4162.—Honuapo Bay** is a slight indentation in the coast 4 miles southwestward of Punaluu Harbor. Most prominent from offshore is the 236-foot cliff 0.5 mile southwest of the pier at the head of the harbor; the upper half of the cliff shows black against the light brown background of the hills, and the lower half is a grass-covered slide. Also prominent are a large storage tank near the inner end of the pier, several tanks 150 yards north of the pier, and the stack and buildings of a sugar mill 0.4 mile northward of the pier. The depth at the outer end of the pier is about 4 fathoms. The bottom slopes rapidly to depths greater than 10 fathoms 200 yards off the pier. Freight is usually handled by lighters. There is little steamer traffic to and from the harbor.

**Chart 4115.—**The villages of **Naalehu** and **Waiohinu** are on the southern side of the base of **Puu Hoomaha**, which is 2,109 feet high and 2.8 miles west of Honuapo Bay. The country between these villages and **Ka Lae** is a grassy plain on which cattle range.

**Maniania Pali**, beginning at **Kimo Point** 2 miles south of Honuapo Bay and ending at **Waikapuna Bay**, is a black cliff 100 to 200 feet high with a band of yellow clay on top. From **Waikapuna Bay** to **Kamilo Point** the coast is low and rocky.

**Kamilo Point**, 8 miles southward of Honuapo Bay, is a low, dark, lava mass on which is a black lava monument with a square base surmounted by a dome. A reef over which the sea generally breaks extends about 0.3 mile from the point.

**Kaalualu Bay**, 1 mile westward of **Kamilo Point**, affords good shelter for small craft during northeast trades, but is exposed during kona weather. Anchorage can be found in depths of about 10 fathoms 200 yards due west of the point on the east side of the entrance. The submerged coral reefs between the anchorage and the northeast part of the bay

should be avoided, especially during periods of heavy swells.

Between **Kaalualu Bay** and **Ka Lae**, the grassy plain is occasionally broken by bare lava. About 2.5 miles southwestward of **Kaalualu Bay**, the low coastline is broken by a 284-foot grayish cinder cone.

**Ka Lae (South Cape)**, 5 miles southwestward of **Kaalualu Bay**, is the southernmost point of the island. A light, 73 feet above the water and visible 14 miles, is shown from a white pyramidal skeleton tower on the point. The southeasterly side of the point is low; the bluff on the westerly side rises gently from the point to a height of 335 feet 2 miles to the northward. The bluff then leaves the shore and trends inland for several miles, increasing in height and forming the **Pali o Mamalu**, a remarkable cliff when seen from the westward. An emergency landing field is on the point near the light. Shoal water extends 0.6 mile south of the point; all vessels should keep 1 mile off to avoid possible dangers. The shore current setting northeastward against the trade wind frequently produces a rough sea on the eastern side of the cape. Offshore the current sets southwestward.

From **Ka Lae** to **Upolu Point**, a distance of about 98 miles, the coast has a general northerly trend and is mostly bold. The largest reef extends about 0.6 mile from shore in **Kawaihae Bay**; few of the others off the numerous capes and points make out more than 0.3 mile. All dangers can be avoided by staying at least 1 mile offshore.

No harbor or anchorage along the west coast affords shelter during all winds; all are smooth during the regular northeast trades but exposed during kona weather. The trade winds draw around **Ka Lae** and hold northward offshore for about 3 miles, generally causing a rough sea. Close inshore the sea is generally smooth.

Storms from the southwest to northwest are most frequent in January and February. Some protection for small craft may be found in **Keauhou** and **Kawaihae Bays** but anchorage space is limited. Boats sometimes seek shelter along the southeast side of the island during these storms.

Gasoline and a limited supply of water are available at most of the small harbors along the west coast. Supplies are mostly obtained from the stores on the main highway inland from the coast.

The section of the west coast between **Ka Lae** and **Kawaihae Bay**, 75 miles northward, is known as the **Kona Coast**. The country along this coast is broken up by numerous lava flows, varying in length from a few hundred yards to 30 miles, that have broken out from **Mauna Loa** and **Mount Hualalai**. Between these flows are areas that are heavily wooded and covered with vegetation above an elevation of 1,500 feet, and there are large areas planted in coffee. Many of the lava flows reach the coast and terminate in bluffs, some fairly high and others only a few feet above the water. Scattered trees and bushes can be seen between many of the flows.

From **Pali o Mamalu** to **Hanamalo Point**, about 20 miles

northwestward, are lowlands several miles wide, which rise gradually to the mountains. The country is extremely desolate, with its grayish-black slopes of bare lava, A particularly black flow lies at the base of the lighter-colored cliffs of Pali o Mamalu.

At an elevation of 2,000 feet the kona region is known for its cool and bracing climate and plentiful rain. Little variation in weather conditions is experienced, there being generally a land and sea breeze, except during kona winds. This condition, however, does not apply between Kawaihae Bay and Upolu Point, since the region is affected by the winds which draw across the island.

**Waiahukini**, a small fishing village at the base of Pali o Mamalu, is marked by a patch of white sand. **Kailikii Shoal** extends about 0.5 mile offshore to the west and north of the landing.

**Puu Hou**, a black, well-defined cone 273 feet high, is close to the beach 1.6 miles northwestward of Waiahukini.

**Pohue Bay**, 9 miles northwestward of Ka Lae, has a sand beach at its head where landings can be made.

**Na Puu a Pele** are a group of cones near the beach 12 miles northwestward of Ka Lae. The cones are prominent landmarks, and at the summit of the highest is a black stone cairn.

**Kauna Point**, 13.5 miles northwestward of Ka Lae, is low, flat, and somewhat grassy, with a small hummock of grayish lava 0.5 mile inland. A light, 52 feet above the water and visible 9 miles, is shown from a white skeleton tower on the point.

**Kaulanamauna**, 3 miles northwestward of Kauna Point, is at the head of a small cove which affords a landing place.

**Okoe** is at the head of **Okoe Bay**, a cove immediately south of Hanamalo Point. The cove indents the shore more than any other in the vicinity and has a little more sand on the beach. Anchorage can be found in depths of 7 to 15 fathoms.

**Hanamalo Point**, 21 miles northwestward of Ka Lae, is a low mass of lava with no prominent features. Unless close inshore, the point is difficult to distinguish from other points in the vicinity. South of Hanamalo Point an inshore current sets southward around Ka Lae and thence northeastward along the shore to the vicinity of Keauhou Point.

**Milolii**, a village 2 miles northward of Hanamalo Point, has a concrete boat landing with derrick and shed. The landing has a depth of 7 feet alongside. The current off the landing has a prevailing northerly set which sometimes reaches a velocity of 2 knots. A reef extends about 400 yards outward from the point of land on which the schoolhouse is located.

A schoolhouse, visible from the northwestward only, is in the ironwood grove 250 yards southward of the Milolii landing. Between the school and the landing is a grove of coconut trees, back of which are the 15 or 20 houses of the village. Otherwise, the countryside is a barren mass of lava. There is no protected anchorage off the landing. Small craft anchor to permanent moorings in depths of about 15 fathoms to which they can tie up during most of the year. Storms occur most frequently in January and February.

The lava flow of 1926 from the slopes of **Puu o Keokeo** entirely destroyed the village of **Hoopuloa**, 1 mile northward of Milolii. The same flow nearly engulfed Milolii. About 3 miles north of Milolii the black flow of 1919 is prominent.

**Lepeamoa Rock**, 11 miles northward of Hanamalo Point, is close offshore from the island. The rock, which is about 100 feet high, is the crescent-shaped rim of an old crater that has had its seaward face blown out. About 1.5 miles inland from the rock is the 1,766-foot peak of **Haleili**. Small villages of a few houses each are scattered along the coast, 1 or 2 miles apart, between Milolii and Lepeamoa Rock. The highway, which is 2 miles inland at Milolii, draws nearer the coast until at Lepeamoa Rock it is only 0.5 mile inland.

**Kauhako Bay**, 34 miles northwestward of Ka Lae, is a small cove which has at its head a pali, or cliff, about 0.5 mile long and 120 feet high. **Hookena** is a small village at the foot of the northerly end of the pali. A prominent landmark is a stone church, with steeple, at the northerly end of the village. A large grove of coconut and shade trees is near the village. Anchorage can be found in depths of 15 fathoms, sandy bottom, about 300 yards off Hookena. There is a landing near the north end of the sand beach.

The bluffs along the coast north of Hookena lose their height. The slope up to the interior is not so steep as to the southward, and the country is covered with brush and coffee plantations.

**Loa Point**, about 35.5 miles northwestward of Ka Lae, is flat and low, and green to within 40 yards of the water, then rocky.

Between Loa Point and Hookena is the settlement of **Kealia**, which is at the north end of a long pebble beach. The villages along this section of the coast usually have a few houses on the beach, and the post offices and most of the houses are on the highway 1 or 2 miles inland.

**Chart 4123.—Honaunau Bay**, 38 miles northwestward of Ka Lae, indents the coast about 500 yards and is about 500 yards in width. The bay lies between two flat lava points. **Puuhonua Point**, on the south, is lower and smaller and is marked by the 12-foot-high stone walls of the **City of Refuge** and by a grove of tall coconut trees. The City of Refuge is of historic interest and is now maintained as a county park. In former times criminals or refugees reaching the place were safe until such a time as the king of the land took action. Sampans anchor in depths of 4 to 8 fathoms 150 yards from the south shore. Ship's boats can easily land on the shingle beach on the southeastern side of the bay during normal weather.

**Palemano Point**, on the south side of the entrance to Kealakekua Bay, is low and flat, with scattered coconut trees and temple ruins near its outer end. The buildings of a resort camp on the point are prominent. A mass of bare rocks extends 125 yards off the north side of the point. About 0.4 mile northward of the point an old lava flow reaches the shore.

**Kealakekua Bay**, 3 miles northward of Honaunau Bay, is marked on its northerly side by a light on **Cook Point**.

The bay is about 2 miles wide between Palemano Point and Keawekaheka Point, and indents the coast about 1 mile. The shore is low, except on the northeast side where a precipitous cliff between 400 and 600 feet high extends about 0.5 mile. A narrow reef fringes the shore between the southerly end of the cliff and Palemano Point. The bay is free of obstructions, affords good anchorage in all but strong southwesterly winds, and is by far the best anchorage along this coast. In choosing an anchorage it is well to remember that in the daytime a sea breeze will prevail, shifting to a land breeze at night. The bottom is of coral and sand and is only fair holding ground.

**Kaawaloa Cove** is the northerly part of Kealakekua Bay and lies between the high cliff and Cook Point. It was here that Captain James Cook was killed by the natives in 1779. **Cooks Monument** is a concrete shaft, 25 feet high, near the shore of the inner side of Cook Point. A concrete landing with a depth of about 6 feet alongside affords a means for visitors to reach the monument.

The village of **Napoopoo** consists of a few houses scattered among the coconut trees just southward of the cliff. Provisions can be obtained in limited quantities; fresh water is scarce. Gasoline and some ship chandlery may be obtained. A post office and telephone communications are available. The landing, which has a depth of about 4 feet alongside, is in the middle of the village. During a heavy swell it is best to land on the sand beach at the north end of the village. A church with a spire is fairly prominent from offshore.

A vessel will be able to pick up Kealakekua Bay by heading for the dome of Mauna Loa on a bearing of 090°; thence a course of 033°, heading for the middle of the cliff, will lead into the bay. Good anchorage can be found in depths of 12 to 18 fathoms with the south end of the cliff bearing 055° and Cooks Monument bearing 314°. The current usually sets northward along the coast, but depends to a considerable extent upon the wind. Inside the bay the current is weak.

**Keawekaheka Point**, on the north side of the entrance to Kealakekua Bay, is a low, bare, lava point. An extensive lava flow reaches from the point to the high cliff at the head of the bay.

**Chart 4140.**—**Puu Ohau**, 1.5 miles north of Keawekaheka Point, is a green cone, 231 feet high, near the beach. The cone has a blowhole in the middle and its seaward side is blown out, forming a red cliff.

**Keikiwaha Point**, 2 miles northward of Keawekaheka Point, is low, black, and jagged, with coconut trees on it. About 2 miles inland from the point, and on the highway, are a stack, a church, and the buildings of **Kainaliu**.

From Napoopoo to Kailua is the most thickly settled section of the coast, and cultivated fields of coffee extend both ways from the highway which parallels the shore 1 to 2 miles inland.

**Chart 4163.**—**Keauhou Bay**, 46.5 miles northwestward of **Ka Lae**, indents the coast 0.3 mile and is 300 yards wide between entrance points. The bay lies between two lava

flows at the foot of a gentle slope and, though small, is one of the best protected along the kona coast. Scattered coconut trees and a few buildings are close to the rock and sand shore at the head of the bay. The schoolhouse at **Keauhou** is located on the highway 1.5 miles inland and is fairly prominent from offshore. The bottom is extremely irregular and has many coral heads with depths of 5 to 6 feet over them. A reef extends 100 yards off the north entrance point, and boats should favor the southerly point when entering. By maintaining a lookout for coral heads, boats of 4-foot draft can enter the bay for anchorage. Breakers frequently extend across the mouth of the bay. Fuel and a limited amount of water are available. A marine railway is capable of hauling out vessels up to 45 feet in length and 20 tons in weight.

**Chart 4140.**—**Kahaluu** is a small village about 1 mile northward of Keauhou.

**Mount Hualalai**, in the central western part of the island, is a conical peak 8,269 feet high, covered with vegetation to its summit and prominent from any point of approach. Its western slopes terminate in a bare, lava plain about 4 miles wide. The plain forms a low beach consisting of sand in some places and lava rocks in others.

**Chart 4164.**—**Kailua Bay**, 51 miles northwestward of **Ka Lae**, is a small indentation in the coast at the southerly end of the flat plain which extends northward to **Kawaihae Bay**. The bay is the approach to the village of **Kailua**.

Shipping in **Kailua** is principally interisland. Principal exports are coffee, cattle, lumber, and general merchandise. Principal imports are petroleum products. The town is a well-known base for sportsmen engaged in trolling for swordfish and sailfish, for which the kona coast is famous. A light, 32 feet above the water and visible 11 miles, is shown from a white pyramidal concrete tower on **Kukailimoku Point**, on the northwest side of the entrance to the bay. An aviation light is about 0.5 mile northwest of the marine light. A prominent church, with a spire, is 100 yards from the shore and 350 yards east of the wharf. The shed of the wharf, the four oil tanks 130 yards westward of the wharf, and the **Kona Inn**, a long building near the beach on the eastern side of the bay, are prominent from seaward.

Approaching **Kailua Bay** from seaward, keep **Mount Hualalai** on a bearing of 066°. When off the entrance to the bay, steer for the church spire on a course of 033°. The wharf on the northwest side of the bay has depths of 15 to 17 feet along the east and south faces and 12 feet along the west face. Gasoline, fresh water, ship chandlery, and provisions are available in limited quantities. See Appendix for **storm warning** display. A highway leads from **Kailua** to other parts of the island.

**Chart 4140.**—The coast between **Kailua Bay** and **Kawaihae Bay** is a black, jagged mass of lava. The numerous capes and indentations are caused by the lava flows over the level country. The flow of 1859 reaches the sea south of **Kawaihae Bay** and marks the northern limit of the

flows. Between **Keahole** and **Upolu Points**, the trade winds draw over the mountains, at times causing a very strong offshore wind. Vessels anchoring in this vicinity should be prepared to use both anchors, as the prevailing northerly current prevents laying to the wind.

**Kaiwi Point**, about 2 miles northwestward of **Kailua**, is low and black, with some small patches of white sand. Shoal water extends about 0.3 mile offshore on the south side of the point, but on the west side the 100-fathom curve is only 0.3 mile offshore. Four prominent red and white towers are on the point. An airport is on the coast between the point and **Kailua**.

**Keahole Point**, 57 miles northwestward of **Ka Lae**, is the westernmost point of the island. A light, 43 feet above the water and visible 11 miles, is shown from a white pyramidal concrete tower on the point. The red sector of the light, visible 8 miles, marks the rocks and reefs off **Kaiwi** and **Makolea Points**. **Keahole Point** is low and well defined, and consists of black lava with some small vegetation. White patches of sand may be seen between the fingers of the lava. A northward current sets past **Keahole Point**. Frequently there are small tide rips near the point, and 2 miles to the northward the rips are violent when the northeast trade winds are strong. A berth of 0.5 mile clears the point in deep water.

**Puu Waawaa**, 13 miles eastward of **Keahole Point**, is prominent and can often be seen when **Puu Hualalai** is hidden by the clouds. The mountain, 3,971 feet high, is dome-shaped, with deep gorges on its side, and rises about 1,000 feet above the slope on which it stands.

Between **Makolea** and **Kawili Points**, 3 and 4 miles northward of **Keahole Point**, shoal water extends about 0.7 mile offshore. The sand and coral bottom is plainly visible. A current sets northeastward along this coast and there are tide rips off **Makolea Point**. Offshore, beyond the 2,000-fathom curve, the current has been observed to set eastward toward the coast. When a heavy swell is running, breakers extend about 0.5 mile offshore. Strangers should give these points a berth of 1.5 miles. The village of **Mahaiula** is at the head of the unimportant bay between the two points. Between **Keahole** and **Mano Points** are several small bays which are rarely used.

**Puu Kuili**, 5 miles northward of **Keahole Point** and 0.3 mile inland, is a brown crater 346 feet high. The hill marks the seaward end of a series of cones on the ridge extending from the northwesterly slope of **Mount Hualalai**. About 2 miles northward of **Puu Kuili**, and between the villages of **Kukio** and **Kaupulehu**, an extensive shoal extends about 0.5 mile offshore.

**Mano Point**, 9 miles northeastward of **Keahole Point**, is a poorly defined, rounded, flat mass of lava.

**Kiholo Bay**, 11 miles northeastward of **Keahole Point**, indents the coast 0.5 mile and is 1 mile wide. The head of the bay is foul, but local steamers have anchored close to the black lava shore on the south side. A southwestward current with an average velocity of about  $\frac{1}{2}$  knot has been observed in **Kiholo Bay**. The village of **Kiholo** consists of a few houses in a coconut grove at the head of the bay.

**Puu Anahulu**, 4 miles east of **Kiholo**, is a prominent yellowish cone, 1,523 feet high, with lava flows on three sides.

**Kapalaoa** is a village on the south side of a small bight 3.5 miles northeastward of **Kiholo**. The bight is foul and can only be used by small boats with local knowledge.

**Chart 4167.—Puako Bay** is a small indentation in the coast 20 miles northeastward of **Keahole Point**. There is no protection for large vessels and very little is available for small craft. The bay is open to westerly and northwesterly winds and is foul with coral heads and reefs. The shores are mostly black, smooth lava extending into the water on a gentle slope, with many detached rocks of the same material. A small landing is at **Puako**, on the southeast side of the bay, and several houses are along the south shore. A lone eucalyptus tree stands above the algaroba trees 0.2 mile southwestward of the landing.

Small boats can approach the landing on a bearing of  $137^\circ$  until within 250 yards of it; thence a lookout must be maintained to pick out the channel. A reef off **Waima Point**, 1 mile southwestward of **Puako**, is easily recognized from a safe distance offshore. Anchorage can be found about 0.8 mile northeastward of **Puako** in depths of 12 to 15 fathoms, sand and coral bottom.

The coast, which has a northeasterly trend to **Puako**, gradually recurves to the northwest, forming **Kawaihae Bay**. The black lava flows are no longer characteristic of the coast, and the back country, with its extensive slopes, is some of the best grazing land in the islands.

**Kawaihae**, 23 miles northeastward of **Keahole Point**, is a village in the northern part of **Kawaihae Bay**. Considerable interisland shipping passes through **Kawaihae**. The principal coastwise shipments are cattle and fresh vegetables; principal receipts are livestock, petroleum products, and general merchandise.

Prominent from seaward are **Honokoa Gulch**, the deep, heavily wooded gulch about 0.5 mile north of the village and **Kawaihae Heiau**, a square of dark rocks on a 50-foot knoll southward of the village. The shore which has a thick growth of algaroba trees, is rocky, with stretches of sand beach. A light, 59 feet above the water and visible 13 miles, is shown from a white pyramidal concrete tower, 0.2 mile northwest of the village.

A Federal project provides for an entrance channel 40 feet deep leading to a harbor basin 35 feet deep and a protective breakwater 4,400 feet long on the south side of the harbor. In August 1958 the channel and basin were at project depths. The breakwater was not completed in 1958. The channel is marked by a lighted range, lighted and unlighted buoys, lights and a daybeacon. In August 1958 the controlling depth was 10 feet in the two small-boat basins, one north of the harbor basin and the other at the southeast end of it.

Good anchorage, except during kona weather, can be found in depths of 8 to 15 fathoms about 0.4 mile offshore between the north side of the entrance channel and **Honokoa Gulch**.

A reef southward of the entrance channel extends 0.6

mile offshore and bares in places. The seas generally do not break over it during offshore winds. In southwesterly weather breakers extend across the entrance channel. The strong northerly current felt off Keahole Point and Makolea Point passes offshore at Kawaihae, where there is practically no current.

The concrete landing about 500 yards northwest of the village is in ruins. Several small stores are in the village.

**Puu Kamalii**, 1 mile north of Kawaihae, is 690 feet high and fairly conspicuous.

**Chart 4140.**—Between Kawaihae and Mahukona, the country is uncultivated grazing land. Mountain slopes terminate in cliffs at the coast and are cut intermittently by ravines.

**Chart 4101.**—**Mahukona Harbor**, 10 miles northward of Kawaihae, is an open bight marked on its southerly side by a light and on its northerly side by **Makaohule Point**. The light, 64 feet above the water and visible 9 miles, is shown from a white pyramidal concrete tower on **Kaoma Point**. The shore is rocky and the slopes back of the village are partially covered with algaroba trees. The village of **Mahukona** consists of a few houses in an algaroba grove near the beach.

Prominent features are a white daybeacon, conical in shape and 15 feet high, 400 yards southward of the landing and 50 yards north of the light and a similar daybeacon on the southerly side of **Makaohule Point**, 400 yards northward of the landing; the abandoned sugar warehouse and derricks at the landing; and the oil tanks and abandoned warehouse on the north side of the bight.

Anchorage may be selected 0.2 mile southwestward of **Makaohule Point** in depths of 10 to 15 fathoms, sand and coral bottom. An anchorage with less wind can be found 0.3 mile northwestward of the point and about 400 yards off the beach.

Reports indicate that the inshore current usually sets northward with considerable velocity. However, during 5½ days of current observations the average northward drift was about ¼ knot, both northward and southward velocities of nearly 1 knot were measured, and the tidal current averaged less than ¼ knot at strength. During the observations winds were light to moderate and variable in direction. Strong offshore winds, accompanied by violent gusts from varying directions, are frequently experienced during the normal northeast trades. Because of these conditions, vessels should anchor with plenty of cable and have a second anchor ready to let go.

The public landing is at the head of the bight and a private landing is on the north shore. Both landings are for small boats only. Power equipment for loading and handling barges is available. Provisions, gasoline, and water are available for small boats.

**Local magnetic disturbance.**—Differences of as much as 4° from normal variation have been observed in the vicinity of **Mahukona**.

**Chart 4140.**—The coast between **Mahukona** and **Upolu Point** is a series of low, black bluffs. Back of the bluffs,

the country is marked by numerous old blowholes and rises gently to the **Kohala Mountains**. The cuts and fills of the railroad which formerly skirted the coast from **Mahukona** to **Kohala** may be seen when close inshore.

At **Puakea Point**, 3.5 miles north of **Mahukona**, are prominent radio masts. **Honoipu** is at the head of an open bight on the north side of the point. Indifferent anchorage can be found in depths of 8 to 10 fathoms off the village. A strong eddy current is reported off **Honoipu**.

**Chart 4115.**—**Alenuihaha Channel**, between the islands of **Hawaii** and **Maui**, is 26 miles wide in its narrowest part, between **Upolu Point** and **Pululele Point**. The channel is free of obstructions and is deep close to the shores.

During strong trade winds the channel is quite rough and a current of 1 to 2 knots sets westward, but during the calms which frequently follow there is at times an easterly set of about 1 knot, and during kona winds the easterly set may reach a velocity of 2 or 3 knots. The channel is roughest and the westerly current strongest when the wind is between north-northeast and east-northeast. During periods of strong northeast trades violent tide rips may be encountered 2 miles north of **Keahole Point**, probably caused by the meeting of the southwesterly offshore current with the northerly inshore current. When bound from **Upolu Point** to **Alalakeiki Channel**, an onshore set is sometimes felt when reaching the lee of **Maui**.

**Chart 4116.**—**Maui**, the second in size of the islands, lies 26 miles northwestward of the island of **Hawaii**. The island is 42 miles long in a northwest-southeast direction and 23 miles in greatest width. A low flat isthmus joins the two distinct mountain masses that make up the island. The extinct crater of **Haleakala** (house of the sun), 10,025 feet high, is near the center of the eastern peninsula. On the northwesterly side of the crater the land slopes gently, while on the southerly and easterly sides, it is much steeper and in some places precipitous. **Koolau Gap** on the northerly side and **Kaupo Gap** on the southeasterly side are two large openings in the side of the crater. **Puu Kukui**, 5,788 feet high, is near the center of the peninsula, which is cut up by rugged peaks and deep valleys and gulches.

**Anchorage**s are numerous on the southwesterly side of **Maui**, the first requirement under ordinary conditions being shelter from the trade winds.

**Currents.**—In the vicinity of **Maui** currents are variable, depending to a great extent upon the velocity and direction of the wind. Usually there is a westward flow in the offshore areas along the north and south coasts which is part of the general westward oceanic drift accompanying the prevailing northeast trade winds. Much of the flow along the south coast appears to continue westward past the south coast of **Kahoolawe**. Weak, variable currents are reported in **Alalakeiki Channel** and there is a strong northward flow in **Auau Channel**. Near the shores of the island the currents are complicated by tidal effects, wind, and counter currents.

**Weather.**—The trade winds divide at Kauiki Head, part following the trend of the coast northwesterly and the other part following the south coast. The winds following the northwesterly coast divide again at the isthmus, part drawing southward and often reaching great force in the vicinity of Maalaea Bay, and the other part following the trend of the coast around the northwesterly end of Maui and through Pailolo Channel, with the greater force on the Molokai side of the channel. That part of the trades following the trend of the south coast of Maui divides, with part continuing along the south shore of Kahoolawe and the other part drawing through Alalakeiki Channel, around the northerly end of Kahoolawe and westward through Kealaikahiki Channel.

On the south coast of Maui a sea breeze frequently sets in about 0900 and continues until after sundown, when the land breeze springs up. Light airs or calms are generally found in the vicinity of Molokini Islet and again along the west shore of Maui between Hekili and Kekaa Points. In the vicinity of Lahaina a light onshore breeze is generally felt, while farther out in Auau Channel the northeast trades are noticed.

**Rainfall** is quite heavy on the windward side of the island and light on the lee side.

**Supplies.**—Ship chandlery is available in limited quantities for small craft at Kahului and Wailuku. Provisions are obtainable at these towns and at other large communities on the island. Fuel and water are available at Kahului, Hana, and Mala.

**Repairs.**—Small vessels can be hauled out at Kahului and some machine repairs can be made.

**Communications.**—Maui has radio and telephone communication with the other islands and with the mainland. Passenger and freight service travels over good to fair highways which extend to most parts of the island. Kahului is a port of call for interisland and transpacific shipping. The island has regular scheduled air service.

From Hana Bay to Cape Hanamanioa the coast has a generally west-southwesterly trend. Between Hana Bay and Nuu Anchorage the coast consists of high, rough bluffs, broken up by numerous small capes and indentations. Vegetation may be seen as far as Kaupo Gap. The entire south face of Haleakala is steep and eroded, presenting a reddish-brown appearance, dotted here and there with green patches. The slopes become less steep as the shore is approached. From Nuu Anchorage to Cape Hanamanioa the coast is bare, with practically no sign of habitation. Dangers lie offshore in the vicinity of Alau Island, Aholo Rock, and between Pohakueaea Point and Cape Hanamanioa. Otherwise the 10-fathom curve lies within 0.2 mile of the shore. Landings can be made during trade wind weather in the numerous coves along the coast between Muolea Point and Nuu Anchorage. Between Nuu Anchorage and Cape Hanamanioa no suitable anchorages are to be found.

**Chart 4113.**—Hana Bay, situated at the easterly end of Maui, lies between Kauiki Head Light and Nanualele

Point. The bay is about 0.4 mile in diameter and open to the eastward. Some interisland shipping passes through the bay. Principal receipts include petroleum products, cattle, lumber, and general merchandise; principal shipments are cattle.

Visible from seaward are the light on Kauiki Head, the range, and the dock sheds. The lights of the settlement are a good mark at night, but they are not visible from the direction of Kauiki Head. **Kauiki Head**, the easternmost point of Maui, is an extinct crater 390 feet high. The outer half of the crater has been eroded, leaving the inside exposed. Because Kauiki Head is joined to the rest of the island by a comparatively low neck of land, it has the appearance from a distance of a separate island, dark brown in color. Close to the northerly side of the crater is an islet on which the light is located. The light, 85 feet above the water and visible 11 miles, is shown from a white pyramidal concrete tower.

The entrance channel to Hana Bay lies between Twin Rocks and a buoy marking a 16-foot shoal. An unlighted range marks the channel on bearing 239°. A local rule is to avoid entering the harbor when the seas are breaking over the buoy at the entrance.

The bay does not afford a desirable anchorage. Small vessels sometimes anchor in the southwest portion of the bay, but swinging room is limited. Anchorages in the bay are exposed to northeast winds and sea, and during strong southwesterly blows vessels are apt to drag anchor. In the absence of local knowledge, anchorage should be attempted only by small craft.

**Currents.**—Just outside the bay a tidal current reaches its southward strength when the tide at Honolulu is rising and its northward strength when the Honolulu tide is falling. Southward and northward velocities of about 1 knot and 1½ knots, respectively, have been observed. Farther offshore, a strong northward or northeastward current has been reported. Off Kauiki Head and Nanualele Point rough seas occur when a northeast wind blows against the northeastward current.

The shore of the bay is rocky except for two short gravel beaches, one at the south end of the bay, and the other on the northwesterly side. A shoal, usually marked by breakers, extends halfway across the bay from the middle of the north shore. A small, 16-foot rocky shoal, marked by a buoy on its south side, lies 350 yards north of the light. Numerous rocks, some bare at all tides, extend for 200 yards off **Nanualele Point**. The point is low, flat lava on the north side of Hana Bay. **Twin Rocks** are two bare rocks, with deep water close-to, lying about 300 yards northeastward of the light; the inner and larger rock is 15 feet high. About 200 yards southward and 300 yards southeastward of outer Twin Rock lie **Inner Pinnacle Rock**, about 3 feet high, and **Outer Pinnacle Rock**, about 5 feet high.

A concrete wharf, 110 yards long, is on the south side of Hana Bay. Depths alongside range from 21 to 26 feet. Vessels drop anchor northeastward of the wharf and make a starboard landing. Lines are run to the mooring buoys. Gasoline and provisions can be obtained at the wharf.

**Chart 4116.**—**Puu o Kahaula**, 545 feet high, is the highest of a group of five hills 0.7 mile westward of the landing at **Hana**. The land for about 4 miles south of the bay is covered with cane.

**Alau Island**, 1.5 miles south of **Kauiki Head** and about 0.4 mile offshore, is about 100 yards in diameter and 150 feet high and is grass-covered. Between the island and the mainland is an extensive reef. Tidal currents of about  $\frac{1}{2}$  knot in velocity, setting northward and southward, have been observed near **Alau Island**. Off the island is a strong northeastward current and there is an eddy between the island and **Kauiki Head**.

Two rocks with about 9 feet of water over them lie close together about 0.7 mile southeastward of **Alau Island**. Under favorable conditions, these rocks appear as small, yellowish-brown spots in the water. However, they are seldom seen and do not break in moderate seas. Vessels may avoid the rocks by giving **Alau Island** a berth of about 1.5 miles in passing.

**Iwiopole**, about 1.5 miles south of **Hana Bay**, is a formation similar to **Kauiki Head** and resembles the latter in size and appearance.

**Mokae Cove**, almost 1 mile south of **Iwiopole**, affords a landing for small boats in northeast weather. Southward currents with velocities up to  $\frac{1}{2}$  knot have been observed 0.5 mile from the shore in this locality.

From **Makaalae Point**, 0.7 mile south of **Mokae Cove**, the coast has a southwesterly trend. Between **Mokae Cove** and **Wailua Cove**, several villages are close to the shore. A large church, with spire, is on the bluff in the vicinity of **Puuiiki**, 1 mile south of **Mokae Cove**.

**Wailua Cove**, about 3.5 miles southwest of **Mokae Cove**, is at the mouth of a valley. Inland from the cove and halfway up the mountain is a high waterfall which is usually conspicuous from offshore. Landings may be made during normal trade-wind weather in almost any of the coves along this coast, although the swell enters all of them. **Muolea Point**, 1 mile eastward of **Wailua Cove**, is rounded and rocky.

**Kipahulu**, 2.5 miles southwest of **Wailua Cove** and 0.5 mile west of **Puhilele Point**, is a plantation settlement marked by a mill with a prominent stack. The village is on the western side of deep **Kipahulu Valley**. The two landings on the shore below the village are no longer used. The village marks the western limits of the canefields. **Ahole Rock**, about 0.3 mile offshore, is low, flat, and bare in appearance. Anchorage in the vicinity of **Kipahulu** is not recommended.

**Kaapahu Bay**, about 1.5 miles west of **Kipahulu**, is a slight indentation in the coast which sometimes can be used as an anchorage by small boats in trade-wind weather. The anchorage has depths of 4 fathoms about 200 yards off the pebble beach.

**Kaupo Landing**, about 2 miles west of **Kaapahu Bay**, is the best in the vicinity during trade-wind weather. The region is divided into small homesteads and cattle raising is the principal occupation. The landing on the eastern side of the village had a derrick on a platform cut in the easterly side of the rocky bluff. Vessels anchor

well off and east of the landing. When the wind is strong from the east landing is difficult. About 0.3 mile westward of the landing, and near the beach, is a conspicuous church.

**Kailio Point**, 2 miles southwest of **Kaupo Landing**, is a narrow point, 73 feet high, at the east end of **Mamalu Bay**. There is a prominent church on the highway directly north of the point. Anchorage can be found in trade-wind weather about 300 yards offshore from the head of the bay in depths of 10 fathoms, sandy bottom.

**Kaupo Gap** is the large opening, about 1.3 miles wide, in the southeastern side of **Haleakala Crater**. An immense old lava flow extends on a gradual slope from the gap to the coast. The wide U-shaped gap at the top is a good day or night landmark for **Kailio Point**. The **Kaupo** lava flow, which is brush covered, forms a marked dividing line between the barren western part and the forest and brush-covered eastern part of the south coast. Waterfalls are numerous east of the gap.

**Apole Point**, 2 miles westward of **Kailio Point**, is low and is composed of black, jagged rock. The point marks the seaward end of **Kaupo** lava flow.

**Nuu Landing**, immediately westward of **Apole Point**, is a small bight formerly used as a shipping point for cattle. A few scattered sheds and a corral are not conspicuous from seaward. Small vessels can find anchorage in depths of about 8 fathoms.

From **Nuu Anchorage** to **Pohakueaea Point**, 11.5 miles to the westward, the coast is barren, with deep water close-to. All dangers are close to the bluffs. A few homesteads may be seen on the slopes that rise to the rim of **Haleakala**. The slopes are cut by gulches and are barren except for a scattering of trees about halfway up. At **Pohakueaea Point** the 20-fathom curve begins to trend offshore.

A pinnacle rock with depths of less than 12 feet over it is reported to exist within 0.5 mile of the shore somewhere between **Pohakueaea Point** and **La Perouse Bay**. The rock may be off **Pohakueaea Point** as an extension of the lava flow which forms the point. Vessels making the run along this coast in recent years have observed no indication of an offshore danger; however, they give **Cape Kinau** a berth of about 1 mile as it is known that a steamer struck bottom in the vicinity of the cape, probably about 0.2 mile offshore.

**Lualailua Hills**, 7 miles westward of **Nuu Anchorage** and 2 miles inland, are a group of red mounds about 2,000 feet high.

**Hokukano**, 1 mile southwestward of **Lualailua Hills**, is a conspicuous red cone with a lava flow reaching the sea in a high black mass.

**Pimoe**, 2.4 miles westward of **Hokukano**, is a red dome irregular in shape with its easterly side broken. The dome, 1,766 feet high, is the crater from which the large, fan-shaped lava flow in the vicinity of **Pohakueaea Point** had its origin.

**Chart 4130.**—**Cape Hanamanioa**, the southwesterly end of **Maui**, is a black lava mass. A light, 73 feet above

the water and visible 13 miles, is shown from a white pyramidal concrete tower on the cape. A current is reported to set constantly northwestward past the cape. However, a short series of current observations taken 1 mile southeastward of the light indicates a tidal current having a velocity of  $\frac{3}{4}$  knot at strength, a westward strength occurring  $2\frac{1}{2}$  hours before high water at Honolulu, and an eastward strength 1 hour before low water at Honolulu.

**La Perouse Bay (Keoneoio)**, between Cape Hanamanoia and Cape Kinau, is about 0.7 mile wide and indents the coast about 0.5 mile. On the northwest side of the bay is **Puu o Kanaloa** a low, yellowish-brown cone at the water's edge, with its seaward side blown out. The crater is surrounded by a lava flow from **Kalua o Lapa**, a small black cone about 1 mile northward of the bay. A small settlement is at the foot of Puu o Kanaloa. A rock with 10 feet of water over it is in the middle of the entrance to the bay and the bottom is rocky. Strangers are advised not to use the bay.

**Cape Kinau**, 1.5 miles northwest of Cape Hanamanoia, is a broad, low, black, lava point. A rock with  $4\frac{1}{2}$  feet of water over it is 400 yards offshore near the northerly end of the cape.

**Puu Olai**, about 2.5 miles northward of Cape Kinau, is the most prominent landmark in this vicinity. The hill is brown in color, 367 feet high, and consists of three bare knolls, of which the southernmost is the highest. The red and white poles of an aviation radio range station are just east of the hill.

**Molokini**, 5.5 miles northwestward of Cape Hanamanoia, is a small crescent-shaped islet about 0.3 mile long and 156 feet high. The islet is the bare southern rim of an extinct crater, the northern part of which is submerged. A light, 188 feet above the water and visible 12 miles, is shown from a white skeleton tower on the islet. A reef extends about 300 yards northward from the northwesterly end of the islet. Deep water is close to the southern side. Vessels pass on either side of the islet.

**Makena Anchorage**, 1 mile northward of Puu Olai, is exposed to kona weather, but affords good holding ground during the trades. Anchorage can be had in depths of 12 fathoms 0.4 mile off the point. Anchorage can also be found in **Ahihi Bay**, just south of Puu Olai. A few houses may be seen among the algaroba trees on the rocky point forming the north side of the bight, and a prominent house is at the southerly end of the white sand beach. The strong trade winds which are felt farther north in Maalaea Bay are not pronounced off **Makena**. The anchorage was formerly used as a shipping point for cattle. Roads lead northward, southward, and eastward from the village.

The country back of Makena rises gently to the mountains. The lower slopes are covered with cactus, while the slopes higher up are wooded in places. From Makena to Kihai the coast has a general northerly trend and is low and thickly covered with algaroba trees. The country back of the coast is like that in the vicinity of Makena.

High up on the slopes are small pineapple fields; otherwise the land is not cultivated.

**Keawakapu** is 4 miles north of Puu Olai. The ruins of an old wharf extend offshore in a southwesterly direction.

**Chart 4104.—Maalaea Bay** is a large bight midway along the southwest coast of Maui. The shores of the bay are low, mostly sandy, and fringed with algaroba trees. The isthmus behind the bay and the slopes on either side are covered with vegetation. Prominent from the bay is **Puu Hele**, a cone 214 feet high and about 1.2 miles north-northeast of Maalaea. Several stacks in the **Kabului** District, on the northern side of the isthmus, may be seen.

Because of the fresh winds that sweep across the isthmus during the konas, Maalaea Bay is only a fair anchorage. A strong northwestward current has been reported in the bay. In the central and eastern portions the bottom is very irregular. A reef fringes the shore for a distance of 3.5 miles south of Kihai. Off **Kalepolepo**, where the reef is widest, a 14-foot spot is 0.5 mile offshore along the edge of the reef. Broken ground with a least depth of 3 fathoms lies about 0.7 mile west-southwestward of the Kihai wharf. A shoal with a least depth of 7 fathoms is in the center of the bay. Strangers should pass well offshore.

**Kalepolepo** is on the eastern side of Maalaea Bay. An old building and radio poles are on the shore, and an old, large, fish pond extends 0.2 mile offshore. Local sampans anchor behind the reef in depths of 3 to 4 feet.

**Kihai** is a village on the northwestern shore of Maalaea Bay. A ranch settlement is scattered among the trees in the vicinity of the wharf. The wharf has a depth of 7 feet at its outer end, and is used occasionally by sampans to unload, but there is generally too much swell to lie alongside. The small dockhouse and derrick are prominent. Steamers do not call anywhere in the bay. Anchorage can be found in depths of 6 fathoms 700 yards off the wharf. Approaching this anchorage, steer  $056^\circ$ , with the wharf ahead, passing 250 yards southward of the 3-fathom broken ground previously described.

**Kealia Pond**, just northwestward of Kihai, is separated from the bay by a narrow sand strip over which the shore highway passes.

**Maalaea** is a village on the northwestern shore of Maalaea Bay. A few buildings can be seen among the algaroba trees. The boat harbor at the village is about 500 yards long east-to-west, about 200 yards across, and is protected by breakwaters. Depths in the harbor are 3 to 8 feet. A lighted range, bearing  $339^\circ$ , and several buoys mark the entrance. The shore between the village and McGregor Point consists of low rocky bluffs with short stretches of sand beach.

**Chart 4130.—McGregor Point**, marked by the concrete structure of an abandoned lighthouse, is on the western side of Maalaea Bay. The coast between McGregor Point and Olowalu is broken by low bluffs rising from the water's edge, behind which the country presents a barren

appearance. The mountains are surmounted by sharp jagged peaks and are cut up by deep gorges.

**Papawai Point**, 0.9 mile west of McGregor Point, is the southernmost point of the western peninsula of Maui. Deep water is close inshore at the point.

**Olowalu**, on **Hekili Point**, about 5 miles west-northwestward of Papawai Point, is marked by a daybeacon. The deep gulch of **Olowalu Stream** appears as a gap in the mountains when abreast Hekili Point, and is an excellent night mark. Vessels can anchor about 0.4 mile off the wharf in depths of 15 fathoms. Swirls and eddies are reported on the south side of Hekili Point. The old wharf, with only a few feet of water alongside, is near the old millsite. The wharf should be approached at high tide only, as the shallow entrance across the reef is generally affected by surf and swell. The landing is no longer used. About 0.2 mile eastward of the landing foul ground extends offshore for 0.3 mile.

**Launiupoko Point**, about 2 miles northwest of Olowalu, is low and rounding. About 0.8 mile inland from the point is an 808-foot hill which has a mottled, grayish-brown appearance. Shoal water extends about 0.2 mile offshore from the point northwestward to Lahaina. The highway skirts the shore between these points and automobile lights along the road are usually the only lights seen along the coast.

**Lahaina** is a village situated among the trees immediately in from the beach about 5 miles northwest of Olowalu. The principal landing is at **Mala**, on **Puunoa Point**, a low point covered with trees, 1 mile north of Lahaina. A small-boat wharf is at Lahaina.

The most prominent feature in the vicinity is a tall, concrete mill stack 0.7 mile southeastward of Puunoa Point. A light, 44 feet above the water and visible 12 miles, is shown from a white pyramidal concrete tower at the inner end of the small-boat wharf at Lahaina.

South of Lahaina wharf is a boat basin that extends about 800 feet alongshore, is about 200 feet across, and is protected by breakwaters. The entrance channel, dredged to 12 feet, is marked by a lighted range, bearing  $045^\circ$ , buoys, and daybeacons.

Off Lahaina is good anchorage, and calm water will generally be found even though strong trade winds are blowing elsewhere. However, the anchorage is exposed in kona weather. In approaching this anchorage vessels should keep about 1 mile offshore until the light bears  $056^\circ$ , then head in on this course and anchor in depths of 9 to 15 fathoms. Anchorage can be had anywhere in the bight north of Mala wharf, 0.6 mile offshore in depths of about 12 fathoms, sandy bottom.

The concrete wharf at Mala is used by tugs, barges, and smaller craft, which generally breast off, as a swell picks up quickly. The depth at the face of the wharf is about 30 feet. The town has a hotel. Supplies are available in limited quantities for small craft.

**Currents.**—The current off Lahaina usually sets northward, reaching a maximum velocity of 1 or 2 knots one or two hours before low water. One or two hours before high water, the current is normally quite weak and may set either northward or southward.

A confused current makes it difficult to approach or lie at the wharf at Mala at times. It is reported that the current at the wharf sets southward most of the time and that the best time to approach the wharf is at or soon after high water.

A reef, over which the sea generally breaks, extends about 0.2 mile off Puunoa Point, southwest of the wharf. A lighted buoy marks the edge of the reef.

In the vicinity of Lahaina, canefields extend along the coast and for several miles inland on the ridges that lead to high, rugged mountains. The coast between Mala and Kekaa Point consists of a low, sandy beach with a fringe of coconut and algaroba trees, back of which the canefields extend inland for about 2 miles.

**Puu Laina**, 1.2 miles northeastward of Mala, is a prominent cone 647 feet high. The lower slopes of the hill are covered with cane.

**Hanakaoo Point**, 2 miles north of Mala, is rounding and not conspicuous from offshore. The 10-fathom curve is about 500 yards off this point, and the bottom slopes gradually to the sandy beach.

**Kekaa Point**, the westernmost of Maui, is a dark, rocky promontory, 85 feet high. From a distance the point appears detached. There are no dangers off the point.

**Kaanapali**, on Kekaa Point, was the former shipping point for sugar produced along this coast. A derrick and two oil tanks are prominent. The landing is little used.

A strong northward current is reported off Kekaa Point. A tidal current of about  $\frac{1}{2}$  knot setting northward and southward was observed 0.5 mile from the shore. The direction of the current may be noted from offshore by observing the heading of small craft moored off the landing.

The coast from Kekaa Point to Lipoa Point consists of a series of low bluffs and stretches of sand beaches, along which may be seen clumps of algaroba trees. The country, sloping gently, is more or less cut up by shallow gulches and covered with cane which extends well up the mountain slopes.

**Napili Bay**, 4.5 miles northward of Kekaa Point, is a small bight between two coral reefs. Anchorage can be found about 0.5 mile offshore in depths of 5 fathoms, but it is seldom used. Northerly currents are reported off the bay. Small boats can land in Napili Bay during trade-wind weather. Breakers extend 0.2 mile offshore for a distance of 1.5 miles southward of the bay.

**Hawea Point** is 5 miles northward of Kekaa Point. A light, 75 feet above the water and visible 10 miles, is shown from a white pyramidal skeleton tower on Hawea Point.

**Honolua Bay** is the open bight on the south side of **Lipoa Point**, which is about 2 miles northeastward of Hawea Point. Fair anchorage for small vessels can be found in the bay. Small boats can land in the cove in the northeastern end of the bay. A water tank can be seen from offshore.

In the vicinity of Lipoa Point, the bluffs along the northern shore of Maui become higher and more precipitous. Also, the bluffs are cut up by more bights and headlands. The country is more rolling and is cut by deeper

gulches. The mountains are steeper and greener. Near their tops the mountains are wooded in places. Patches of black rocks, awash at high water, are found close inshore off several of the points in the vicinity. Vessels should give this coast a berth of at least 0.8 mile.

**Kanounou Point**, about 2 miles east-northeastward of Lipoa Point, has several bare, black rocks a short distance offshore.

**Honokohau**, on the west side of Kanounou Point, consists of a few houses at the mouth of **Honokohau Stream**. There is little protection off the village, which is the last settlement on the road that skirts the western shore of Maui.

**Nakalele Point** is about 3 miles east-northeastward of Lipoa Point. A light, 166 feet above the water and visible 12 miles, is shown from a white skeleton tower on Nakalele Point. Several bare, black rocks are close off the point.

**Chart 4124.—Kahakuloa Head**, 3 miles east-southeastward of Nakalele Point, is the seaward end of one of the numerous abrupt capes in this general vicinity. **Puu Koae (Sugarloaf)**, a dark, bare, conical mound 634 feet high, is on **Kahakuloa Head**; this feature is one of the most conspicuous landmarks on the island of Maui. Eastward and close to Puu Koae, on the same ridge, is a low and more rounded dome. **Kahakuloa** is a small village in the bight just west of **Kahakuloa Head**. Deep water is found close to the head. A rock awash lies 0.4 mile off the head of the cove between Puu Koae and Mokeehia Island.

**Mokeehia Island**, 1.4 miles southeastward of Puu Koae, is a large, bare rock 170 feet high, just off the outer end of **Hakuhee Point**. Caverns can be seen in the faces of the cliffs on both sides of the island.

**Puu Olai**, 0.7 mile inland from Mokeehia Island, is 1,002 feet high and is at the northern end of the road from Wailuku. Pineapple fields may be seen in this vicinity.

**Hulu Islets**, 2 miles southward of Mokeehia Island, are several rocks close to the shore. The highest has an elevation of 95 feet.

About 1 mile south of Hulu Islets, **Waihee Reef** extends 0.7 mile offshore. **Waihee**, a plantation settlement, is a short distance inland to the westward of the reef. Cane fields surround the settlement.

**Chart 4130.—Waihee Valley**, 2.5 miles southeastward of Mokeehia Island, is deep and has precipitous sides. The valley is covered with verdure and is quite prominent.

**Iao Valley**, south of Waihee Valley, is deep, has steep sides, and is also covered with verdure. Some of the finest scenery on the island is to be found in this vicinity.

**Chart 4124.—Wailuku**, an inland town at the mouth of Iao Valley, has highway connections with Kahului. Wailuku is the county seat and the largest town on Maui. The town has numerous stores and several hotels.

**Kahului Harbor**, 6.2 miles southeastward of Mokeehia Island, is the most important harbor on the island of Maui, and is protected from all except northerly weather. The harbor is formed by breakwaters which extend out over shoals. The bay is the approach to the wharves at the town of **Kahului**. Principal shipments from the port are sugar, pineapple, and molasses. Principal receipts are petroleum products, feed, fertilizers, lumber, and general merchandise. Considerable interisland shipping passes through the harbor.

**Prominent features.**—A lighted range, bearing 177°, marks the passage between the breakwaters. Prominent to the eastward of the range are the shed on Pier 1; the two stacks of a power plant of Pier 1; and three stacks at Puuene mill, 1.4 miles inland from Pier 1. A radio tower is 0.8 mile west of the rear range, and a mill stack and a white church spire stand out at Wailuku, 2 miles west of the harbor.

**Channel.**—A Federal project provides for an entrance channel and harbor basin 35 feet deep. The channel and basin are maintained at or near project depth. A lighted range, lighted and unlighted buoys, and lights on the channelward ends of the breakwaters mark the channel and basin.

**Anchorage.**—Swinging room inside the breakwaters is too restricted for large vessels, which usually anchor about 0.5 mile east of the outer buoy in depths of 9 to 12 fathoms, hard bottom. There is plenty of anchorage room for small craft outside the improved areas in the harbor.

**Dangers.**—**Spartan Reef**, about 0.7 mile wide, begins east of the easterly breakwater and fringes the coast in an east-northeasterly direction for a distance of about 7 miles. **Waihee Reef** is northwest of the westerly breakwater. Vessels will clear the reefs by giving the coast a berth of 1.2 miles until on the entrance range. The western part of the harbor is shoal.

**Tides and currents.**—The mean range of the tide is about 1½ feet. Currents in the harbor are weak.

**Weather.**—The prevailing winds are the northeast trades. Occasionally, very strong northerly winds blow into the harbor and vessels cannot get out; at such times light-laden vessels should not enter.

**Pilotage and towage.**—Pilotage is not compulsory, but certain fees are charged to vessels entering or departing. Pilots board vessels at the outer buoy. A 65-foot towboat and pilot boat equipped with a 400-horsepower diesel engine and ship-to-ship telephone is available in the harbor to assist in docking and shifting berths.

**Quarantine, customs, and immigration.**—Quarantine and customs officers board with the pilot. Vessels are allowed to enter before they have passed quarantine. Central Maui Memorial Hospital is between Wailuku and Kahului approximately 2 miles west of Port Kahului. Kahului is a port of entry but marine documents are not issued. An immigration official is not stationed at the port but must come from Honolulu. A deputy collector of customs who issues entries and departures is stationed at Kahului.

**Harbor regulations** are established by the Board of Harbor Commissioners of Hawaii. The harbormaster enforces the regulations and assigns anchorages.

**Terminal facilities.**—The two modern wharves operated by the Board of Harbor Commissioners are on the east side of the harbor. Both piers have transit sheds, rail connections, and water lines. Pier 1, at the inshore end of the east breakwater, has a length of 1,134 feet and depths alongside of not less than 35 feet. Conveyors for the loading of sugar and molasses, and fuel lines, movable gantries, and other cargo-handling equipment are available. Pier 2, parallel to and about 275 yards southwest of Pier 1, has a length of about 900 feet and a depth along the northwest side of not less than 33 feet. Most of the interisland trade is handled at this pier.

**Supplies and repairs.**—Provisions, fresh water, diesel oil, gasoline, and some ship chandlery can be obtained. Fuel oil is available in small amounts in an emergency. Any supplies not available locally can be sent from Honolulu. Hotels and stores can also be found at Wailuku, Kahului and Lahaina. Machine shops at Kahului can make minor ship repairs. A marine railway at the port can haul out vessels up to 60 feet in length.

**Communications.**—Kahului is a port of call for interisland and transpacific shipping. Passenger travel is mostly by air. Radio and telephone communication is available to the other islands and to the mainland. Good to fair roads connect Kahului with other parts of the island.

The coast between Kahului Harbor and Pauwela Point is low, and the country back of it is planted in sugarcane. Spartan Reef extends about 0.7 mile offshore.

**Kanaha Pond**, situated 0.5 mile east of Kahului, is a shallow lake about 0.5 mile long. The pond is connected with the sea on its northwesterly side by a short drainage canal.

**Spreckelsville**, 3 miles east of Kahului and just inland of **Papaula Point**, is a plantation settlement which is not conspicuous from offshore.

**Paia**, 5 miles east of Kahului, is a plantation settlement marked by several stacks. One stack is low and near the shore and another is a short distance inland on higher ground. The lights of the settlement are numerous and conspicuous at night. An opening in the reef off Paia is sometimes used by launches to enter an anchorage behind the reef. Local knowledge is necessary.

**Maliko Bay** about 2.5 miles northeast of Paia, is a narrow opening with steep, rocky sides. The bay is a fair anchorage for small boats when the trade winds are blowing, as the rocks off the east side of the entrance extend about halfway across the mouth, forming a natural breakwater. Anchorage is available in depths of 4 fathoms, rocky bottom.

**Pauwela Point** is 1.2 miles eastward of Maliko Bay. **Pauwela Point Light** (20°56.9' N., 156°19.5' W.), 169 feet above the water and visible 19 miles, is shown from a white pyramidal skeleton tower on the point. An eastward current is reported off the point. **Pauwela**, a village

1 mile inland from the point, is marked by the buildings and stacks of a pineapple cannery.

**Chart 4116.**—The villages of **Haiku** and **Hamakuapoko** are situated between Paia and Pauwela and about 1.3 miles inland. Several hills, with heavily wooded tops, are within a 2-mile radius of Pauwela.

From Pauwela to Nahiku, a distance of about 15 miles, the bluffs become higher, in many places reaching heights of 300 to 400 feet. Eastward of Nahiku, the bluffs become gradually lower, and when Hana is reached, they are low. Sugar cane ceases to be a characteristic feature of the coast after passing Pauwela Point until within about 5 miles of Hana. The country is green, and the higher slopes are heavily wooded. Numerous gulches cut the land and, because of the heavy rains, numerous waterfalls empty into the sea. Pineapples are grown along the slope for a distance of 10 miles southeastward from Pauwela Point. The highway between Kahului and Hana may be seen along this coast, in some places along the shore, while in other places it is high up on the slopes and 1 or 2 miles inland. A number of rocks are close inshore between Pauwela Point and Hana, but all dangers can be avoided by keeping 1 mile offshore.

**Uaoa Bay**, 3 miles east of Pauwela Point and just east of **Opana Point**, indents the coast about 0.4 mile. Fair anchorage during southerly winds can be had 0.3 mile offshore in depths of 12 to 16 fathoms, sandy bottom. A large detached rock off Opana Point marks the western side of the bay.

**Pilale Bay**, 1 mile east of Uaoa Bay, is a small opening at the mouth of a deep valley. Fair anchorage for small boats during trade-wind weather can be found a short distance off the beach in depths of 4 or 5 fathoms.

**Honopou Cove**, 1 mile east of Pilale Bay, is an abandoned landing place. A sunken rock off the entrance usually breaks with only a slight sea running. When a heavy swell comes in from the north, the breakers on the rock continue on into the cove increasing in size and force.

**Waipio Bay**, 6 miles eastward on Pauwela Point, lies between **Honokala Point** and **Huelo Point**. The bay is open to the northeast. **Huelo** is a village along the highway 0.5 mile inland from the bay.

**Hoalua Bay**, 1 mile southeast of Waipio Bay, can sometimes be used as an anchorage for small boats and as a landing place when the trade winds are blowing.

**Oopuola Cove**, 1.5 miles southeast of Hoalua Bay, is narrow and has steep sides. Landings can be made at times, or anchorage can be found for small boats in depths 3 to 6 fathoms near the center of the cove. **Puu Kukai**, 574 feet high, is 0.5 mile westward of Oopuola Cove.

**Keopuka Rock**, 1.5 miles southeast of Oopuola Cove, lies close to the shore and is 141 feet high. The rock is very prominent. Southwest of the rock is a small cove which is a poor anchorage in trade-wind weather.

**Honomanu Bay**, 1 mile south of Keopuka Rock, is a good landing place and a fair anchorage for small boats when the trade winds are blowing, although the swell is felt in the bay. Anchorage can be had in depths of 2 or

3 fathoms about 200 yards from the black shingle beach at the head of the bay. The east side of the bay is shoal. A few houses are near the shore at the head of the bay, which is at the mouth of **Honomanu Valley**. **Puu o Kohola**, 844 feet high, is 0.5 mile west of the bay.

**Keanae Point**, 1.7 miles southeast of Keopuka Rock, is low and juts out 0.3 mile from the bluff line. Several houses can be seen among the palm trees on the point. An old landing, with a derrick on it, is near the foot of the bluffs on the northwest side of the point. The landing is no longer used. Small vessels can anchor in depths of 8 fathoms immediately westward of the point. This anchorage should not be used without local knowledge. A black rock, about 15 feet high, lies nearly 0.2 mile offshore and westward of the landing.

**Keanae Valley**, just eastward of Keanae Point, is the largest and most prominent valley on this part of the island. The valley leads inland 7 miles to **Koolau Gap**, the large opening in the northern rim of Haleakala Crater. Three high rocks, close inshore, form the most prominent landmark in this vicinity.

**Pauwalu Point** is 0.8 mile southeast of Keanae Point. An eastward current is reported off Keanae and Pauwalu Points. **Mokumana Rock**, just off Pauwalu Point, appears almost to be a continuation of the point, with an opening 30 yards wide separating the two.

**Waiokilo Anchorage** midway between Pauwalu Point and the bight at Wailua, has a depth of 9 fathoms, sandy bottom, about 0.2 mile northward of Aluea Rock and 400 yards offshore. The anchorage is entirely exposed to the trade winds, but is fair in southwesterly weather.

**Aluea Rock**, 0.9 mile southeastward of Pauwalu Point and about 0.2 mile offshore, is only a few feet high. The sea breaks over the rock continuously and sunken rocks extend about 300 yards farther offshore.

**Wailua**, consisting of a few houses, is along the shore of the small bight immediately southward of Aluea Rock. The east point of the bight is a high wooded bluff, and the west side is low and grass-covered. Taro is raised on the flat behind the trees along the shore of the bight. The highway leading to Hana leaves the shore west of the bight and may be seen from seaward as it winds its way southward, high up on the ridges.

**Nahiku**, 2.2 miles southeastward of Wailua, is a small settlement southeastward of an open bight. Anchorage can be had close inshore in depths of 7 fathoms. Strangers should not attempt this anchorage, as two sunken rocks are near the shore. Off Nahiku a southeastward current is reported. Between Nahiku and Kaniki Head, the current near the shore is said to be weak. **Kuhiwa Gulch** may be seen 3 miles inland from Nahiku.

**Opikoula Point**, on the easterly side of the Nahiku anchorage, is a low, rocky bluff. The coast from Opikoula Point to Pukaulua Point, a distance of about 5 miles, consists of low, rocky bluffs, with no easily recognized landmarks.

**Pukaulua Point**, 2.5 miles northwestward of Kauiki Head and Hana Bay, is low and covered with uncultivated

vegetation. The point forms the northern side of a small bight which is open to the eastward.

**Kaeleku**, about 1 mile inland from Pukaulua Point, is a plantation settlement with a number of evenly spaced cottages.

**Chart 4130.—Alalakeiki Channel**, between Maui and Kahoolawe, is about 6 miles wide. The channel is clear of dangers, with the exception of Molokini, which is marked by a light. The currents are variable. The trade winds draw through the channel, hauling around the north end of Kahoolawe. The trades blow with much force at the easterly entrance to the channel, but in the vicinity of Molokini it is generally calm.

**Auau Channel**, between Maui and Lanai, is about 8 miles wide. With the exception of a reef about 3 miles long, which extends not more than 0.5 mile offshore northward of Kikoa Point, Lanai, the channel is free from obstructions. In the middle of Auau Channel, the current usually sets northward. During two days of continuous current measurements, the average northward velocity was  $\frac{1}{2}$  knot and the largest was 1 knot. Northward maximums usually occur about 1 hour before low water at Honolulu. Current information for the Maui side of the channel has been discussed in connection with Lahaina. Near the shore on the Lanai side of Auau Channel, southeastward velocities of 1 knot and northwestward velocities of  $\frac{1}{2}$  knot have been observed. The southeastward maximums occurred about  $2\frac{1}{2}$  hours before high water at Honolulu and the northwestward maximums about  $2\frac{1}{2}$  hours before low water. During trade winds it is often calm in the channel. The aviation light at Molokai airport can be seen when passing through Auau Channel.

**Pailolo Channel**, between Maui and Molokai, is about 7.5 miles wide. The channel is clear of obstructions with the exception of Mokuhooniki and Kanaha Rock, near the easterly end of Molokai, and a reef about 0.8 mile wide which fringes the shore of Molokai. There is no definite current information available for the middle of Pailolo Channel. Both westward and northward currents have been reported. However, from the results of current observations in Auau and Kalohi Channels, which show resultant northward and eastward currents, respectively, in those channels, a northeastward flow would be expected in Pailolo Channel. There are many reports of strong northeastward currents on the Maui side of Pailolo Channel, and a northeastward flow is also reported on the Molokai side. Observations close to the Maui coast show currents with velocities up to  $\frac{1}{2}$  knot setting in both directions along the shore.

**Kahoolawe**, the eighth in size of the islands, is 6 miles southwestward of the southwesterly end of Maui. The island is about 10 miles long and 6 miles wide, and from a distance has an even, unbroken appearance. The high cliffs on the eastern and southern sides are almost black, while the soil of the mountain tops and the gentle slopes of the northern and western sides are reddish in color.

The island has scarcely any rainfall and the huge clouds of red dust which trail to leeward during strong winds can be seen for many miles. **Moaula**, a brown dome 1,444 feet high near the easterly end of the island, is the most prominent landmark.

**Warning.**—Kahoolawe is under Naval jurisdiction and is closed to the public. A danger zone of an aerial bombing target and naval shore bombardment area extend about 2 miles off all sides of the island; limits and regulations are given in § 204.223, Chapter 2.

From **Cape Kuikui**, the most northerly point of the island, to **Kanapou Bay**, the coast is rocky and the bluffs gradually increase to cliffs several hundred feet high at the bay.

**Ule Point**, 2.8 miles southeast of **Cape Kuikui**, is on the northern side of **Kanapou Bay**.

**Kanapou Bay**, 2 miles wide between **Ule Point** and **Halona Point**, offers protection in kona weather. Anchorage is available for small vessels in **Beck Cove** on the southwest side of the bay. The bay should be entered on a southwesterly course, heading for the middle of the cove, and anchorage should be made in depths of 15 to 20 fathoms off the mouth of the cove and midway between the sides. The bottom shoals rapidly from depths of 12 to 3 fathoms about 0.2 mile from the sandy beach at the head of the cove. Westerly winds draw down the canyon at the head of the cove with considerable force.

From **Kaka Point**, the southeastern point of **Kahoolawe**, to within 1 mile of **Smuggler Cove** on the southwest side, the coast consists of sheer cliffs which reach a maximum height of 800 feet at **Kamohio Bay**. There are no off-lying dangers except **Puukoae Island**.

**Kamohio** and **Waikahalulu Bays**, 3 and 6 miles west of **Kaka Point**, each indent the coast about 0.7 mile. Neither bay can be recommended as an anchorage because of the deep water close to the shores. The bays are subject to strong gusts of wind which sweep down over the high cliffs when the trades are blowing. On the west side of **Kamohio Bay** is **Puukoae Island**, a black mass of rocks 378 feet high and about 100 yards offshore. A light, 140 feet above the water and visible 12 miles, is shown from a white skeleton tower on the point on the west side of **Waikahalulu Bay**. The prevailing current along the south coast is westerly.

**Smuggler Cove** is 1 mile southeastward of **Kealaikahiki Point**, the westernmost point of the island. The cove is the best anchorage on the island except during westerly or southerly weather. Anchorage can be had in depths of 10 to 12 fathoms 0.5 mile off the sand beach. The prevailing current at the anchorage is northwesterly. The best landing for boats is on the sand beach close to the conspicuous black rock at the head of the cove. The shore is low and has alternate stretches of sand and rocks. A stream, which is usually dry, and a clump of algaroba trees may be seen.

**Kuia Shoal**, with a least depth of 1 fathom, extends 0.7 mile westward from **Kealaikahiki Point**. A shoal with a least depth of 3 fathoms is above 0.5 mile southwestward of **Kuia Shoal**. Vessels should give the point a

berth of at least 1.5 miles. The country slopes up evenly from **Kealaikahiki Point** to the eastward.

The northwest coast is rocky, and has a line of low bluffs from which the country slopes gently up to the reddish hills in the center of the island. There are scarcely any distinguishing marks, and no off-lying dangers.

**Kuheia Bay**, 2 miles southwestward of **Cape Kuikui**, is a very small bight where boats can land at times. Two or three buildings may be seen on the shore of the bay.

**Kealaikahiki Channel**, between **Kahoolawe** and **Lanai**, is about 15 miles wide. The channel is free from obstructions. A northerly current is reported westward of **Kahoolawe**. Sailing vessels should avoid this channel during trade winds, as long periods of calms sometimes occur southward and westward of **Kahoolawe** and **Lanai**.

**Chart 4116.**—**Lanai**, the sixth in size of the islands, is about 8 miles westward of the west shore of **Maui** and about the same distance southward of **Molokai**. The island is about 15 miles long in a northwesterly direction and about 10 miles wide near its southerly end, gradually narrowing toward its northwesterly end. The highest point on **Lanai** is **Lanaihale**, 3,370 feet high and 3.5 miles inland from the southeastern side of the island. The slopes on the easterly side of the mountain are steep and cut by gulches, while those on the westerly side are more gradual, terminating in a rolling plain between the 1,000- and 2,000-foot levels. There is little rainfall, and, in general, the island has a barren appearance. The central portion of the island is covered with extensive pineapple fields which, because of their position on a high plain, are not easily seen from the sea. Pineapple cultivation is the principal occupation, although some livestock is raised. **Lanai City**, built in the center of the island by the pineapple company, is the only large village.

**Chart 4130.**—From **Kikoa Point**, the easternmost point of **Lanai**, to **Kamaiki Point**, 3.1 miles south-southwestward, the coast is low, sandy, and brush-covered. A coral reef and shoal water fringe the shore from 200 to 400 yards off the beach. At **Kamaiki Point**, low bluffs appear, gradually increasing in height until close to **Manele Bay**, where they reach a maximum of about 400 feet.

**Manele Bay**, on the south side of the island and 3 miles southwestward of **Kamaiki Point**, is about 0.3 mile wide and indents the coast about 0.3 mile. The shores of the bay are rocky except for the sand beach at the head of the bay. A low, detached rock, over which the sea usually breaks, is about 300 yards off the easterly entrance point. Small local vessels have anchored in depths of 14 fathoms about 350 yards southwestward of the rock. Under certain conditions, when the trade winds are blowing, squalls will be alternately from the head of the bay and from the northeast. This causes an anchored vessel to swing considerably, and it usually will be found advantageous to shift anchorage to the bay west of **Puupehe Rock**, where the squalls are not so pronounced. There are no houses in the vicinity of **Manele Bay**.

**Puupehe Rock**, 0.5 miles southwest of **Manele Bay**, is

110 feet high, brown on its steep sides, and flat and grass-covered on its top. It is separated from the shore by a short, low sandspit. The rock is the most prominent landmark along this section of the coast. Rocks, over which the sea usually breaks, extend 300 yards eastward and southward from Puupehe Rock. The bay just to the west of the rock has a sandy beach at its head. Anchorage can be found about 400 yards from the head of the bay in depths of 8 fathoms, sandy bottom.

From Manele Bay to Palaoa Point, the coast consists of low bluffs, behind which the land rises in steep slopes to the tableland above. It is reported that the currents are weak along the south coast of Lanai. A high, detached, grass-covered rock is close to the shore 1.8 miles west of Puupehe Rock. Many small rocks are close to the shore; one, awash at times, is 400 yards offshore and about 2 miles east of Palaoa Point. No buildings can be seen along this coast.

**Palaoa Point (Cape Kaea)**, the southwesterly point of Lanai, is a rocky, double point. A light, 91 feet above the water and visible 9 miles, is shown from a white skeleton tower on the easterly point. A small bight is between the points. Small boats can usually land on the rocky shore of the bight during trade-wind weather. A small, black rock, about 5 feet high, is about 200 yards off the northerly side of the point. Another rock, about the same distance offshore but 0.3 mile northward, is about 28 feet high.

Beyond Palaoa Point, the coast has a north-northwesterly trend. Between the point and Kaumalapau Harbor, the sheer coastal bluffs of **Pali Kaholo** are more than 1,000 feet high in some places. The bluffs are marked by two landslides; one, very large and conspicuous, is 1.5 miles northward of Palaoa Point; the other, not so large, is 2.5 miles northward of the cape.

**Chart 4122.—Kaumalapau Harbor**, 3.5 miles northward of Palaoa Point, is the best harbor on the island in all but westerly and kona weather. Considerable freight passes through the harbor; the principal shipment is pineapple, and the principal receipt is general merchandise.

The harbor is a small bight at the mouth of the most prominent gulch in the vicinity. A group of oil tanks, 100 yards from the wharf and on high ground, is a good offshore mark. A few houses may be seen among clumps of trees on the bluff above the harbor. A light, 66 feet above the water and visible 9 miles, is shown from a white wooden house on the south side of the entrance. There is also a light on the outer end of the breakwater on the north side.

Indifferent anchorage can be had in depths of 22 fathoms, sand and coral bottom, 300 yards 069° from the breakwater light.

Current observations taken 0.2 mile west of Kaumalapau Harbor entrance show an average northward flow of  $\frac{1}{4}$  knot, and northward maximums up to  $\frac{3}{4}$  knot when the tide at Honolulu is rising.

A short breakwater and seawall on the northerly side of the harbor serve as protection for a substantial wharf which has depths of 27 feet alongside. The bight has been dredged so that towboats can place large pineapple

barges at the wharf for loading. The mooring buoy in the north part of the harbor is secured by an anchor to the southwestward, and to the east shore by two chains. It is used to ease pineapple barges and ships alongside the wharf. There is not room for large vessels within the breakwater. A reef projects out 150 yards from the eastern shore of the harbor and is marked by a buoy. A buoy marks the deep water off the southern entrance point. Shoal water extends about 200 yards northwestward from the outer end of the breakwater.

Gasoline, diesel oil, and water can be obtained at the wharf. A derrick can hoist small craft 30 to 40 feet in length to the top of the wharf. There is a machine shop in Lanai City; small repairs can be done at the machine shop near the wharf. The Board of Harbor Commissioners has an assistant stationed at Kaumalapau Harbor. The port has radiotelephone communication with Honolulu, and a highway connects with Lanai City, 4.5 miles inland.

**Chart 4120.**—Between Kaumalapau Harbor and Kaena Point, the coast is a series of bluffs, in some places precipitous and 300 to 400 feet high. The shore is rocky, with a few short stretches of sand. In general, the bottom is fairly steep-to, although small steamers can find anchorage with sufficient swinging room in some places. At times, when the trades are blowing, the wind sweeps down the gulches in heavy gusts which are felt for a mile or more offshore. There are no houses or trees of any size along this coast, and it has a barren appearance.

**Five Needles**, about 2.3 miles northward of Kaumalapau Harbor and near the middle of the westerly side of the island, are a group of detached pinnacle rocks. The outermost rock is about 300 yards offshore and 32 feet high, and the inner pinnacle is 110 feet high. The rocks are of the same material as the higher cliffs of the shore and are therefore not easily recognized from offshore.

**Keanapapa Point**, 7.5 miles northwest of Kaumalapau Harbor, is the westernmost point of Lanai. The point is low and rocky and is marked by a small knoll 150 yards inland from the shore. A small detached rock, 8 feet high and 150 yards offshore, is 1.9 miles southeastward of Keanapapa Point. The cliffs, which are 200 feet high in the vicinity of this rock, gradually diminish in height until they are only 20 or 30 feet high 0.5 mile southward of Keanapapa Point.

**Kaena Point**, 1 mile north of Keanapapa Point, is low and rocky and is hard to distinguish from the other points in the vicinity. The low, rounding, unlighted, northwest coast of Lanai is not easily seen at night and vessels should give it a berth of at least 1 mile, although 0.5 mile will clear all dangers. There are many small, rocky, points and short, sandy, indentations in this vicinity, and boats can land in the lee of the points at times.

About 1.3 miles eastward of Kaena Point is the west end of a long, sandy beach. Boats can land on the sand beach as there is no reef offshore. Close to the beach, low, rocky bluffs extend westward. Eastward of this beach a coral reef fringes the sandy shore along the northern and eastern side of the island and extends not

more than 0.5 mile offshore. In general, behind the low section of the beach is a narrow, low strip of land which rises gently to the tableland. The vegetation consists of low brush, cactus, and a few small trees. No cultivated areas or villages can be seen.

**Chart 4130.—Pohakuloa Point**, 4 miles eastward of Kaena Point, is the most northerly point of Lanai. It is low and so rounding that it does not look like a point. About 0.5 mile westward of the point and on the reef, 400 yards offshore, are the engines and boilers of an old wreck, which have the appearance of two or three small, regular-shaped rocks. On the eastern side of Pohakuloa Point is an opening in the reef about 150 yards wide which affords a landing for small boats. The opening is marked by an old windmill among the trees near the shore. The windmill and the opening in the reef are difficult to make out from a distance. A lighted buoy is about 5 miles east of Pohakuloa Point and about 0.8 mile offshore.

**Maunalei Gulch**, 6 miles eastward of Pohakuloa Point, is forked and should not be confused with the deep Hauola Gulch, 2.5 miles farther to the southeastward.

There are no villages of any size on the north or east coasts of Lanai, and lights are seldom seen on the shore.

**Keomuku**, about 10 miles southeastward of Pohakuloa Point, consists of a few houses and a church, none of which are prominent from offshore. There is an opening in the reef off the houses, and boats of less than 4-foot draft can find anchorage behind the reef south of the entrance.

**Halepalaoa**, 1.4 miles southeast of Keomuku, is a small settlement behind an opening in the coral reef. A small wharf, in poor condition, has a depth of about 3 feet at its outer end. Vessels should give the northeast coast of Lanai a berth of at least 0.8 mile. Current information for this coast is given in the discussion of Auau Channel.

**Kalohi Channel**, between Lanai and Molokai, is about 8 miles wide. With the exception of a reef about 1 mile wide which fringes the shore of Molokai, and the reef not over 0.5 mile wide along the Lanai coast, the channel is free from dangers. Three days of current observations taken near the middle of Kalohi Channel show a tidal current combined with a nontidal eastward flow. The strength of the eastward current occurred about  $\frac{1}{2}$  hour before low water at Honolulu and had a velocity of about  $1\frac{1}{2}$  knots. The westward strength occurred about  $\frac{1}{2}$  hour before high water at Honolulu and had a velocity of about  $\frac{1}{2}$  knot. The average duration of the eastward current was  $7\frac{1}{2}$  hours and that of the westward current 5 hours. The wind blew from the northeast quadrant during the entire period covered by the observations. Very similar currents, but with smaller velocities, were observed near the Molokai side of Kalohi Channel. Along the Lanai side of Kalohi Channel there is generally a weak eastward flow.

**Chart 4116.—Molokai**, the fifth in size of the islands, is 7.5 miles northwestward of Maui and 8 miles northward of Lanai. The island, more or less rectangular in shape, is

about 34 miles long in a westerly direction and about 7 miles wide. The easterly end is mountainous, its summit being **Kamakou**, 4,970 feet high. On the northerly side, the mountain slopes are very steep, in many places almost perpendicular, and numerous deep gorges with precipitous sides can be seen. On the southerly side, the slopes are gradual, are cut by gorges, and terminate in a narrow strip of rolling land near the coast. On the westerly side, the land slopes gently and is cut by gulches; here and there an extinct crater can be seen. About 10 miles from the westerly end of the island the plain is only a few hundred feet high and is marked here and there by prominent blow-holes. The entire westerly end of the island is a bare tableland cut by small gulches and rising gradually to **Mauna Loa**, 1,400 feet high. From seaward this part of the island presents a smooth and rolling appearance.

The island does not have sufficient water for economic raising of sugar cane. Pineapples and cattle are the principal products.

**Anchorage**.—Depths along the south and west coasts of Molokai are such that vessels may anchor at will, having due regard for the abrupt shoaling inside the 10-fathom curve. The bottom is mostly coral and sand. The east end of the island is exposed to the northeast trades and the north coast is unsurveyed. The only traffic along the north coast is an occasional vessel bound for Kalaupapa.

**Currents**.—Current observations have been made at several places along the southern shore of Molokai between Kamalo and Laau Point. They indicate, in general, an eastward flow along the shore in the vicinities of Kaunakakai and Kamalo and a westward flow near Laau Point. Combined with these movements are tidal currents which usually reach an eastward maximum velocity about the time of low water at Honolulu and a westward maximum about the time of high water. The westward flow near Laau Point is reported to turn sharply northward at the point and vessels should guard against a set toward the point. Currents are said to set westward along the entire northern coast of Molokai and northeastward along the east coast. For further current information covering waters adjacent to Molokai, see the discussions of Pailolo, Kalohi, and Kaiwi Channels.

**Weather**.—The trade winds divide at Cape Halawa, part following the north shore and another part following the south shore. Because of the topography of the island the trade wind is frequently a little south of east along the south coast of Molokai. The wind is usually light in the early morning but blows with considerable strength in the middle of the day. During strong trades, dust clouds appear over the western end of the island. Very heavy rainfall is found on the northeast side of the island; the south and west sides have very little rainfall.

**Supplies**.—Practically no supplies other than food are available on Molokai.

**Communications**.—The island has radio and telephone communication with the other islands and with the mainland. Good roads extend from Kaunakakai, on the south coast, to Molokai Airport, in the west central part of the island, and to Kamalo, Kolo, and other small towns. Interisland air and irregular steamer service are available.

From Cape Halawa, the eastern part of the island, to Kamalo, a distance of about 12 miles, the coast has a general southwesterly trend; thence to Laau Point, a distance of about 25 miles, the trend is westerly. A reef about 1 mile wide fringes almost the entire coast, the widest part being in the bight about 13 miles eastward of Laau Point. During the day the limits of the reef can generally be determined by the breakers, but at night, vessels are cautioned to give this coast a good berth.

**Chart 4130.**—Cape Halawa, the eastern point of Molokai, is a brown cliff about 300 feet high. Breakers extend about 300 yards off the point and a rock, which bares at times, is 250 yards offshore. During a heavy easterly sea, it is apt to be quite choppy off this point and vessels should give the cape a berth of about 1.5 miles.

**Koalii**, 1 mile west of the cape, is a hill 794 feet high. In general, the coast between Cape Halawa and Kaunakakai Harbor is low, but rises, first gently, then rapidly, to high, rugged mountains which are cut by many gulches.

**Mokuhooniki**, a small, yellow, bare, rocky islet, 198 feet high and with almost perpendicular sides, is 0.9 mile offshore and 1.6 miles southward of Cape Halawa. **Kanaha Rock**, 95 feet high, is about 50 yards southwestward of Mokuhooniki. Midway between the rocks and Molokai are depths of about 15 fathoms. The danger zone of a high and low level aerial bombing target is centered on Mokuhooniki; limits and regulations are given in § 204.223, Chapter 2.

**Honouliwai**, 3.5 miles southwestward of Cape Halawa, is a small indentation in the coast which offers small boats a little protection from the trades. It should be entered only with local knowledge. About 0.3 mile northeastward of Honouliwai is **Honoulimaloo**, a small bight in the coast. The coral reef trends farther offshore from Honouliwai southwestward.

**Waialua**, 4.6 miles southwestward of Cape Halawa, consists of a few houses at the mouth of a gulch.

**Pauwalu Harbor**, 5 miles southwestward of Cape Halawa, is a double opening in the reef. The western opening is about 200 yards wide and is usually marked by breakers on either side. Within the entrance is a small pocket with depths of about 2 fathoms, where a few local sampans find some shelter. A house and tank near the beach are partly hidden by trees. The reef extends 0.6 mile offshore and the 10-fathom curve is about 1 mile offshore.

About 0.8 mile southwestward of Pauwalu Harbor is another opening in the reef near **Kainalu**. A church is situated close to the shore 0.4 mile westward of the opening.

**Chart 4121.**—Pukoo Harbor, 7.4 miles southwestward of Cape Halawa, is a pocket in the reef some 500 yards long, and narrower at the entrance than inside. An 18-foot channel about 50 yards wide extends across the entrance bar. A depth of 12 feet can be carried over the bar for a clear width of 150 yards. A few pilings, the remains of an old wharf which extended 300 yards seaward, may be seen. The harbor is smooth during the trades, although

the wind sweeps across it with full force. During kona storms, breakers extend across the bar. This anchorage is suitable only for small craft. The village of Pukoo consists of a few houses on the lowland near the beach in front of a steep-sided gorge which extends well back into the mountain. The reef at Pukoo extends 0.6 mile offshore.

**Chart 4130.**—There are many old fishponds in the vicinity of Pukoo and along the coast for 10 miles westward. About 1 mile westward of Pukoo is the village of **Kaluaaha**, where two church steeples may be seen above the trees.

**Kalaeloa Harbor**, 3.2 miles westward of Pukoo Harbor, is the largest and best protected harbor along the coast, but its use is limited by a 7-foot bar across the entrance, which is an unmarked opening in the reef.

**Chart 4121.**—Kamalo Harbor, 5 miles west-southwestward of Pukoo Harbor, is a pocket opening southward in the reef at the most southerly point on Molokai. The harbor, excluding the entrance, is about 150 yards wide, and extends more than 0.5 mile into the reef. The entrance, about 90 yards wide, has a bar with a general depth of 14 feet, although it is possible to carry 19 feet into the harbor through a channel with a least width of 30 yards. A lighted buoy is off the entrance. The coral reefs marking the limits of deep water within the harbor are easily seen by day. Near the head of the harbor the channel turns eastward to the wharf, which has a depth of 19 feet at its outer face. The wharf is in ruins. The village of **Kamalo** consists of a few houses at the mouth of a gulch back of the wharf, and a church 0.5 mile to the eastward.

Kamalo Harbor is the only one along the south coast of Molokai that is considered safe during a kona storm. It is used by sampans but seldom by larger vessels. The swell is not felt within the harbor. Current observations taken about 1 mile offshore in the vicinity of Kamalo show a tidal current with maximum eastward and westward velocities occurring at about the times of low water and high water, respectively, at Honolulu. The eastward current is usually the stronger, but both eastward and westward velocities of approximately 1 knot have been observed.

**Chart 4120.**—Puu Papai, 2 miles northwestward of Kamalo Harbor and 0.6 mile inland, is 830 feet high. The hill is bare of trees and has a slightly lighter color than the mountain slopes in the background.

**Kamalo Gulch** is deep and lies 1 mile east of Puu Papai. About 2.5 miles west of the hill, **Kawela Gulch** extends well inland from the small village of **Kawela**.

From Kamalo Harbor the coast has a west-northwesterly trend, and the reef extends 0.5 to about 1 mile offshore.

**Chart 4121.**—Kaunakakai Harbor, 9 miles westward of Kamalo Harbor, is a pocket in the reef about 600 yards long, 200 yards wide, and open to the southward. This is the principal harbor on Molokai and is the approach to the

village of **Kaunakakai**. Considerable interisland shipping passes through the harbor; the principal shipments are pineapple, and the principal receipts are general merchandise and petroleum products.

Approaching the harbor, the dock shed and the lighted range structures can be seen for a distance of 4 to 5 miles. About 1 mile westward of Kaunakakai is a conspicuous, thick, coconut grove at the water's edge. The village is not easily seen from seaward because of the trees.

A Federal project provides for a harbor basin 23 feet deep. The basin is maintained at or near project depth. The channel leading into the basin is marked by a lighted range, a lighted buoy and unlighted buoys.

Approaching the harbor from either direction, keep at least 1.5 miles offshore to clear the reef which fringes the coast. When off the entrance, steer 034° on the lighted range to enter the harbor. Vessels can anchor temporarily just off the entrance in depths of about 15 fathoms, but there is little shelter from the northeast trade winds and kona storms.

Current observations taken about 1 mile offshore at Kaunakakai indicate that the current sets eastward most of the time. Maximum velocities up to about 1 knot eastward and ½ knot westward were observed. Eastward and westward maximums of velocity occur at about the time of low water and high water, respectively, at Honolulu.

A rock and gravel mole extends about 700 yards from the shore in a southwesterly direction to a concrete wharf which is operated by the Board of Harbor Commissioners. Oil tanks are at the outer end of the mole and a warehouse is at the outer end of the wharf. The mole affords protection to small craft from the trade winds. Barges can lie at the wharf except during the two or three severe kona storms which usually occur during the winter season; Kamalo Harbor offers better protection for small craft during kona winds.

Water is piped to the wharf. Gasoline, diesel oil, and kerosene can be either delivered by tank wagon or be obtained at the wharf. Limited food supplies and ship chandlery are obtainable in Kaunakakai.

The wharf has cranes for loading and unloading, and small craft up to 7 tons in weight can be hoisted out of the water. Small marine repairs can be made by the various pineapple companies.

The Board of Harbor Commissioners has an assistant stationed at Kaunakakai Harbor.

**Chart 4120.**—For a distance of 3 miles westward from Kaunakakai, the lowlands extend much farther inland than along any other section of the coast. The reef extends 1 mile offshore and has depths of 1 to 3 feet of water over it and many coral heads awash at low water. Between Kaunakakai and Kolo the country is bare and rocky and cut up by numerous small gulches. The sandy beach is fringed with algaroba trees. An aviation light is about 2.5 miles inland.

**Chart 4121.**—Kolo Harbor, about 10 miles west of Kaunakakai Harbor, is a large pocket in the reef with a

narrow entrance channel opening to the southward. The harbor was once a shipping point for pineapple, but all traffic is now handled through Kaunakakai Harbor. The unmarked channel into Kolo Harbor from southward is about 250 feet wide and has depths of 8 feet; the harbor has similar depths and is subject to shoaling. A moderately heavy swell causes heavy surf on the bar at the entrance; the surf, plus the current, often creates a hazardous condition. Kolo Harbor affords anchorage with limited swinging room, but the swell is felt even though its full force is broken by the outer reefs. An iron tripod stands 5 feet above water 500 yards southwestward of the wharf which is in ruins. The harbor should be navigated only with local knowledge.

**Chart 4120.**—From Kolo Harbor westward to Laau Point, the coast is low and has a narrow sand beach, broken here and there by short stretches of rocky shore. The coral reef gradually becomes narrower until it disappears at Laau Point.

**Haleolono Point**, 3 miles west of Kolo Harbor, is a conspicuous brown bluff, about 50 feet high, that extends about 0.2 mile along the water's edge. **Waielei**, a hill 625 feet high, about 1 mile northeast of Haleolono Point, is bare and prominent.

**Laau Point**, the southwest point of Molokai, is low and rocky. A light, 151 feet above the water and visible 13 miles, is shown from a white pyramidal skeleton tower on the point. The 10-fathom curve around the point is about 0.5 mile offshore. The prevailing current off Laau Point is northerly and vessels are cautioned against a set onto the point.

**Penguin Bank**, an extensive shelf, makes out from the western end of Molokai in a general west-southwesterly direction for a distance of 28 miles from Laau Point. The bank is fairly flat and consists of sand and coral at depths of 21 to 30 fathoms. Along the northern, western, and southern edges, the bank drops off very abruptly into depths of more than 100 fathoms.

In the vicinity of Laau Point currents are strong and likely to be erratic. There is usually a westward current flowing along the west part of the south coast of Molokai which turns sharply to the north as it rounds the point. A strong tide rip west and north of the point forms breakers when the wind is northerly. A northeast set over Penguin Bank joins the northerly current along the west coast of Molokai. This current is not felt in the deep water west of Penguin Bank, but is apparent at the edge of the bank when passing inside the 100-fathom curve. There is no apparent connection between this current and the tides, and the trade winds appear to have little effect upon it, although it appears to be stronger or weaker according to whether there is a barometric depression north or south of the islands.

Between Laau Point and Ilio Point, a distance of about 8 miles, the west coast of Molokai is bare, low, and rolling, and cut up by a few small gulches. The beach is marked by low bluffs and short stretches of sand, back of which the land rises gently.

A restricted area for a Navy drill minefield is 3.5 miles

southwestward of Laau Point; limits and regulations are given in § 207.805, Chapter 2. The danger zone of a low-level aerial bombing target extends about 3 miles from shore and 3 miles northward of Laau Point; limits and regulations are given in § 204.223, Chapter 2.

**Chart 4121.—Papohaku Roadstead**, about 6 miles northeastward of Laau Point, is an abandoned landing which was formerly used for loading pineapple. The foundation of the loading tower may still be seen on the 60-foot rocky bluff which projects out 200 yards from the general coastline. The 10-fathom curve lies about 0.5 mile offshore in this vicinity.

**Chart 4120.—Ilio Point**, the northwesterly point of Molokai, is a low peninsula about 1.2 miles long, 0.7 mile wide, and rounded at its outer end. Shallow water makes off about 0.3 mile northwest of the point. During heavy weather, breakers have been observed about 0.3 mile offshore. A hill 293 feet high is 0.8 mile inland from the end of the point. The Loran tower near the point is marked by a flashing red light shown from the top, 345 feet above the water, with two fixed red lights exhibited between the top and the ground.

From Ilio Point to Cape Halawa, a distance of about 32 miles, the north coast of Molokai has a general easterly trend. The coast is not surveyed, and although generally bold, deep-draft vessels should not stand close to the shore. No harbors or anchorages on this coast afford shelter in all winds. Kalaupapa is the only port of call for the local steamers and, with this exception, there is practically no traffic along this coast.

**Mokio Point**, about 2.6 miles east of Ilio Point, is a low, rocky bluff marked by a detached rock just offshore.

About 5 miles eastward of Ilio Point, **Hauakea Pali**, a low, precipitous cliff, extends inland at right angles to the beach. This cliff forms the westerly boundary of the low plain that extends across the island. The seaward end looks like a large, white, sand bank and is the most conspicuous landmark in the vicinity.

From Hauakea Pali eastward, the bluffs along the coast gradually increase in height, until they become precipitous cliffs, in some places between 2,000 and 3,000 feet high and continue to the northeast end of the island. **Paulaia Point**, 9.5 miles eastward of Ilio Point, is not prominent.

**Makanalua Peninsula**, 16 miles eastward of Ilio Point, is low, about 1.5 miles wide, and extends out about 2.2 miles from the face of a high, precipitous cliff. **Molokai Light** ( $21^{\circ}12.8' N.$ ,  $156^{\circ}58.3' W.$ ), 213 feet above the water and visible 21 miles, is shown from a white octagonal pyramidal tower 0.5 mile inland from **Kahiu Point**, the northern point of the peninsula. This is the only light on the northern shore of the island that is shown continuously. Deep water is close to the peninsula, except on the westerly side, where a reef about 0.8 mile long extends about 0.2 mile offshore just northward of the landing at Kalaupapa.

**Kalaupapa**, on the western side of Makanalua Peninsula, is the village of the leper settlement which occupies

the peninsula. Numerous houses may be seen among the trees in the vicinity of the landing. Shipping consists of interisland receipts for the leper settlement, including groceries and general merchandise. Anchorage can be found in depths of about 12 fathoms 0.2 mile off the landing. A lighted range bearing  $109^{\circ}$  is shown when required. The boat landing, which has a depth of 2 feet alongside, is somewhat protected by a stone breakwater about 25 yards long. A permit to land is necessary, unless on Government business.

**Chart 4130.—Between Makanalua Peninsula and Cape Halawa**, the country has a very irregular and jagged appearance, and is more or less covered with vegetation. The precipitous cliffs along the coast are cut with many deep gulches, bights, and headlands. Except for a few piles of debris at the foot of the cliffs and a few level spots in the mouths of the gulches, there are no landing places.

**Kalawao**, on the southeast side of Makanalua Peninsula, is part of the leper settlement.

**Mokapu Island**, 3 miles southeastward of Molokai Light and 0.7 mile offshore, is 360 feet high. The island is the outermost of two islets; the other, **Okala Island**, is 370 feet high and close to the shore.

**Pahu Point**, about 5 miles southeastward of Molokai Light, is a bold, pyramidlike headland, 1,022 feet high. The point is the seaward end of a sharp ridge extending inland on the west side of a deep gulch. **Mokolea Rock**, over which the sea always breaks, lies 0.5 mile off this point.

**Umilehi Point**, about 1 mile east of Pahu Point, is the double-pointed seaward end of a steep ridge. The point is particularly conspicuous, and appears to be a small crater with the entire seaward side blown out. **Mokohola Island**, a dark rock 20 feet high, is 0.3 mile off Umilehi Point.

**Pelekunu**, on the westerly side of the cove at the mouth of the deep gulch between Pahu and Umilehi Points, is a small, deserted village with an abandoned landing derrick. Neither the village nor the derrick are readily seen from offshore. Vessels have anchored in the cove, which affords some protection from the trade winds, but is unsurveyed and cannot be recommended. The visible rocks and islets off the cove and along the shore to the westward indicate the possibility of submerged rocks, and strangers are cautioned to keep well offshore.

**Wailau** is on the westerly side of **Lepau Point**, which is 8.4 miles eastward of Molokai Light. The settlement is at the mouth of a wide gulch, and consists of a few houses occasionally used by fishermen.

The eastern half of the north coast of Molokai is noted for its rugged scenery and numerous high waterfalls. **Papalaua Falls**, about 5 miles westward of Cape Halawa and just southward of **Kikipua Point**, may be seen at the head of a deep gulch. The falls start from an elevation of about 2,000 feet, and in one place have a perpendicular drop of about 500 feet.

**Halawa Bay**, at the northeasterly end of Molokai, lies between Cape Halawa and **Lamaloa Head**, a precipitous cliff 837 feet high. The bay is about 1.5 miles wide and

indents the coast about 0.7 mile. No shelter is afforded from the trades, but indifferent anchorage can be had in depths of 5 fathoms about 0.3 mile off the old landing on the northerly side of the village. The shores of the bay are mostly high cliffs. Two black, detached rocks are close to the southerly shore.

The village of **Halawa** consists of a few houses in the mouth of a deep gulch on the southwesterly side of the bay. The gulch penetrates the island in a westerly direction and a waterfall may be seen about 1 mile up the gulch. About 0.5 mile eastward of the village and at the water's edge on the south shore of the bay is the conspicuous face of a triangular cliff about 300 feet high. Halawa is at the northeast end of the highway which skirts the southern shore of the island. Steamers no longer call here.

**Chart 4116.—Kaiwi Channel**, between Molokai and Oahu, is about 22 miles wide and clear of obstructions. A general northward drift is reported over Penguin Bank and in the vicinity of Laau Point. Elsewhere in the channel it appears that the currents are variable, depending mainly upon the direction and velocity of the wind. The trade winds which follow the northeasterly and southerly shores of Molokai draw across the channel toward Makapuu Head.

**Chart 4110.—Oahu**, the third in size of the islands, is 22 miles westward of Molokai. Oahu is about 40 miles long between Makapuu and Kaena Points and about 26 miles wide between Kahuku and Barbers Points. The island has two important mountain ranges, and, in general, has a rougher and more jagged skyline than any of the other islands.

**Koolau Range** parallels the northeasterly coast for nearly its entire length. The part of the range between Makapuu Point and Kaneohe Bay has on its seaward side a sheer, rocky cliff, or pali, nearly 2,000 feet high in some places. Northwestward of Kaneohe Bay, the cliffs give way to steep, rugged slopes. From offshore, the northwesterly half of the range appears as a long ridge, sloping gradually downward, and ending in low bluffs near Kahuku Point. The crest of the ridge and about half the seaward slope are wooded; the lower part of the slope is grass-covered. The entire range has a very jagged appearance and is cut up on its inland side by deep gorges and valleys. The greatest elevation on Koolau Range is at **Puu Konahuanui**, 3,150 feet high and 5 miles back of Honolulu; the peak is on the east side of Nuuanu Valley and overlooks the famous **Nuuanu Pali** at the head of the valley. Two miles closer to Honolulu is **Tantalus**, a rounded peak, 2,013 feet high, with a heavily wooded summit. On the seaward side of Koolau Range the land is mostly low and rolling; it is cut by a few sharp hills, and is under cultivation.

**Waianae Mountains** parallel the southwesterly coast for nearly the entire distance between Kaena and Barbers Points. Several spurs extending from the range toward the shore form short valleys. The range has numerous high peaks; **Kaala**, 4,046 feet high, is the highest.

Between the two mountain ranges is an extensive plain

which extends from Pearl Harbor on the south to Haleiwa on the north; the plain rises to an elevation of about 1,000 feet at Wahiawa. There are low, flat, coastal plains between Honolulu and Barbers Point, in the vicinity of Waianae, Haleiwa, and Kahuku Point, and between Kaneohe Bay and Waimanalo. The greater part of these plains is under cultivation, principally in sugarcane.

Prominent headlands on Oahu are Makapuu Point, Koko Head, Diamond Head, Kaena Point, Kahuku Point, Kualoa Point, and Mokapu Peninsula. The entire coast of the island is fringed with coral reefs 0.5 to 1 mile in width, except along parts of the west shore between Barbers Point and Kaena Point. From Kaena Point to Kahuku Point, the reefs are not so continuous as along other parts of the island.

**Bays and harbors.**—The largest indentations in Oahu are Kaneohe Bay and Pearl Harbor, both of which are prohibited areas. Honolulu is the only commercial port on the island. Fishing craft and other small boats can put into Ala Wai Boat Harbor and Kewalo Basin at Honolulu, Maunaloa Bay, Pokai Bay, and Waialua Bay. The northeast coast is exposed to the trade winds throughout most of the year and the only shelter available to small craft is in Kaneohe Bay, which may be entered only with the permission of the Navy.

**Boundary lines of Inland Waters.**—The line established in Mamala Bay is described in § 82.175, Chapter 2.

**Currents.**—Currents in the vicinity of Oahu depend to a great extent upon the winds and are variable in velocity and direction. In general, there is a flow westward or northward along the coast. Tidal currents and eddies are noticeable in some places. Details of the current movements, where known, are given in connection with the localities to which they apply.

**Weather.**—The climate of Oahu is semitropical. It is said that the water temperature in the vicinity of the islands is 10 degrees colder than in the same latitude in other parts of the Pacific Ocean; this has a moderating effect on the air temperature. The humidity, however, is high. The warmest month at Honolulu is August, with an average temperature of 78.5 degrees; the coldest is January with an average temperature of 72.0 degrees. In general, an average decrease in temperature of about 4 degrees occurs with every 1,000 feet of elevation.

The island lies within the belt of the northeast trades, which are nearly continuous throughout the year. Occasionally, the area is subjected to northerly winds which are cooler, or kona winds from west to south. The kona winds are the storm winds; they bring more rain to the kona coasts than the trades and are warmer.

The greatest rainfall occurs in the Koolau Range and Waianae Mountains, or close to the southwest of the ranges. In some parts of the Koolau Range, the annual rainfall is as much as 240 inches; at Honolulu it is about 24 inches. In the valleys and hills northeast of Honolulu the rainfall is considerably greater than in Honolulu. The area between Barbers Point and Waianae is known as the desert part of the island, and the rainfall is least in this vicinity.

See Appendix for storm warning displays. Seismic Sea

**Wave (Tidal Wave) Warnings** in the form of "OXM" of the International Code flags will be flown only during the day at the Aloha Tower, Ala Wai Boat Harbor, and Kewalo Basin at Honolulu. Any vessel observing this signal should not put into port but remain at least 2 miles offshore.

**Supplies and repairs.**—All kinds of supplies are available at Honolulu. Vessels up to 370 feet in length and 3,000 deadweight tons can be hauled out for repairs.

**Communications.**—The island has a good network of hard-surfaced highways. One highway encircles the island except for a gap between Kaena Point and Makua; others extend from Honolulu to Haleiwa through the valley, and from Honolulu to Kaneohe over Nuuanu Pali. Scheduled passenger and freight service operates between most of the towns along these highways. Passenger and freight planes have scheduled runs from Honolulu to the other islands and to the mainland, and to western and southwestern Pacific areas. Interisland and transpacific ships operate out of Honolulu. Radio, radiotelephone, cable, and telephone communications are available.

The south coast of Oahu extends from Makapuu Point to Barbers Point, a distance of about 28 miles. From Makapuu Point to Koko Head and Diamond Head, the shores are abrupt and mountainous. From Honolulu Harbor to Barbers Point is a flat, low, sand and coral plain on which are several airfields. Buildings and palms border the shore and extend back to the mountains between Koko Head and Keehi Lagoon.

**Chart 4131.**—**Makapuu Point**, the easternmost point of Oahu, is on the seaward side of **Makapuu Head**, a bold, barren, rocky headland, 647 feet high. **Makapuu Point Light** (21°18.8' N., 157°39.1' W.), 420 feet above the water and visible 28 miles, is shown from a white cylindrical concrete tower on the head; a radiobeacon is near the summit of the head about 670 feet southwest of the light. See Appendix for storm warning display. The seaward side of Makapuu is a high, dark, sheer precipice, while the inshore side slopes rapidly to the valley which separates it from the mountain range. The head is prominent and is generally the landfall for vessels bound from San Francisco to Honolulu. Deep water is close to the easterly side of the point, but a ledge extends offshore between the point and Koko Crater. The 10-fathom curve is about 0.7 mile offshore on the ledge and vessels should give this section of the coast a berth of about 1 mile taking care to stay in depths not less than 20 fathoms. The sea always breaks close to shore in this vicinity. Between Makapuu Head and Koko Crater, the coast is low and is made up of sand, rock, and shingle.

**Koko Head** begins about 2 miles southwest of Makapuu Point, extends southwestward about 2.5 miles, and includes **Koko Crater** and **Kuamookane Hill**. **Koko Crater** a sharp brown cone about 1,200 feet high, is a prominent landmark for vessels approaching from eastward. Between the crater and **Kuamookane** the coast is rocky, precipitous, and somewhat irregular. **Kuamookane** is a bold promontory 640 feet high. The seaward side is

precipitous, the top is flat, and the inshore ends are steep slopes. On the lower slopes of the western side the headland is partly wooded, but elsewhere it has a brown and barren appearance. Deep water is close to the southern side. Strong westward currents have been reported off Koko Head.

**Hanauma Bay**, 3.5 miles southwest of Makapuu Point, is 0.3 mile wide and indents Koko Head 0.5 mile. Some shelter is afforded small craft, but the waters off the entrance are very choppy during east-northeast or easterly winds. A sand beach, fringed by a coral reef about 150 yards wide, extends across the head of the bay. Directly back of the beach is a steep bluff with a short trail leading to the highway. The bay is a popular bathing resort.

**Kawaihoa Point**, the southwest end of Koko Head, is on the southeast side of Maunalua Bay.

**Maunalua Bay** is an open bight on the westerly side of Koko Head. A coral reef fringes the shore, the water deepening gradually outside the reef. An opening in the reef about 0.3 mile off the west shore of Koko Head has a least depth of 5 feet. The course through the reef is about 040°; the opening is narrow and local knowledge is necessary to enter. Inside the reef is one of the few alongshore anchorages offering shelter to small craft in all but kona storms. Depths of 13 feet are found in this anchorage. A small private dock is southeast of the bridge over the inlet to Kuapa Pond. Private moorings have been placed off this dock in deeper water. In Maunalua Bay a tidal current has been noted flooding westward and ebbing eastward along the shore, with slack waters occurring at about the times of high and low waters at Honolulu.

**Kuapa Pond**, a shallow, brackish body of water, is north and west of Koko Head and is separated from Maunalua Bay by a narrow, low neck of land.

Along the shores of Maunalua Bay, and westward to Honolulu, are many homes. There are numerous small openings in the reef between Koko Head and Diamond Head, but the water inside is shallow. A long pleasure pier extends out from the sandy shore about 1.5 miles west of Kuapa Pond.

**Wailupe**, 2.8 miles westward of Koko Head, is a filled in fish pond used for residential purposes. It is reported that the entrance channel is about 12 feet deep and 175 feet wide. Numerous private piers extend out from the seawall around the residential area. A prominent red and white radio tower is well back of the shoreline between Wailupe and Diamond Head.

**Kupikipikio Point**, 1 mile east of Diamond Head Light, is a small, dark rocky point with several houses among the trees.

**Diamond Head**, about 6 miles westward of Koko Head, is an extinct crater 761 feet high. The slopes and the top of the crater are bare and brown; the base is thickly wooded. The slopes are steep and on the seaward side is a narrow bench about 100 feet above the water which shows as a broken bluff line to seaward. A light, 147 feet above the water and visible 18 miles, is shown from a white pyramidal concrete tower on the southwest side of Diamond Head. A reef extends 0.4 mile off the light

and is marked at its outer end by a lighted buoy. Current velocities up to 1 knot and setting in various directions were noted about 3 miles southwest of Diamond Head.

**Chart 4132.**—From Diamond Head to Honolulu Harbor, the coast is low and thickly developed. Palm trees are numerous, and along this stretch is the world-famous **Waikiki Beach** with its prominent hotels and natatorium. Off the hotels, outrigger canoe races are frequently held in a break in the coral reef.

**Ala Wai Boat Harbor**, 2.5 miles northwest of Diamond Head Light, has good facilities for berthing and mooring. An entrance channel dredged through the reef had a reported controlling depth of 18 feet in August 1957. Depths of 12 to 20 feet are inside the boat harbor. The entrance is marked by a lighted buoy, and the channel by a lighted range and daybeacons. An assistant harbor-master controls the facilities in the harbor.

**Chart 4109.**—**Kewalo Basin**, 3.5 miles northwest of Diamond Head Light, is used mostly by fishing craft. The entrance channel dredged through the reef has a controlling depth of about 18 feet. Depths of 18 to 24 feet are in the basin. The entrance channel is marked by a lighted range, and lighted and unlighted buoys. On the northwest side of the basin are a cannery and a shipyard. The railway at the yard can handle vessels up to 75 feet in length and 100 tons in weight. The basin is operated by an assistant harbormaster.

**Charts 4109, 4132.**—**Honolulu Harbor** is about midway along the south coast of Oahu. The harbor is protected from all winds and is free from surge. A well-marked deep-water channel makes the harbor easy of access both day and night.

**Honolulu** is the capital and most important port of the islands. A large amount of transpacific and coastwise shipping passes through the port. Principal shipments include pineapple, sugar, fruit juices, molasses, and hides. Principal receipts include petroleum products, lumber, and general merchandise.

**Sand Island** borders the southwest side of Honolulu Harbor. The island is owned by the Government and has been built up principally by dredging from the harbor. The island is low and sandy and has a few trees.

**Prominent features.**—A light, 198 feet above the water and visible 21 miles, is shown from **Aloha Tower** on Pier 10; the cream square clock tower is one of the most conspicuous objects in the city. Also prominent are the radio and television towers northwest of Diamond Head.

The pineapple-shaped tank at **Iwilei** has a top elevation of 199 feet. North of this distinctive tank is a 150-foot stack; and black twin steel stacks, with a third stack nearby, are on the eastern part of sand Island. The aviation light at the Honolulu International Airport, on the north side of Keehi Lagoon, is conspicuous at night. The installations of the Tripler General Hospital, 1.3 miles directly north of Keehi Lagoon, are very prominent during daytime and show a prominent red light at night.

**Punchbowl Hill**, flat-topped and 500 feet high, is im-

mediately back of the city. On the south slope of Tantalus is a privately maintained light, 1,346 feet above the water, that can be seen 25 miles in the sector from 030° to 094°.

**Channels.**—A Federal project provides for an entrance channel 40 feet deep, an outer harbor basin 35 feet deep, and a channel to and including Kapalama Basin 35 feet deep. The channels and basins are maintained at or near project depths. A lighted range, lighted and unlighted buoys and lights mark the entrance channel.

A Federal project also provides for **Kalihi Channel**, about 1.5 miles westward of the main channel into Honolulu Harbor, 35 feet deep and 1,000 feet wide at the entrance decreasing to 400 feet wide through the coral reef to Kapalama Basin. This project has not been completed (1958). In January 1946 the controlling depth was 17 feet to the causeway at the west end of the Kapalama Basin.

**Anchorage.**—The recommended anchorage is between the entrance to the main channel and Kalihi Channel in depths of 12 fathoms, sand and coral bottom. Anchorage can also be had between Kewalo Basin and the hotels on Waikiki Beach in depths of 12 fathoms, sand and coral bottom. The water shoals rapidly toward the reef and vessels should approach the desired depth with caution. These anchorages should not be used during strong kona winds. Anchorage is not practicable inside the harbor because of the limited swinging room.

An **explosive anchorage area** marked by buoys is 2 miles westerly of the entrance channel to Honolulu Harbor; limits and regulations are given in § 202.235, Chapter 2.

**Caution.**—Vessels approaching the harbor from the west at night should not mistake the lights between Pearl Harbor and Honolulu for the lights of Honolulu, or the lighted buoy off Kalihi Channel for the lighted buoys off the main entrance. Vessels have mistaken these lights and gone aground off Keehi Lagoon. From the eastward the lights north of Diamond Head should not be confused with those of Honolulu, or the lighted aids of Kewalo Basin with those of Honolulu Harbor.

**Tides.**—Daily tide predictions for Honolulu are given in the Tide Tables.

**Currents.**—It is reported that a tidal current floods westward and ebbs eastward along the coast between Makapuu Point and Honolulu. In the vicinity of Honolulu an eastward counterflow along the edge of the reef is reported to accompany the westward flood. Strong westward currents have been reported off Honolulu. Currents setting toward all four quadrants and having velocities up to 1 knot have been noted about 3 miles southwest of Diamond Head.

**Pilotage.**—Harbor Pilots of the Board of Harbor Commissioners may be obtained by flag hoist, by radio to the harbormaster, or in an emergency, by signaling the control tower at Pearl Harbor, call letters H-1. Ships are boarded about 2 miles off Sand Island.

**Towboats** are available in Honolulu for any requirement.

**Quarantine.**—Quarantine officers board vessels at the dock or off the entrance buoys. The quarantine station

is at **Fort Armstrong** on the east side of the harbor entrance.

The U.S. Public Health Service maintains an outpatient clinic in Honolulu and has contract space in several hospitals, one of which is the Army's Tripler General Hospital. Medical advice for ships at sea is available by commercial or Government radio.

**Customs and Immigration.**—Honolulu is the headquarters of a customs district and is a customs port of entry at which marine documents are issued. The Immigration Service maintains offices in the city.

Other local offices of the following **Federal agencies** are in Honolulu; see Appendix for addresses: Coast and Geodetic Survey, Navy Branch Hydrographic Office, Coast Guard, Weather Bureau, and the Federal Communications Commission. The office of the Corps of Engineers, U.S. Army, is at Fort Armstrong.

**Harbor regulations.**—Regulations are established by the Board of Harbor Commissioners of Hawaii and are enforced by the harbor master. **Traffic control** in Honolulu is controlled by means of orange ball and cone signals on the yardarm on Aloha Tower by day and by amber lights on the tower at night. The lower light, showing fixed, is 143 feet above the water; the upper light, showing quick flashing, is 153 feet above the water. The lights are visible 5 miles from 320° to 062°. Traffic signals are: by day, ball hoisted at yardarm, incoming traffic only; cone hoisted at yardarm, outgoing traffic only; ball and cone hoisted at yardarm, harbor closed to all traffic; by night, flashing light on, incoming traffic only; fixed light on, outgoing traffic only; both lights on, harbor closed to all traffic. It is the invariable custom to display the ball on the eastern, or Waikiki, side of the yardarm and the cone on the western, or Ewa, side of the yardarm. To pass visual messages, contact Pearl Harbor Signal Tower, Call H-1.

The **speed limit** in Honolulu Harbor is 5 knots for large vessels and 10 knots for sampans, motorboats, and other small craft.

**Terminal facilities.**—Honolulu Harbor has ample berthing space for deep-draft vessels. Depths alongside the principal piers vary from 28 to 37 feet. All cargo is loaded and discharged at Honolulu by ships' gear, using shoreside pallets and finger trucks. Floating derricks, with 90-foot booms, are available for handling weights up to 40 tons. The Army has a derrick which will handle weights up to 100 tons. The principal small-boat facilities are in Kewalo Basin and Ala Wai Boat Harbor, which have already been discussed.

**Supplies.**—Diesel oil, fuel oil, gasoline, provisions and ship chandlery are available in quantity. Water is available on most of the piers. Bunker coal is not available.

**Repairs.**—Honolulu and Pearl Harbors have facilities for ship repairs of all kinds. One floating drydock at Honolulu can haul out vessels up to 370 feet in length and 3,000 deadweight tons, having keel block lengths of 300, 200, and 54 feet. A marine railway at Kewalo Basin can haul out vessels up to 90 feet in length and 125 deadweight tons. Infrequently, vessels more than 350 feet in length

have been hauled out by special arrangement at the Pearl Harbor Naval Shipyard.

**Communications.**—Transpacific vessels operate scheduled runs out of Honolulu. Daily air service to the mainland and to all the islands, except Niuhau and Kahoolawe. Good highways extend to all parts of Oahu. Radio, radio-telephone, cable, and telephone communications are available.

Just westward of Honolulu Harbor is **Keehi Lagoon**, a triangular-shaped indentation of the coast. Three intersection channels have been dredged to a depth of 10 feet in the lagoon to form seaplane areas. Small craft may enter the channels only with permission of the Navy. Reefs extend some distance seaward from the lagoon and several reefs or islands between the runways are bare at high tide. The edges of the runways are marked by buoys. The 10-foot depth is available in the channel except for scattered areas along the edges.

**Honolulu International Airport**, on the north shore of Keehi Lagoon, is the largest commercial airport in the islands. The aviation light on the control tower is a good aid to surface navigation at night.

**Chart 4133.**—From Keehi Lagoon to Barbers Point, a low, flat plain extends 3 to 5 miles back from the sandy shore line. The area includes Pearl Harbor and several airfields. West of Pearl Harbor, much of the area is covered with trees or planted in sugarcane.

The entrance to Pearl Harbor is about 6 miles westward of Honolulu Harbor Light. Prominent landmarks eastward of the entrance are a 125-foot tower painted international orange and white with a flashing red light on top, a 183-foot tower, with a spire marked by fixed red lights at night, and a large, tall hangar. A water tank, marked by flashing red lights at night, is on the south side of West Loch, and 2 miles northwestward of the entrance. The channel, dredged to a depth of 45 feet, is marked by a lighted range, and lighted and unlighted buoys.

**Pearl Harbor Defensive Sea Area.**—An executive order dated 26 May 1939, establishing a defensive sea area at Pearl Harbor, is quoted in part as follows:

(a) The area of water in Pearl Harbor, Island of Oahu, Territory of Hawaii, lying between extreme high-water mark and the sea, and in and about the entrance channel to said harbor, within an area bounded by the extreme high-water mark, a line bearing south from the southwestern corner of the Puuloa Naval Reservation, a line bearing south from Ahua Point, and a line bearing west from a point 3 miles due south from Ahua Point, has been established as a defensive sea area for purposes of national defense, and no persons (other than persons on public vessels of the United States) are permitted to enter this defensive sea area, and no vessels or other craft (other than public vessels of the United States) are permitted to navigate in this area, except by authority of the Secretary of the Navy.

(b) For the purpose of acting on requests of vessels registered, enrolled, or licensed under the laws of the

United States, whose normal legitimate business requires entry into Pearl Harbor, the Commandant, 14th Naval District, is designated as the representative of the Secretary of the Navy, with authority to act on such requests.

(c) The Commandant, Naval Shipyard, Pearl Harbor, is responsible for prescribing and enforcing such rules and regulations as may be necessary for insuring security and for governing the navigation, movements, and anchorage of vessels in the waters of Pearl Harbor and in the entrance channel thereto.

**Chart 4110.—Pearl Harbor**, the site of a Naval Shipyard and Naval Base, is about 4.5 miles wide and is divided by two peninsulas and an island into four smaller basins, **West, Middle, East, and Southeast Lochs**. The basin is much broken by islands, points, and peninsulas, and the channels connecting and leading to the four lochs are narrow. The navigable channels are fringed on both sides by reefs with only a few feet of water over them, but these extend only a short distance offshore, are steep-to, and can easily be distinguished by their color.

**Chart 4133.**—About 3.5 miles west of Pearl Harbor entrance and 2 miles inland are two prominent chimneys of a sugar mill at **Ewa**. Mariners are cautioned to keep clear of the **beaching area** marked by buoys 4.5 miles eastward of Barbers Point. An aviation light is about 2 miles eastward of Barbers Point. Three red and white radio towers are near the light.

**Barbers Point**, the southwest point of Oahu, is a low, flat, coral plain covered with algaroba trees. The coast curves gradually and shows a white sandy beach with dark rocks here and there. The land is level back to the foothills of the Waianae Mountains about 3 miles inland. The slopes of the hills are steep and partly covered with vegetation, the bare red soil showing in places and giving them a noticeable reddish appearance. **Barbers Point Light** ( $21^{\circ}18.0' N.$ ,  $158^{\circ}06.5' W.$ ), 86 feet above the water and visible 15 miles, is shown from a white cylindrical concrete tower on the point. A lighted buoy is about 1 mile offshore southeastward of the light. The reef extends about 0.6 mile off the point.

**Currents.**—There is a general westward current along the coast between Honolulu and Barbers Point. Off the point, velocities up to  $\frac{3}{4}$  knot, setting westward, have been measured and larger velocities have been reported. Tidal currents are generally weak but the ebb sometimes exceeds  $\frac{1}{2}$  knot in Pearl Harbor.

**Chart 4110.**—The coast has a general northwesterly trend between Barbers Point and Kaena Point, a distance of about 20 miles, and consists of alternating ledges of rock and stretches of white sand. Spurs of the Waianae Mountains extend to most of the points. Between the spurs and ridges are heavily wooded valleys which contrast with the rocky and bare mountains. A highway follows the coast from just north of Barbers Point to Makua, where a trail continues to Kaena Point.

Much of the shoreline is fringed with rocks and reefs, but they are mostly close to the shore. The 3-fathom

curve is within 0.5 mile of the shore and the 10-fathom curve is within 1 mile. Vessels can avoid all outlying dangers by giving the coast a berth of 1 to 1.5 miles. There are no harbors or anchorages along the west coast that afford shelter in all winds. During easterly weather small craft anchor 0.5 mile offshore in Pokai Bay.

**Kahe Point**, 3.5 miles northward of Barbers Point, is the seaward end of a mountain spur.

**Nanakuli**, 5.5 miles northward of Barbers Point, is a group of homesteads near the shore.

**Puu o Hulu**, about 7 miles northwestward of Barbers Point, is a narrow rocky, barren ridge, 1.5 miles long. The ridge is on **Mali Point**, the southerly of the two important projecting points of this coast, and is the most conspicuous landmark in this vicinity. The westerly end of the ridge is close to the shore, has an elevation of 856 feet, and is precipitous on its seaward side.

**Chart 4136.**—The **Lualualei Homestead** tracts are north and northeast of Puu o Hulu. Several radio towers are prominent in this valley. **Puu Mailiili** about 2 miles northward of Puu o Hulu, is a narrow, rocky ridge, 723 feet high, near the shore and approximately at right angles with it.

**Kaneilio Point**, about 10 miles northwestward of Barbers Point, is a small, low point extending out about 0.2 mile. Between Puu o Hulu and the point, and 0.3 mile inland, the light-colored buildings of a limekiln show up against a dark background.

**Pokai Bay**, north of Kaneilio Point, is a small indentation in the coast. The bay is the approach to the town of **Waianae**, most of which is hidden by the trees. The breakwater built out in a northwesterly direction from the midpoint of Kaneilio Point provides sheltered water inside with depths of  $1\frac{1}{2}$  to 2 fathoms. Shoal water extends about 0.3 mile off the shore of the bay. Small craft can land and seek shelter behind the breakwater. Waianae is on the coastal highway.

**Local magnetic disturbance.**—Differences from the normal variation of  $2^{\circ}$  or more may be expected in Pokai Bay.

A deep valley extends about 4 miles inland between Puu o Hulu and Lahilahi Point and is the largest valley on this side of the Waianae Range. The broken ridge which makes down to Puu Paheehee divides the valley.

**Puu Paheehee**, 652 feet high, is about 1 mile inland from Waianae.

**Lahilahi Point**, 1.7 miles northwest of Kaneilio Point, is a detached, steep ridge of dark rock, 234 feet high. This narrow, conspicuous point, projecting seaward about 0.2 mile, has the appearance of an islet from a distance.

**Kepuhi Point**, about 1.2 miles northwestward of Lahilahi Point, is at the seaward end of a bold, rocky, mountain spur, which comes to within a few hundred yards of the shore. At the base of the bluff is a low, narrow strip of thickly wooded land.

**Chart 4110.**—From Kepuhi Point to Makua the coast trends north. **Makua**, a village 3 miles north of Kepuhi Point, is the terminus of the coastal highway. A few houses can be seen among the trees near the shore. Back

of the village is a small crater-shaped valley. Vessels can anchor about 0.2 mile offshore in depths of 4 to 6 fathoms. Small boats can land on the sand beach when the sea is smooth.

The coast trends northwesterly between Makua and Kaena Point and is rocky except for one short sand beach. The mountains rise steeply from the shore.

**Kaena Point**, the westernmost point of Oahu, is low and rocky and extends a few hundred yards from the foot of the Kuaokala Ridge. A light, 65 feet above the water and visible 14 miles, is shown from a white pyramidal concrete tower on the point. There are numerous temporary buildings on the point. Just off the end of the point are several low, jagged rocks, over which the sea washes, and breakers extend offshore for about 0.4 mile. West of the point the 10-fathom curve lies 0.8 mile offshore.

**Currents.**—Currents are generally weak along the west coast of Oahu, except near Barbers and Kaena Points. Off Kaena Point a continuous northwestward current and moderate tide rips are reported. Current observations taken over a 24-hour period at a location 0.8 mile southward of Kaena Point Light show a northwestward current averaging  $\frac{3}{4}$  knot. The largest velocity measured was 1 knot.

The north coast of Oahu trends eastward from Kaena Point to Kaiaka Bay, a distance of about 9 miles, thence northeasterly to Kahuku Point, an additional distance of about 11 miles. The coast consists of alternating ledges of rock and stretches of white sand beach. A broad valley centered around and back of Waialua and Haleiwa extends in reasonably flat lands toward Kaena and Kahuku Points, the width of the coastal plain narrowing as these points are approached. A large part of the valley is under cultivation, mostly in sugarcane. From Kaena Point to Waialua the mountains have a rugged appearance; from Waialua to Kahuku Point the hills have the appearance of a continuous plateau. A hard-surfaced highway parallels the north coast.

Most of the shore is fringed with reefs which extend as much as 0.5 mile off, but all dangers can be avoided by giving the coast a berth of at least 1 mile. There are no harbors along the north coast that offer shelter in all weather, even for small craft.

**Kuaokala Ridge**, terminating at Kaena Point, is high and its seaward end breaks off rather abruptly. Along the shore from Kaena Point Light to Waialua are scattered beach houses behind which agricultural land extends to the mountains. Two red and white radio towers are 3 miles east of the light and an airfield is 5 miles eastward.

About 6 miles eastward of Kaena Point and 0.5 mile offshore is a rock awash. The rock or breakers are always visible.

**Kaiaka Bay**, almost 9 miles eastward of Kaena Point, is a small indentation in the coast at the mouth of Kiikii and Paukauila Streams. Prominent from offshore is the stack of the sugar mill in Waialua (Puuiki), 0.7 mile southwestward of the bay. A depth of 3 or 4 feet can be carried into the bay by passing between the reefs at Kaiaka Point, on the northeast side of the bay, and a reef off the middle

of the bay. There is a depth of 3 feet about halfway into the bay.

**Waialua Bay**, about 1 mile northeast of Kalaka Bay, is a small indentation at the bend in the middle of the north coast. The shores of the bay consist of low, black rock, with sand patches in the bights and a fringe of large algaroba trees. Back of the shore the country is low, sloping gently to a tableland with mountain ranges on either side. **Haleiwa** is a village on the shore of Waialua Bay.

**Anahulu River** empties into the southwest corner of Waialua Bay. A channel marked by buoys leads to the mouth of the river where moorings have been installed along a jetty and seawall. These moorings are protected from all but heavy northerly and northwesterly weather. Small fishing and pleasure craft moor to the river banks or alongside small docks up the river, but navigation is restricted by a fixed bridge at the mouth which has a horizontal clearance of 14 feet and an overhead clearance of 8 feet. A depth of 6 feet can be carried in the buoyed channel to the moorings at the mouth of the river and 3 to 4 feet through the fixed bridge to a highway bridge. There are shoals and rocks in the river channel and caution must be exercised.

Along the coast between Waialua and Kahuku Point is a narrow strip of lowland, back of which is a tableland covered with vegetation and steep slopes facing the sea. These slopes are cut up in places by deep gorges.

**Waimea Bay**, 3.5 miles northeast of Waialua Bay, is a small indentation in the coast at the mouth of a deep gorge which divides into two branches some distance up. When close in, a highway bridge can be seen across **Waimea River**, the stream that flows down the gorge. Several scattered buildings are visible on the northerly side of the bay. Two large rock crushers are on the point on the northeast side of the bay; the southerly crusher, a tall, square, cement tower, is the most conspicuous object in the vicinity.

Vessels seeking anchorage should stand in for the middle of Waimea Bay and anchor about 0.3 mile offshore in depths of 9 or 10 fathoms, sandy bottom, with the mouth of the river bearing  $101^\circ$ . The bay affords little shelter and a landing can be made only in very smooth weather. There is a wide sand beach at the head of the bay, but the shore on both sides of the entrance consists of low, rocky ledges. The bay is of no commercial importance.

**Wanapaoa Islet**, the outer of two ragged masses of black rock off the point on the south side of Waimea Bay, has deep water close to its offshore sides. Near the point on the northeast side of the bay are some submerged rocks which are generally marked by breakers.

A number of cottages and buildings are visible along the beach, locally known as **Sunset Beach**, 2.3 miles northeast of Waimea Bay.

**Waialea**, about 4 miles northeastward of Waimea Bay, has a group of large, conspicuous, tan-colored buildings, which are at the foot of a bluff and a few hundred yards inland. On the western side of the group is a short stack.

**Kahuku Point**, the northernmost point of Oahu, is

low, consists of sand dunes which are partly grown over with vegetation, and has a few scattered trees. A group of radio masts is about 0.5 mile inland, and a prominent chimney is about 0.6 mile eastward of the point. The coast rounds gradually at this point and several small black rocks are close inshore. The land rises gently to the mountains from the low bluffs at the point. Off the point the 10-fathom curve draws in to about 0.4 mile from the shore. In the daytime the breakers afford sufficient warning of all dangers. At night, however, great care must be used as it is difficult to locate the point because of the low land and the absence of any aids to navigation. Off Kahuku Point the current usually sets westward or northwestward but at times there is no current. Tide rips are reported about a mile eastward of the point.

The danger zone of a low level aerial radar target is centered about 2.5 miles east of Kahuku Point; limits and regulations are given in § 204.223, Chapter 2.

The coast has a general southeasterly trend from Kahuku Point to Makapuu Point, a distance of about 30 miles. This coast, locally known as Windward Oahu, is more productive than other parts of the island, principally because of a greater rainfall. The Koolau Range parallels the coast and several spurs reach the shore between Laie and Kaneohe Bays. The shoreline is mostly low and sandy, with black rocks in some places, particularly at the headlands and most of the points. Between the shoreline and the mountain range is a narrow strip of cultivated land. From the north end of Kaneohe Bay to Waimanalo, this lower coastal area widens and is one of the principal agricultural areas of Oahu. A highway extends along the entire coast.

Coral reefs, with little or no water over them at low water, fringe nearly all the northeast coast. Numerous openings in the reefs can be navigated by small craft with local knowledge; however, throughout most of the year this coast is exposed to the sea and swell built up by the northeast trades. Wider openings in the reefs lead to Kahana, Kaneohe, Kailua, and Waimanalo Bays. Except off Kaneohe Bay, the 10-fathom curve is no farther than 1.7 miles offshore and the 3-fathom curve 1.3 miles.

**Kahuku**, a village about 3 miles southeastward of Kahuku Point, is easily distinguished because of the prominent mill stack about 0.5 mile inland. A prominent aero radiobeacon tower is 0.8 mile northward of the village.

**Makahoa Point**, about 3.5 miles southeast of Kahuku Point, is low and projects out about 0.2 mile. A submerged rock with a depth of 4 feet over it is 0.6 mile east of the point; the rock sometimes breaks.

**Kihewamoku Islet**, 24 feet high, is 0.5 mile eastward of Makahoa Point and about 0.2 mile southward of the submerged rock.

**Laie Bay**, about 1 mile southward of Makahoa Point, is a narrow opening in the reef. The bay has depths of 3 to 7 fathoms and small craft with local knowledge can find shelter and make a landing. The bay should be entered near the south shore of Mokuauia Island, on a course of 214° heading for the Mormon Temple, the building with a

large, flat roof. Strangers should not attempt to enter without a pilot.

**Mokuauia Island**, 23 feet high and about 0.3 mile long, is 0.2 mile off **Kalanai Point**, the wooded point on the north side of **Laie Bay**. Between the point and the island are reefs with depths of 1 to 2 feet over them. About 0.2 mile seaward of the island is a submerged rock with a depth of 10 feet over it.

**Pulemoku Rock**, in **Laie Bay** and 0.4 mile southeast of Mokuauia Island, is 30 feet high. A rock 2 feet high lies close to the southern side of Pulemoku Rock.

**Laie Point**, on the south side of **Laie Bay**, is narrow, low, and bare and has a rocky beach. The point has been divided into residential lots. Just off the end of the point are two small, flat, rocky islets, **Kukuihoolua Islet**, 30 feet high, and **Mokualai Islet**, 33 feet high. Vessels should pass at least 0.5 mile off these islets.

**Puu Kaipapau**, 2 miles southward of **Laie Point** and 0.8 mile inland, has a pyramidal-shaped, grass-covered top.

**Hauula Park**, 2.5 miles south of **Laie Point**, has a flagpole and a public bathhouse.

**Punaluu**, a village 4 miles southward of **Laie Point**, has two small churches near the beach and 0.2 mile apart. The churches are among the trees and are not readily seen from seaward.

**Kahana Bay**, about 6 miles southward of **Laie Bay**, is a long, narrow opening in the reef where small craft, with local knowledge, can find shelter. The breakers on both sides of the bay are the only guides for entering. **Makalii Point** is on the northern side of the bay, and **Mahie Point** is on the southern side. The 10-fathom curve lies 1.2 mile off these points.

**Chart 4134**.—About 0.7 mile southward of **Kaoio Point**, and along the highway, is the gray, square chimney of a former sugar mill. About 0.3 mile northward of the chimney is a small, privately owned boat landing.

**Kualoa Point**, 1.5 miles southward of **Kaoio Point**, is on the northern side of **Kaneohe Bay**. About 0.3 mile eastward of the point is **Mokolii Island**, a conspicuous, conical islet, 206 feet high.

**Kaneohe Bay** extends southeastward from **Kualoa Point** for about 5 miles to **Pyramid Rock** and indents the coast about 2 miles. The shores of the bay are low sand or coral beaches with numerous walled fishponds which are no longer in use. There are numerous coral and sand shoals and islands throughout the bay, the largest island being **Mokuoloe Island** in the southern part. The towns of **Waikane**, **Waiahole**, **Heeia**, and **Kaneohe** are along the west shore of the bay. A pier used by glass-bottom boats for tourist excursion cruises is 0.9 mile northwestward of **Heeia Landing**. The radio towers at **Heeia** are prominent.

**Kaneohe Bay Defensive Sea Area**. An executive order dated 14 February 1941, establishing a defensive sea area and airspace reservation at **Kaneohe Bay**, is quoted in part, as follows:

The territorial waters within **Kaneohe Bay** between extreme high-water mark and the sea and in and about the entrance channel within a line extending 3 miles northeast

from Kaoio Point, a line extending 4 miles northeast from Kapaho Point, and a line joining the seaward extremities of the two above-described bearing lines, are hereby established and reserved as a naval defensive sea area for purposes of national defense, such area to be known as Kaneohe Bay Naval Defensive Sea Area; and the airspace over the said territorial waters is hereby set apart and reserved as a naval airspace reservation for purposes of national defense, such reservation to be known as Kaneohe Bay Naval Airspace Reservation.

At no time shall any person, other than persons on public vessels of the United States, enter Kaneohe Bay Naval Defensive Sea Area, nor shall any vessel or other craft, other than public vessels of the United States be navigated into said area, unless authorized by the Secretary of the Navy.

At no time shall any aircraft, other than public aircraft of the United States, be navigated into Kaneohe Bay Naval Airspace Reservation, unless authorized by the Secretary of the Navy.

**NOTE.**—Until further notice The Chief of Naval Operations has suspended Naval Control over entry into that portion of Kaneohe Bay Naval Defensive Sea area northward of a line drawn from Lae O Kealohi Point (21°26'47" N., 157°48'39" W.) to the easternmost point of Kapapa Island (21°28'47" N., 157°47'58" W.); thence to seaward on the bearing 45° to the present northeastern limit of the Naval Defensive Sea Area (21°31'39" N., 157°44'57" W., approx.). Naval Control over entry into the remainder of the Kaneohe Bay Naval Defensive Sea Area remains in full force and effect.

A permit to enter Kaneohe Bay may be obtained from the Commanding Officer, Kaneohe Naval Air Station. The bay is by far the best locality for the operation of small craft on Oahu. Many permits are being obtained by property owners to dredge small-boat basins and channels through the reefs. Numerous docks, including the Kaneohe Yacht Club dock, are located in the bay. A dredged channel marked by buoys leads into the northern end of the bay. See Appendix for storm warning display.

**Pyramid Rock**, on the southeast shore of Kaneohe Bay, and on the northwest point of Mokapu Peninsula, is black, and has a sharp summit. A light, 101 feet above the water and visible 16 miles, is shown from a white square concrete house with black diagonal stripes on the northwest point of the peninsula. An aviation light is 1 mile southward on the light.

**Chart 4110.—Mokapu Peninsula**, about 20 miles southeastward of Kahuku Point, is a prominent landmark with a greatest elevation of almost 700 feet. **Ulupau Crater**, part of the rim of an old crater at the northeasterly end of the peninsula, is a rocky headland. **Mokumanu Islands**, 0.7 mile northeastward of the head, are two small islands with vertical sides 202 feet and 132 feet high. The passage between the islands and the peninsula has a depth of about 5 fathoms in midchannel, but it should not be used by strangers. An eastward current is reported in the vicinity of Mokumanu Islands.

The beach between Mokapu Peninsula and Makapuu Point is mostly low and sandy, with black rocks showing in some places. A narrow strip of cultivated land lies between the beach and the foot of the sheer, rocky cliffs, or pali. These sheer cliffs are a characteristic of the mountain range from a point abreast Kaneohe Bay to Makapuu Point. The range gradually draws nearer the coast as Makapuu Point is approached.

**Mokolea Rock**, 2.2 miles south of Mokumanu Islands and 1 mile offshore, is a small, black rock, 20 feet high, with depths of 5 to 8 fathoms around it.

**Kailua Bay**, southward of Mokapu Peninsula, is an open bight which affords no shelter from the trades. The beach at the head of the bay is sandy and is marked by a public bathhouse. The 3-fathom curve lies 1 mile offshore in the bay. For a distance alongshore of about 1.5 miles there is no fringing coral reef off the bay. Between Kailua and Waimanalo Bays a group of grass-covered hills may be seen near the beach.

**Alala Point**, 6.5 miles northwest of Makapuu Point, is on the south side of Kailua Bay and is a low bluff with a white stone monument 25 feet high which resembles a lighthouse.

**Mokulua Islands**, 5.5 miles northwestward of Makapuu Point and about 0.7 mile offshore, are steep rocky islets with grass-covered slopes. The northerly islet is 206 feet high; the southerly is 182 feet high. Westward of the islets is an extensive reef. Between the reef and the mainland is a small-boat passage leading to privately owned boat landings.

**Chart 4131.—Wailea Point**, 1.3 miles southeastward of Alala Point, is on the north side of Waimanalo Bay. An airfield occupies an extensive area south of the point. There is a Government pier 1.2 miles south of the point.

**Waimanalo Bay**, between Wailea and Makapuu Points, affords shelter for small craft in all weather behind the barrier reef which parallels the coast along part of the bay. For a distance of 2 miles there is no fringing coral reef. In the southern part of the bay the reef is close inshore, disappearing near Makapuu Point. The village of Waimanalo is 1 mile inland. The entrance to the bay is in the northwesterly part and has a least depth of 12 feet over the bar and 10 feet inside. During strong trades the entrance is closed by breakers. A shallow-boat passage leads along the beach between Waimanalo and Kailua Bays.

**Manana Island**, 361 feet high, is 1 mile north-northwest of Makapuu Point Light. The island is part of an old crater and has a lighter shade of rock than any in the vicinity. The sides are bluff, except on the westerly side where there is a short sloping point. Deep water is close to on the northeasterly side of the island. There is a depth of about 4 fathoms between Manana Island and the mainland, but strangers should not attempt to pass between them.

**Kaohikaipu Island** is a flat, black, mass of rock 80 feet high, lying about midway between Manana Island and Makapuu Head. A double rock, about 10 feet high,

lies 200 yards northeastward of the island. In a heavy swell the sea breaks about 100 yards outside the rock. A small black rock, showing just above the water, lies about 170 yards southwestward of the island. There is a depth of about 5 fathoms between Manana and Kaohikaipu Islands, but because of the reefs which make off from both islands, strangers should not attempt passage. Depths in the bight between Kaohikaipu Island and Makapuu Point are 4 to 6 fathoms. Vessels should not attempt to pass between the island and the mainland.

**Chart 4117.**—Between Oahu and Kauai, 64 miles to the west-northwestward, is **Kauai Channel** which is deep and clear. During the trades the current generally sets westward across the channel and divides at Kauai, part following the northerly side of the island and the other part following the southerly side. The current often sets eastward during the first calms after strong trades. Strong southerly or southwesterly winds cause the current to set in the opposite direction to that produced by the trades.

**Kauai**, the fourth in size of the islands, is about 23 miles in diameter, and slopes from centrally located **Kawaikini**, a peak which has an elevation of 5,170 feet. On the westerly and northerly sides the mountains descend in steep and jagged ridges; on the easterly and southerly sides the gentle slopes are cut by numerous gulches. The peaks and highlands are nearly always clouded over, making the island difficult to see from any great distance. Dome-shaped **Haupu**, 2,280 feet high, is prominent in the southeastern part of the island. The entire northwest coast consists of sheer high bluffs; the rest of the coast is mostly low and rocky with some scattered sand beaches. A low, flat coastal plain extends westward from the town of Waimea. The few outlying dangers can be avoided by giving the coast a berth of 2 miles.

**Anchorage and harbors.**—Port Allen on the south coast and Nawiliwili on the east coast are the only harbors of commercial importance on the island and the only ones offering suitable shelter in almost all weather. Hanamaulu Bay has a short breakwater, but the surge is large and the port is little used. Numerous bays, none of which offer shelter in all weather, provide anchorage for small pleasure and fishing craft. The entire eastern half of the island is exposed to a swell and rough seas from the northeasterly winds which blow with considerable strength throughout most of the year. Except during westerly storms, small craft can find some shelter alongshore west of Port Allen, but most small craft anchor or tie up at Nawiliwili or Port Allen.

**Currents.**—The oceanic currents in the vicinity of Kauai generally follow the winds. The available local information relative to currents is given in the discussions of the various localities.

**Weather.**—The trade winds divide on the easterly side of Kauai, part following the north coast and part the south coast, and uniting again some distance west of the island. On the west side, between Mana and Makaha

Points, calm or light variable airs prevail. A moderate southwest wind is sometimes felt at Waimea Bay, while a strong east wind is blowing about 2 miles offshore. Along the northerly and southerly shores the early morning trade wind is usually light until about 0900, and again decreases in strength about 1600. Occasionally kona winds, starting in the southeast, displace the normal trades; this condition occurs more often during the winter months.

The east and north, or windward, sides of the island are noted for their heavy rainfall, which reaches a maximum yearly average of more than 400 inches on **Mount Waialeale**. The lower slopes have much less rain, and along the southerly side the fall seldom exceeds 20 inches. The winter months, from December to March, produce the strongest winds, which sometimes reach gale force and are accompanied by more rain than is usual at other times of the year.

**Supplies and repairs.**—Food supplies are obtainable at the various towns on the island, particularly at **Lihue**, the county seat. Ship chandlery is limited to small-craft requirements and occasionally must be ordered from Honolulu. Fuel and water are available at Nawiliwili and Port Allen; limited bunker oil is available at Port Allen. The island has no repair facilities for medium or large vessels. Small vessels can be hauled out at Nawiliwili. Some of the plantations have shops capable of handling small machine repairs.

**Communications.**—Port Allen and Nawiliwili are ports for a few interisland barges and transpacific vessels. Interisland passenger traffic is by air. Radiotelephone communication is available to the other islands and to the mainland. A good highway skirts the island except on the northwest side.

**Chart 4111.**—**Nawiliwili Bay**, on the southeast side of Kauai, is 0.8 mile wide between Carter and Ninini Points and indents the coast about 1 mile. The village of Nawiliwili is on the northern side of the bay, and Lihue, the county seat, is 1.5 miles inland. The bay has a protecting breakwater and is the only harbor on the island that is protected from all winds, except southeast winds when a surge is felt. Both transpacific and interisland shipping passes through the bay. Principal transpacific shipments are bulk sugar, molasses and pineapple; receipts include petroleum products and general merchandise.

**Prominent features.**—The shore consists of rocky bluffs, except at the mouth of Huleia Stream and in the vicinity of Nawiliwili. The jagged, mountainous coast extending southwestward from the bay is in marked contrast with the lowlands of Huleia Stream, on the southwest side of the bay, and affords a means of fixing the entrance from well offshore.

**Ninini Point**, on the north side of the entrance, is low, flat, and rocky, and is backed by land planted in cane. A rocky ledge with a depth of 12 feet at the outer end extends about 100 yards southward of the point. **Nawiliwili Harbor Light** (21°57.5' N., 159°20.3' W.), 118 feet above the water and visible 17 miles, is shown from a buff-

colored cylindrical concrete tower on the point. The reflections of the light are frequently seen by vessels 40 miles away.

**Kukii Point**, 0.7 mile westward of Ninini Point and on the north shore of the bay, is a high bluff with a low, rocky shelf at the base. There is a light on the point.

**Carter Point**, on the south side of the entrance to Nawiliwili Bay, is rocky and rises rapidly to **Kalanipuu**, which is 758 feet high; the hill is marked by an aviation obstruction light. The mountain spur that extends inland rises to **Haupu**, the most prominent feature of southeastern Kauai. A breakwater extends north-northeastward from Carter Point over South Reef to within 0.2 mile of Kukii Point. The outer 40 yards of the breakwater has been damaged by heavy seas.

**Kawai Point**, 0.5 mile south of Carter Point, is a bold rocky headland 525 feet high, very irregular and jagged in appearance.

**Channels.**—A Federal project provides for an entrance channel 40 feet deep to a harbor basin 35 feet deep. The channel and basin are maintained at or near project depths. Lights, and lighted and unlighted buoys mark the entrance and the basin.

**Anchorage** with some protection from the trades can be found between Ninini and Kukii Points, outside the breakwater, although it is reported that the holding ground is poor. Small boats can find excellent anchorage in **Huleia Stream**, except when the sandbar at the mouth closes the entrance. The stream which empties into the southwesterly end of the bay is navigable for small craft only at high water to the first footbridge, about 2 miles above the entrance, where a dam obstructs further passage.

**Caution when entering.**—The reverse turn, first around the breakwater and then around the seawall, which must be made when approaching the wharf, is difficult for large vessels in all but calm weather, and the assistance of a tug is usually needed. Vessels are sometimes required to drop anchor before warping alongside. The harbor has little surge.

**Pilotage and towage.**—The harbormaster for Nawiliwili Bay is also the pilot. Tugs are available.

**Quarantine and customs** officials are stationed at Honolulu and Port Allen. A hospital is located in Lihue.

**Terminal facilities.**—The wharf operated by the Board of Harbor Commissioners is on the north shore west of the seawall and has more than 990 feet of berthing space. Depths alongside range from 27 to 35 feet.

**Supplies.**—The wharf has a transit shed and pipelines for water, diesel oil, molasses, kerosene, and gasoline. Some supplies are available at Lihue, 1.5 miles northwest of the harbor. Ship chandlery is limited to items for small craft.

**Repairs.**—A lift in the harbor has a capacity of 100 tons and can haul out vessels up to 65 feet in length; the plant has a small machine shop.

The village of **Nawiliwili** consists of a few buildings at the head of the arm of the bay between Kukii Point and the seawall. The bight, which is used only by small boats, has a sand and coral bottom, and a sand beach at its head.

**Chart 4117.**—**Kawelikoa Point**, 4 miles southwestward of Nawiliwili Bay, is a dark, rocky headland, 687 feet high. The point is at the end of a ridge which extends northward to Mount Haupu.

From about 1.5 miles southwest of Kawelikoa Point to Hanapepe Bay the coast is made up of low bluffs and beaches; the country is almost all under cultivation, and in some places the cane fields extend well up the mountains.

**Makahuena Point**, 3.5 miles southwest of Kawelikoa Point, is the southeast point of Kauai. The point is low and flat, and has a rocky shoreline with bluffs 20 to 50 feet in height. The land near the point is sandy and rolling, and there are short stretches of sand beach both northeast and west of the point. A light, 80 feet above the water and visible 15 miles, is shown from a white pyramidal concrete tower on the point. The bottom slopes gradually to a depth of 7 fathoms about 0.5 mile off the point. Several reefs extend about 300 yards offshore between the point and Koloa Landing.

About 2 miles inland from Makahuena Point is the conspicuous stack of the **Koloa** mill. The stack may be seen from all along this coast except for a short distance in which it is hidden by **Paa Cones**, which are on a long, low ridge extending inland from the point.

**Koloa Landing**, 1.5 miles westward of Makahuena Point, has a walled-in landing slip. The landing is a small indentation that affords fair protection for small craft in trade-wind weather, but is entirely exposed to the south. Anchorage can be had in depths of 12 fathoms, rocky bottom, about 400 yards southward of the landing. A road leads from the landing to the village of Koloa.

**Kuhio Park**, about 0.5 mile west of Koloa Landing and on the shore road, is marked by a tall flagpole. Several beach houses are between the landing and the park.

**Kukuila Bay**, 1.3 miles west of Koloa Landing, is 150 yards wide and indents the coast about 300 yards. Considerable protection is afforded for small boats except in southerly winds. A breakwater is formed by rocks piled on the reef extending southeastward from the bay. A number of small fishing sampans use the bay. A small village is on the shore. About 0.2 mile west of the village is a salt-water spout, known as **Spouting Horn**, which is quite active even in smooth weather. Five red and white radio range towers are 0.5 mile southeast of the bay.

**Lawai Bay**, 1 mile west of Kukuila Bay, indents the coast about 0.2 mile and is about 300 yards wide. The sides of the bay are low and rocky, but a wide sand beach is at the head, back of which is a privately owned park in the gulch. A large, lone, grass-topped rock, about 70 feet high, stands at the upper edge of the sand on the west side of the stream. The bay affords fair protection from the trade winds for small boats, but is open to the southwest.

**Makaokahai Point**, 4.6 miles westward of Makahuena Point, is easily recognized because of the several hills extending northward from it. One particularly prominent hill, 0.5 mile inland, is 440 feet high and well-rounded, has canefields on the lower slopes, and is evenly capped with trees. The first low hills on the point are the walls of a water-filled crater.

**Lanipua Rock**, with 3 feet of water over it, is about 0.3 mile southeast of Makaokahai Point and is marked by a lighted buoy. Vessels should not attempt to pass northward of the buoy.

**Chart 4108.—Wahiawa Bay**, 2.8 miles westward of Makaokahai Point and 1 mile east of Port Allen, is 170 yards wide at the entrance and indents the coast about 0.2 mile. Excellent protection is afforded small craft in all but southerly winds. Boats anchor in depths of 5 to 10 feet, sandy bottom. The sides of the bay are rocky. The seas usually break over the shoal 100 yards off **Weli Point**, on the southeastern side of the bay.

**Hanapepe Bay**, midway along the south coast of Kauai, is the approach to **Port Allen**. The bay is about 0.6 mile wide and indents the coast about 0.4 mile. A breakwater protects the dock at Port Allen on the eastern side of the bay. The shores are low, rocky bluffs except at the head of the bay, where there is a sandy beach. Principal shipments from Port Allen are sugar, molasses, and pineapple; principal receipts are petroleum products, fertilizer, lumber, and general merchandise.

**Prominent features.**—About 1.8 miles east of Port Allen are the conspicuous stack and buildings of a mill. A light, 51 feet above the water and visible 9 miles, is shown from a white pyramidal skeleton tower on low, flat, and rocky **Puolo Point**, on the west side of the bay. The red sector of the light visible 6 miles from 261° to 282° covers Lanipua Rock. The hangars and radio towers of an airport back of Puolo Point are in disrepair. The airport is used only for emergency purposes. A light, 32 feet above the water and visible 11 miles, is shown from a white pyramidal concrete tower on the outer end of the breakwater. On the easterly side of the bay are several oil tanks and large warehouses.

**Channels.**—A Federal project provides for an entrance channel and a harbor basin 35 feet deep. The channel and basin marked by lighted and unlighted buoys, are maintained at or near project depth.

A reef extends about 200 yards from the shore eastward of the inner end of the breakwater. In heavy weather breakers extend 350 yards offshore on the northwest side of the bay and 50 to 150 yards off the southeasterly side of Puolo Point. The prevailing current is westerly.

**Hanapepe River** empties into the northwesterly end of the bay through a deep gulch. Boats can enter at high water, taking care to avoid the rocks at the entrance.

**Anchorage.**—The usual anchorage off Port Allen is in depths of 9 fathoms, coral and sand bottom, with the edge of the warehouse just east of the dock bearing 350° and the northwest shore of Wahiawa Bay bearing 048°. This anchorage is just within the red sector of the light on Puolo Point. Small craft generally anchor or tie up to mooring buoys in depths of 5 to 15 feet north and south of the shore end of the pier. The harbor affords shelter for all craft in almost all weather, but may become congested.

A pilot of the Board of Harbor Commissioners is available. A towboat assists in docking, undocking, and maneuvering.

**Quarantine officials** board vessels at the dock. There is a private hospital in the area. Port Allen is a customs port of entry.

**Harbor regulations** are established by the Board of Harbor Commissioners of Hawaii and are enforced by the harbormaster.

**Terminal facilities.**—The Board of Harbor Commissioners operates a pier 600 feet long in the eastern part of the bay. Depths alongside range from 28 to 35 feet. The pier has a transit shed which is connected by an abandoned conveyor shed to two sugar warehouses. A general merchandise warehouse also is near the pier. The pier has pipelines for fuel oil, gasoline, kerosene, molasses, and water.

Ships are required to drop an anchor when approaching the pier. This assists in maneuvering to a berth as well as getting away in an emergency. During and after strong trade winds some surge is experienced at the pier. This condition may require small and medium craft to cast off but does not interfere with the cargo handling of large vessels.

**Supplies.**—Water, and limited amounts of bunker and diesel oil are piped to the pier. Gasoline is supplied by tank wagon. Food is obtainable in the principal towns on the island. Ship chandlery is limited to items for small craft.

**Communications.**—Port Allen has highway and telephone communication with other parts of the island and radiotelephone and air communication with the other islands of the group. The town is a port of call for inter-island and transpacific vessels.

**Chart 4114.**—The village of **Makaweli** is about 2 miles northwestward of Puolo Point and 0.4 mile inland. A mill stack shows prominently and at night a row of street lights is conspicuous. Between the town and Makaweli Landing shoal water extends 0.2 to 0.5 mile offshore.

**Makaweli Landing**, 1.7 miles northwest of Makaweli, is on the easterly side of **Hoanuanu Bay**. The dock is in ruins, only piling remains. A large warehouse is on the shore. The easterly side of the bay is rocky, and the northwesterly portion has a sandy beach backed by trees. Good protection is afforded small craft from the trade winds.

About 0.2 mile southeast of **Pakala Point** is a small-boat harbor known as **Robinson Landing**. A channel has been dredged, and a stone wall built around the harbor where boats with drafts of 2 to 4 feet can enter and tie up. A small marine railway can be used for hauling out small craft.

**Makaweli Reef** extends about 0.7 mile off **Poo Point**, which is 0.7 mile northwestward of Makaweli Landing and halfway between the landing and Waimea. A buoy marks the outer end of the reef.

**Waimea Bay**, 5.5 miles northwest of Port Allen and about 1.3 miles northwest of Hoanuanu Bay, is an open bight and the approach to the village of **Waimea**, which is among the trees back of the sand beach. It was here, in January 1778, that Capt. James Cook, R.N., first

landed in the islands. Prominent from seaward are the mill stack, just northwest of the wharf and about 200 yards inland, and the church spire, north of the wharf and about 500 yards inland.

Good anchorage can be found during ordinary weather in depths of 3 to 20 fathoms, sandy bottom. Small boats generally shift anchorage to Makaweli Landing for better protection when the trades are strong. Depths of 6 to 14 feet extend 0.2 to 0.4 mile from the shore of the bay. The dock at Waimea has depths of about 11 feet at its outer end, but the depths are subject to change because of wave action on the sandy bottom. Small craft use the dock only occasionally as the swell is heavy. Provisions are obtained in limited quantities in the village. There is a hospital in Waimea.

**Waimea River**, which empties into Waimea Bay on the easterly side of the village, is navigable only for pulling boats, because of the bar at the mouth. The river descends from the mountains through the deepest gorge on this part of the island. The ruins of a Russian fort are on the east bank of the river near the mouth. The fort was built in 1815 and abandoned in 1817.

**Chart 4117.**—From Makaweli westward the coastline is almost continuous sand beach, usually visible at close range at night, with several scattered patches of rocks. Between Waimea and **Oomano Point**, about 2 miles to the westward, a reef extends out about 0.4 mile. The reef breaks in heavy weather. Between Oomano Point and Nohili Point the 10-fathom curve lies about 0.5 mile offshore. A low, flat plain, about 2 miles wide extends westward from Waimea around the end of the island and northward about 3 miles beyond Nohili Point. The seaward edge of this plain has a growth of algaroba trees, behind which are several sand dunes. Sugar is grown as far west and north as Nohili Point.

**Kekaha**, 2.5 miles westward of Waimea, is a plantation settlement marked by a mill and stack about 0.3 mile inland.

**Kokole Point**, about 5 miles westward of Waimea, is low, rounding, and wooded. A light, 58 feet above the water and visible 12 miles, is shown from a white pyramidal skeleton tower on the point. Good anchorage can be found along the open coast from Kokole Point eastward for a distance of 1.5 miles.

**Mana Point**, about 3.5 miles northward of Kokole Point, is the westernmost part of the island. Along the water's edge is a strip of sand which extends 2 miles on either side of the point, but the sea breaks on a lava ledge at the edge of the sand, making the beaching of boats dangerous except when the sea is smooth. The lowlands back of the point extend for 2 miles to the sheer bluffs of the mountains.

Current observations taken during a 24-hour period 0.5 mile off Mana Point show a tidal current of  $\frac{3}{4}$ -knot velocity at strength setting southward and northward along the coast. The southward maximum occurs about 3 hours after low water at Honolulu and the northward maximum 3 hours after high water. Similar observations taken near the coast about 3.5 miles northeastward of Nohili Point

show a tidal current with velocities generally less than  $\frac{1}{2}$  knot.

Discolored water, caused by the drainage canals and the undertow from the beach, is often noted as far as 2 miles off Mana and Kokole Points. The south drainage canal, at **Waieli**, 1 mile south of Mana Point, is prominently marked by a broken group of ironwood trees, much taller than other timber in the vicinity. The village of **Mana**, 1 mile inland from the point, is marked by several large bushy trees. An aviation control tower just northwest of Mana is prominent.

**Nohili Point**, about 2 miles northward of Mana Point, is marked by **Nohili Dune**, 100 feet high, and the highest and southernmost of a chain of sand dunes extending along the coast for 2.5 miles to the northeastward. The dunes are known as **Barking Sands** and mark the northern limits of the road and cane fields on this side of the island.

A narrow sand shoal, with depths of 7 to 10 fathoms, extends from Nohili Point to **Alapii Point**, 7.5 miles to the northeastward. The shoal, which appears to be a succession of east-west sand ridges, lies 1 to 2 miles from shore. A depth of 4 fathoms is found 0.5 mile off Alapii Point; from there to Kailiu Point, 7 miles farther to the northeastward, the 15-fathom curve is at an average distance of 1 mile from shore.

From Barking Sands northeastward to Kailiu Point, the coast is rocky and precipitous. The section between Alapii and Kailiu Points consists of a series of cliffs known as **Napali**. These cliffs are 2,000 feet high in some places, and are cut up by numerous streams which form small waterfalls. The southerly part of this section is practically bare, but the northerly part is wooded.

**Kalalau Valley**, 2.5 miles northeast of Alapii Point, is the broadest and deepest along the northwest coast and is easily distinguished from offshore. An old horse trail follows the coast northeastward from the old village of **Kalalau** to Haena Point.

**Kailiu Point**, on the north coast of Kauai, is the seaward end of a jagged ridge which ends abruptly in a sharp peak about 1,000 feet high. There is a narrow strip of lowland at the point.

**Chart 4118.**—**Haena Point**, 1.2 miles eastward of Kailiu Point is low and rounding. A reef, which bares at low water, extends 600 yards northwestward from the point, and the 15-fathom curve is 1.5 miles offshore. About 0.2 mile inland from the point, and under the bold face of the mountains, are the **Haena Caves**, which cannot be seen from seaward. The caves are at the western end of the highway which skirts the north shore of the island.

**Kepuhi Point**, 0.7 mile east of Haena Point, is on the western side of Wainiha Bay. An extensive reef fringes the point and the sea breaks 0.5 mile off the point in heavy weather.

**Wainiha Bay** is an open bight 0.8 mile wide between Kepuhi Point and **Kolokolo Point**. The bay affords little protection except in kona weather. The western part of the bay is foul. **Wainiha River** empties into the head of the bay from the most westerly of the deep valleys on the north side of the island.

**Lumahai River** empties into the sea at Kolokolo Point at the west end of a sandy beach with a few rocky patches. The river valley is the western limit of the many rice fields on the north side of Kauai. The river is not navigable.

**Makahoa Point**, 0.8 mile east of Kolokolo Point, is black and rocky, and is on the west side of Hanalei Bay. Back of the point is a high, green hill.

**Hanalei Bay** is about 1 mile wide between Makahoa and Puu Poa Points and indents the coast about the same distance. A coral reef, which generally breaks, fringes the shore on both sides of the entrance. During northerly or northwesterly gales seas break across the entrance but good protection is afforded from the easterly trades. To enter, steer  $157^\circ$  for the middle of the bay and anchor in depths of 6 fathoms, sandy bottom, about 0.5 mile from shore.

Along the sandy beach at the head of Hanalei Bay are clumps of ironwood and coconut trees and the scattered houses of Hanalei. The highway is close to the shore. Three miles inland the mountains attain heights of more than 4,000 feet.

**Hanalei River**, which empties into the east side of the bay, is navigable for shallow-draft boats for a distance of 2 or 3 miles; at high water a depth of  $4\frac{1}{2}$  feet can be carried over the bar at the mouth. A clump of ironwood trees is prominent on the north side of the river's mouth. A wharf, with a depth of about 4 feet at the outer end is on the eastern side of the bay and 200 yards south of the Hanalei River.

**Waioli Stream** and **Waipa Stream**, which empty into the head of Hanalei Bay, are not navigable. Rice and taro are grown extensively along these streams and along Hanalei River.

**Puu Poa Point**, on the easterly side of Hanalei Bay, is a bluff about 50 feet high, back of which a green ridge extends inland.

From offshore the northerly side of Kauai presents a very irregular and jagged skyline, with ridges extending in all directions. In the northwesterly part of the island these ridges often end abruptly at the sea. The mountains are heavily wooded. The coast between Hanalei and Kalihiwai Bays is a series of more or less wooded bluffs, cut up by gulches, back of which a rolling plain extends to the mountains. Between the shore and the highway, 1 mile inland, are pineapple and sugarcane fields.

**Kalihiwai Bay**, 4.5 miles eastward of Hanalei Bay, is about 0.5 mile in diameter. **Pukamoe Point**, a red precipitous bluff about 150 feet high, is on the east side of the entrance. Several houses are scattered along the sand beach at the head of the bay, which is backed by a wooded gulch. Indifferent anchorage, with poor holding ground, can be found in depths of 5 fathoms in the center of the bay, but a heavy swell sets in during northerly winds. A rock awash lies 150 yards north of Pukamoe Point. A reef, 0.2 mile wide and bare at low water, fringes the shore for 2.5 miles westward from Kalihiwai Bay and vessels should stay at least 0.8 mile offshore. A shore road, with beach houses along it, extends westward from the bay for 1.5 miles.

**Kilauea Point**, 1.3 miles northeastward of Pukamoe Point is a grass-covered bluff about 165 feet high. **Kilauea Point Light** ( $22^\circ 14.1' N., 159^\circ 24.3' W.$ ), 216 feet above the water and visible 21 miles, is shown from a white conical concrete tower; a radiobeacon is at the light. **Mokuaeae Island**, 200 yards off Kilauea Point, is a black, flat, grass-topped rock about 200 yards in diameter and 92 feet high. The island is the northernmost part of Kauai and is the most prominent feature in the vicinity of coasting vessels.

The village of **Kilauea**, 1.3 miles inland from Kilauea Point, is not easily seen when close inshore. The sugar of the district is trucked to Nawiliwili for shipment.

Between Kilauea Point and Mokolea Point the coast is bluff, rising gradually from each point to an elevation of about 500 feet midway between them.

**Makapili Rock**, 0.8 mile southeast of Kilauea Point, is 156 feet high, black, and prominent. The rock is on the outer end of a narrow neck of land which juts out 200 yards from the general coastline.

**Mokolea Point**, 1.2 miles southeastward of Kilauea Point, is narrow, 140 feet high, and projects out 0.3 mile from the general coastline. The point is on the northwest side of Kilauea Bay and has two old buildings near its outer end.

**Kilauea Bay** is about 0.5 mile wide and indents the coast about the same distance. The bay is open to the trade winds, but offers some protection in westerly weather. Anchorage can be found in depths of 6 fathoms, rocky bottom, near the center of the bay. A narrow coral reef fringes the shore. **Kilauea Stream** empties into the head of the bay. The bay was formerly a shipping point for Kilauea but is no longer used.

**Kepuhi Point** is a low point 1.9 miles eastward of Mokolea Point. The coast between the two points is low and fringed with a narrow coral reef.

**Chart 4117.—Moloaa Bay**, 1.6 miles southeast of Kepuhi Point, is a small, open bay, about 0.3 mile wide, at the mouth of a gulch. Depths in the center of the bay are 3 to 6 fathoms. During the trades a heavy swell sets into the bay and very little protection is afforded except in southerly weather. There are few houses on the sand beach at the head of the bay and rice is grown in the gulch. The interior between Moloaa and Anahola Bays is used principally for the growing of pineapple and for grazing purposes.

**Papaa Bay**, 1.8 miles southeast of Moloaa Bay, is a bight open to the trade winds. The central portion of the bay is foul and a rock is awash 300 yards offshore. A coral reef fringes the shore south of the bay.

**Anahola Bay**, 3 miles southeastward of Moloaa Bay, is a small bight exposed to the trades. **Kahala Point**, a low bluff with a grove of ironwood trees near the outer end, is on the southeast side of the bay. A light, 40 feet above the water and visible 9 miles, is shown from a white pyramidal skeleton tower on the point. Discolored water frequently extends for a considerable distance off **Kuaehu Point**, on the northwest side of the bay. A reef extends about 0.3

mile from Kuaehu Point. Because of the numerous reefs, strangers should not attempt to enter the bay. In moderately smooth weather small vessels can find anchorage well inside the bay in depths of 4 to 6 fathoms, mud bottom.

**Pinnacle Peak (Needle Point Mountain)**, about 1.3 miles westward of Anahola Bay, is the most prominent mountain peak in this part of the island. It is a tall, dark mountain spire with green slopes, just inland of a dome-like mountain mass which is at the seaward end of a range of conspicuous peaks extending well into the interior of the island. Approaching from northward a natural arch can be seen, which looks like a small white house high up under the ridge.

Between Kahala Point and Kealia the coast consists of low bluffs and a rocky shore with some patches of sand.

**Kealia**, 3 miles southward of Kahala Point, is a plantation village. A short breakwater, extending southeastward from the shore, affords some protection from northerly weather for shallow-draft boats. The breakwater is not kept in repair, and portions have been carried away by the sea. Vessels should not approach the village without local knowledge. About 0.7 mile south of Kealia, a flat building on a low hill is prominent from offshore.

**Kapaa**, 1.5 miles southward of Kealia, is a comparatively large village scattered along the beach. A reef, which is 0.3 mile wide in some places, extends alongshore from north of Kapaa to Hanamaulu Bay. An opening in the reef at Kapaa is usually marked by breakers on either side. Sampanns find anchorage in depths of about 2 fathoms behind the reef and about 150 yards off the northern side of the village.

**Wailua**, 2.3 miles southwestward of Kapaa, is a small village on the shores of Lehuawehe Bay. The village consists of a few houses on both sides of the Wailua River. The river, which is spanned by a bridge at its mouth, is navigable for small boats for several miles, once the shifting bar at the mouth is passed. Vessels may find unprotected anchorage off Wailua in depths of 10 to 15 fathoms, rocky bottom, but, like the whole northeast coast of the island, anchorage is not safe when the trade winds are blowing. **Waipouli** is a village 1 mile northeastward along the highway from Wailua.

**Nonou**, 1.3 miles northwestward of Wailua and 1,238 feet high, is the northernmost and highest of the low mountains near the coast.

**Kalepa Ridge** is 1 mile inland and parallels the coast from Wailua to Hanamaulu Bay. The southern end of the ridge, which is about 700 feet high, is marked by several buildings high on the seaward face of the bluff. The buildings can be seen for many miles offshore and are a good leading mark for Hanamaulu Bay.

**Chart 4112.—Hanamaulu Bay**, 3.4 miles southward of Wailua and 2.6 miles northward of Nawiliwili, is about 0.3 mile wide and indents the coast about 0.5 mile. **Ahukini Landing** is on the point on the south side of the entrance. Only the outer third of the bay has deep water; the sand and coral bottom slopes gradually from the 18-foot curve to the beach at the head of the bay. The shores of the bay are low, rocky bluffs, about 40 feet high, except for the

white sand beach at the head. A fringe of trees on the bluffs form a windbreak for the extensive cane fields on either side of the bay. **Hanamaulu Stream**, which empties into the head of the bay, is not navigable.

The most prominent mark from offshore is the previously mentioned buildings on the southern part of Kalepa Ridge, 1.5 miles west-northwest of the bay. Just southward of the ridge and 1 mile inland is a mill settlement, the lights of which are prominent at night. A concrete tower is on the outer end of the 300-foot stone breakwater which extends northwestward from the point on the south side of the entrance.

The wharf at Ahukini Landing has a face more than 200 foot long. Depths alongside are reported to be 21 to 32 feet, the greatest depth being at the southwestern end. A heavy outside swell causes a heavy surge in the harbor.

**Chart 4117.**—The coast between Ahukini Landing and Nawiliwili consists of a series of low bluffs, with occasional stretches of sand beach. There are no off-lying dangers. An aviation light is 1.5 miles easterly of Lihue. Sugarcane is grown extensively on the land back of the beach.

**Kaulakahi Channel**, between Kauai and Niihau, is about 15 miles wide and clear of obstructions. Off Mana Point the trade wind following the south coast of Kauai meets the air current that has followed around the north side. The trades blow directly across the lowlands of Niihau, but part is deflected southward and around the southeast point of the island.

**Currents.**—Little is known of the current in Kaulakahi Channel, but presumably it is variable depending mainly upon the velocity and direction of the wind. There appears to be a general northwestward flow along the southwest coast of Kauai. It is reported that a current sometimes sets southward along the east coast of Niihau at the same time that the current is setting northwestward along the Kauai coast. There are noticeable tidal currents near the western extremity of Kauai.

**Niihau**, the seventh in size of the islands, is at the westerly end of the group. The island is about 16 miles long in a northeast-southwest direction and varies in width from 3 to 5 miles. Near the middle of the island is a high tableland with low projecting cones, or peaks, the highest of which is **Paniau**, with an elevation of 1,281 feet. The northerly and easterly ends of the tableland are precipitous and vary in height from 600 to 1,000 feet; the southerly and westerly slopes are gradual. There are no streams on the island. Of the less than 300 persons who live on the island, most are pureblooded Hawaiians. The title to the entire island lies in one family. A single ranch, devoted to stock raising, furnishes the sole occupation of the inhabitants. There is no regular communications with Niihau. A dirt road follows the west coast of the island for most of its length.

**Lehua Island**, about 0.6 mile off the north end of Niihau, is a small rocky, crescent-shaped island, with the crescent open to the northward. The easterly and westerly

points are low, rising gradually to an elevation of about 700 feet near the center of the island. On the westerly point is a natural arch. A light, 700 feet above the water and visible 12 miles, is shown from a white skeleton tower on the highest point of Lehua Island.

**Lehua Channel**, between Niihau and Lehua, is restricted on its southerly side by rocks that show above water and extend about halfway across it. A depth of 7 fathoms can be carried through the channel by staying within about 350 yards of the Lehua shore. In heavy northwest weather the swells almost break in the passage, and as little is to be gained by using the channel, vessels should pass northward of Lehua Island. The current through the channel varies with the tide and sets in both directions with a maximum velocity of about  $1\frac{1}{2}$  knots.

To the eastward of Lehua Channel vessels should give the north coast of Niihau a berth of 0.5 mile; to the westward the clearance should be about 1 mile.

**Puukole Point**, on the north end of Niihau, is low, as is **Kikepa Point**, 1 mile to the eastward. Between these points and the high bluff on the northerly side of the tableland, the land is low and grass-covered, with a few low hills. From a distance this lowland is not visible and Lehua Island appears to be about 3.5 miles from Niihau.

**Kaunuopou Point**, 1.8 miles southeast of Kikepa Point, is the easternmost point of Niihau. **Kaunuopou Rocks**, over which the seas break, are 300 yards off the point. Another rock, about 0.4 mile off the southern side of the point, usually breaks and should be given a good berth by vessels approaching Kii Landing.

**Kii Landing**, in a small bight about 0.7 mile west of Kaunuopou Point, is only slightly protected from the trade winds. The landing is usable in ordinary weather, but not in southerly weather. The landing is built on beach boulders and has depths of only 2 or 3 feet alongside. Anchorage can be had in depths of about 8 fathoms, coral bottom, about 0.6 mile off the landing.

About 1.3 miles southward of Kii Landing a reef, with about 1 fathom of water over it and usually breaking, extends 0.5 mile offshore. The 10-fathom curve is about 1 mile offshore. From the vicinity of the reef to Pueo Point the coastline consists of cliffs reaching a height of 1,000 feet.

**Pueo Point**, 5 miles southward of Kii Landing, is a prominent brown, precipitous bluff about 800 feet high. Southward from the point for a distance of about 4.5 miles the coastline consists of bluffs which gradually diminish in height toward the lowlands of the southern half of the island. The bluffs are broken by small bights, most of which have short sand or pebble beaches where boats could land during smooth weather. Beyond the bluffs to Kawaihoa Point, a distance of about 6 miles, the coast consists of a series of low bluffs about 15 feet high, with stretches of sand beach, a few sand dunes, and scattered trees. Between Pueo Point and Kawaihoa Point are no known outlying dangers, the few isolated rocks being very close to the shore.

The lowland of the southern part of the island is broken by two hills, one on Kawaihoa Point and the other, **Kawaewae**, a gently rounded hill 315 feet high,

which is 4 miles north of the cape and 1.3 miles inland from the west coast.

**Kawaihoa Point**, the southernmost point of Niihau, is formed by a hill 548 feet high, the seaward face of which is steep. From a distance the hill has the appearance of an island and can easily be mistaken for Kaula Island. Deep water is close to the point. About 2 miles south of the cape there is a prevailing westerly current which reaches a velocity of about  $1\frac{1}{2}$  knots.

Beyond Kawaihoa Point the coast gradually curves westward and northward and is low and rocky with occasional short sand beaches. At **Leahi Point**, 1.7 miles westward of the point, the 10-fathom curve is 0.6 mile offshore. A dirt road skirts the western shore.

The coast between **Kamalino**, a former village 4 miles northwestward of the point, and Puukole Point is practically one low, continuous beach, with an occasional group of rocks. Near the beach are numerous sand dunes covered with sparse vegetation. In the vicinity of Kamalino weak currents have been reported setting northward and southward along the coast.

**Nonopapa Landing**, 5.5 miles northwestward of Kawaihoa Point, is the principal landing on the island. Local steamers call occasionally for the island's cattle. The landing is used only from May to September, as there is often a heavy northerly swell during the winter months. The landing is marked by a shed and derrick on a short concrete retaining wall at the north end of a long sand beach. **Kaao**, a cone 1,018 feet high and near the center of the tableland, shows on the skyline from the anchorage.

Anchorage is available in depths of 8 fathoms, coral and sand bottom, about 660 yards off the derrick, with the landing shed and Kaao in range and bearing  $070^\circ$ . Kawaewae is 1.5 miles  $135^\circ$  from the anchorage. The landing is somewhat protected by a small reef extending about 75 yards southwest from the end of the retaining wall. Small boats approaching the landing head south of it until the reef is rounded. **Puuwai**, the principal village of the island, is about 2.5 miles northeast of the landing.

**Kuakumoku Rock**, 1.6 miles northward of Nonopapa Landing, is a large, single rock about 4 feet above water and near the center of a reef some 200 yards in diameter and 500 yards offshore. The reef should be given a berth of 0.5 mile, and only small craft should attempt the passage between the reef and the shore. Other reefs extend about 0.5 mile offshore 0.5 mile south and 3 miles northeast of Kuakumoku Rock.

**Kaununu Point**, 4.5 miles northeastward of Kuakumoku Rock, is marked by a group of rocks a few feet high and close to the shore. A coral reef with depths of 6 fathoms over it lies 1.5 miles off the point. It is reported that the reef breaks in heavy weather. The passage inside the reef is not recommended except for small boats.

**Keawanui Bay** is no more than a slight curve in the shoreline that extends northeastward from Kaununu Point for 3 miles. The bay has a sand and coral bottom and a sandy shore. A rock with 2 feet of water over it lies in the southern part of the bay, 0.8 mile northward of Kaununu Point, and 0.5 mile offshore.

From the northern side of the bay to Puukole Point the coast is foul for a distance of about 0.8 mile offshore. Vessels should give this section of the coast a berth of at least 1 mile. About 1.8 miles southwestward of Puukole Point and 0.7 mile offshore is a reef with depths of 16 feet over it; 0.9 mile southwestward of this reef and 0.8 mile offshore is a rock with 5 feet of water over it.

**Kaula**, 19 miles southwestward of Niihau, is a small, bare, rocky islet, 550 feet high. Vessels have anchored close to both the south and east sides of Kaula in depths of about 20 fathoms, but as the islet is only 0.7 mile long, little protection is afforded. A rock with a least depth of 5 fathoms lies 3.8 miles 300° from the highest point of Kaula. A bank with depths of 30 to 40 fathoms extends 5 miles northwestward from the islet.

The **danger zone** of an aerial bombing and strafing target is centered on Kaula Rock; limits and regulations are given in § 204.223, Chapter 2.

**Chart 4000.**—The small rocky islands, reefs, and atolls extending west-northwestward from Niihau form a well-defined chain. Between Niihau and Gardner Pinnacles, about 500 miles distant, are several widely separated high barren rocks. Continuing to the westward are the coral reefs and atolls.

**Atolls.**—An atoll may comprise one or more low coral islands situated on a strip or ring of coral surrounding a central lagoon. Many of these atolls have openings in the coral ring which permit passage of small boats, and sometimes large vessels, to anchorage in the enclosed lagoon.

**Reefs.**—Successful navigation through or among coral reefs is often dependent upon the eye. They are always more plainly to be seen from the masthead than from the deck or bridge. The best observing conditions are with the sun high and behind the observer, and with the sea slightly ruffled; reefs are extremely difficult to distinguish if the sea is glassy calm.

Reefs with about 3 feet of water over them appear light brownish in color; those with a fathom or more appear light green, deepening to darker green and finally to deep blue. Under favorable circumstances, a reef with depths of 3 or 4 fathoms over it can be seen from aloft for a considerable distance; in greater depths, the reef can only be seen when nearly over it. Polaroid glasses have been found of great help in navigating among reefs.

**Vigias.**—A *vigia* is an indication on a chart that a dangerous rock or shoal is thought to be near the spot indicated. Doubtful navigation and strong currents account for a large proportion of the *vigias* that encumber or have encumbered the charts of the Pacific Ocean. Phosphorescence, seaweed scum, and shoals of fish often resemble reefs and breakers so closely as to deceive the most experienced. Many *vigias* have been disproved by extensive investigation, but many others are still on the charts and remain a source of annoyance to the navigator.

**Chart 4181.**—**Nihoa (23°03' N., 161°55' W.)**, a barren, rocky, and uninhabited island, is about 120 miles

northwestward of Niihau. The island was discovered by Captain Douglas of the British vessel *IPHIGENIA* on April 13, 1790. The low, stone walls of ancient ceremonial sites still remain on the island, and many stone images and other evidence of past visitations have been removed to the Bishop Museum in Honolulu. The island is the resort of several species of sea birds.

Nihoa is about 0.8 mile long and 0.2 to 0.5 mile wide. The easterly, northerly, and westerly sides are high and precipitous; the southerly side is much lower and its slopes are more gradual. **Millers Peak**, 910 feet high and the highest point on the island, is near the northwesterly end. **Tanager Peak**, 874 feet high, is near the northeasterly end. The southeast and southwest sides of the island terminate at points on either side of **Adams Bay**. In the bay are three small bights, the westernmost having a sand beach while the shores of the other two are rocky ledges. There is deep water, close to all sides of the island.

The safest anchorages are between the 15- and 20-fathom curves westward and southwestward of the island, but the holding ground is poor. The middle cove of Adams Bay probably affords the best landing, but the surge is considerable and great care must be taken in landing anywhere on the island. During heavy northwesterly weather landing is very dangerous. A steep trail leads from the middle cove to the top of the bluff. At the foot of the bluff is a seepage of water which is not suitable for drinking purposes except in emergencies.

**Currents.**—The prevailing current sets westward in the vicinity of Nihoa Island. Current observations taken about 0.2 mile west of the island show a nontidal flow of about ¼ knot setting west-southwest combined with a tidal current of nearly ½ knot at strength setting northward and southward. The northward strength of the tidal current occurs about 6 hours after the local transit of the moon and the southward strength at about the time of local transit. The largest velocity measured was nearly 2 knots and set southward.

**Local magnetic disturbance.**—Differences from normal variation of as much as 33° have been observed on Nihoa. Nihoa is near the southwesterly end of a bank which is about 15 miles long in a northeast-southwest direction, 10 miles wide, and has depths of 20 to 30 fathoms. Another bank, the center of which is about 18 miles west by south from Nihoa, is about 14 miles long in an east-west direction, 9 miles wide, and has depths of 15 to 25 fathoms. A bank about 54 miles southeastward of Nihoa has a least depth of 32 fathoms; the two banks 57 and 70 miles westward have least depths of 29 and 33 fathoms, respectively. The edges of the banks slope steeply to much greater depths.

**Necker Island (23°34' N., 164°42' W.)**, is 158 miles west by north from Nihoa. It was discovered by La Perouse on November 1, 1786, and was annexed to Hawaii in 1895. The island, which might well be called a rock, is uninhabited, but, like Nihoa, shows unmistakable evidence of ancient habitation. It is the home of countless sea birds.

About 0.7 mile long and less than 0.2 mile wide, Necker Island is made up entirely of lava rock. There are four peaks or hills, one near each end and two between. The highest, **Summit Hill**, 277 feet high, is near the middle of the island. **Annexation Hill**, 249 feet high, at the southwestern end of the island, is separated from the other hills by a low saddle, and, when seen from a distance, appears detached. There is a sparse growth of low brush on the upper slopes of the hills.

**Northwest Cape**, a rocky spur extending northward from the west end of the island, is joined to the rest of the island by a low isthmus over which the seas break in rough weather. On the west side of the cape is **West Cove**, and on the east side is **Shark Bay**. Off the east end of the island are several low, detached rocks. A depth of 5 fathoms has been reported 0.5 mile south of Necker Island where general depths are 10 to 12 fathoms.

Vessels can anchor in depths of about 12 fathoms 0.5 mile south of the southwest point of the island, but the island is so small that it affords little protection. **West Cove** and **Shark Bay** are the landing places, but there are times when it is impossible to land anywhere on the island. During heavy northwesterly weather landing at **West Cove** is very dangerous. **Shark Bay**, open to the northeast trades, is usually filled with breakers. At certain seasons of the year some water may be found in a small ravine on the southeastern side of the island. Small seepages of unpalatable water have been found on the island.

**Tide.**—The rise and fall of the tide is about 1 foot.

**Current.**—The prevailing current sets westward, but countercurrents may be expected close to the island. Four days of current observations taken 0.2 mile west-northwest of the west end of Necker Island show a westward nontidal flow of about  $\frac{1}{2}$  knot, combined with a tidal current of about  $\frac{3}{4}$  knot at strength. The north-northeastward strength of the tidal current occurs about 6 hours after the local transit of the moon and the south-southwestward strength about the time of local transit. Easterly trade winds prevailed during the observations.

**Weather.**—September is reported to be the calmest month of the year; strong north and northeast winds prevail during the other months.

**Local magnetic disturbance.**—Differences from the normal variation of as much as 22° have been observed on Necker Island.

Necker Island is near the northern end of a bank about 40 miles long in a northwest-southeast direction. The bank is about 15 miles wide and has depths of 8 to 23 fathoms. The sand and coral bottom is plainly visible.

**Charts 4171, 4172.**—**French Frigate Shoals**, about 85 miles west by north from Necker Island, is a crescent-shaped atoll about 17 miles long in a north-northwest direction. It was discovered by La Perouse on November 6, 1786, the day after leaving Necker Island, and like that island, was annexed to Hawaii in 1895. The atoll consists of a coral reef with a number of small, bare, sand islets on it, and is flanked by a volcanic rock and numerous coral heads and reefs.

The crescent reef is double, and the outer and inner arcs bound a lagoon which is 1 to 6 miles wide. At its midpoint the windward reef lies about 8 miles from a line joining the tips of the crescent; the leeward reef is about 5 miles from this line. The windward reef is nearly continuous and can be plainly seen in the daytime for a considerable distance by vessels approaching from the north, east, or southeast. The sea practically always breaks over the reef, and the few times it is not breaking, the green shoal water inside the reef is seen in ample time to avoid danger. The bottom slopes uniformly from the reef to the 100-fathom curve 1 to 2 fathoms off, and there are no known dangers from north through east to south of the windward reef.

The leeward or inner reef, however, is broken in many places, and, in normal weather is seldom marked by breakers. The lagoon between the reefs is foul with numerous coral heads.

A bank with depths of 8 to 20 fathoms extends about 8 miles westward from the midpoint of the inner reef, where it then drops off rapidly to great depths.

**La Perouse Pinnacle** (23°46' N., 166°16' W.), a volcanic rock about 60 yards long, 20 yards wide, and 122 feet high, lies about midway between the tips of the crescent and west of the leeward arc of the reef. The rock is so steep and rugged that it is almost inaccessible. From a distance its guano-coated outline resembles a brig under sail. A small detached lava rock about 9 feet high lies off the westerly side of the pinnacle. The points of the crescent reef, as indicated by the ends of the line of breakers, bear about 170° and 310° from La Perouse Pinnacle.

**Shark Island**, the northwesternmost of the sand islets, lies 6 miles northwest of La Perouse Pinnacle. A coral reef fringes the islet. **Tern Island**, about 2 miles east-northeastward of Shark Island, is marked by a Loran tower, a water tank, and an observation tower. A radio-beacon station is also on the island.

**East Island**, 3 miles east-northeast of La Perouse Pinnacle, is a low sand bar 600 yards long in a northwesterly direction and about 100 yards across. Reefs that are awash most of the time extend a mile westward and 0.2 mile southward from the island; the southern reef seldom breaks. A coral head that sometimes breaks is 0.6 mile south of East Island. Northeast and east of the island are numerous coral heads and reefs.

The several islets between Tern Island and East Island, and southeastward of East Island, are low and sandy, some with a scattering of low weeds, and are the nesting places of sea birds and turtles. Due to the exceedingly uneven bottom and the presence of numerous coral heads, extreme caution must be exercised in approaching or navigating in the vicinity of these islets.

**Channels.**—The principal approach to Tern Island is through **Southwest Channel**, which extends from a position 1.5 miles southwest of the island to a basin about 500 feet across at the west end of the island; the basin is somewhat protected by the reef to the northward. In June 1952 the controlling depth was 16 feet to Tern Island. The channel is marked by buoys. There are several coral

heads close outside Southwest Channel; one, on the east side of the outer reach, is 15 to 20 feet across and is covered only 1 fathom.

**Anchorage.**—The best holding ground southwest of the reef is found in depths of 13 to 15 fathoms, the bottom in lesser depths being mostly coral. Good anchorage can be found about 0.7 mile southwestward of East Island in depths of 14 fathoms with the southeast end of East Island and Bare Island in range and La Perouse Pinnacle bearing 261°, distant 2.6 miles. This anchorage has good holding ground and is protected from northeast and easterly winds, but is exposed to the westward. Another anchorage, with less protection, lies 1 mile northwestward of La Perouse Pinnacle in depths of about 14 fathoms. A submerged coral head and patches of 7 to 8 fathoms are near this anchorage. For large vessels, there are no anchorages protected from all weather; however, the conformation of the reef is such that anchorage can be found from which choppy seas and nearly all ground swell are excluded. By picking their way between the coral heads, small vessels can find good protection behind the shoals from any kind of weather.

In 1944 it was directed that no vessel should anchor at French Frigate Shoals in the area southwestward of a 148°-328° line drawn through a point 3 miles 240° from La Perouse Pinnacle.

**Directions.**—Vessels approaching French Frigate Shoals from the north, east, or southeast in the daytime should have no difficulty in picking out the outer reef from a considerable distance off. In clear weather La Perouse Pinnacle is plainly visible from outside the reefs. From the south, the reef is not so easily seen. The sea may not break over the shoals, and although the bottom is plainly visible close in, the shoals might not be detected from a little distance. The 100-fathom curve is only about 0.5 mile from the shoals.

Vessels approaching La Perouse Pinnacle and the anchorage southwest of the reef should stay in depths greater than 100 fathoms until within an arc from La Perouse Pinnacle of 195° to 315°. From the northward, Shark Island should be given a berth of about 4 miles.

**Currents.**—A prevailing current sets westward in the vicinity of French Frigate Shoals, but variable currents have been noted. A southwestward current of 2 knots has been measured. A 1-day series of half-hourly current observations taken 0.7 mile west of the southern end of the shoal during a period of small wind velocity shows practically no current.

**Weather.**—The northeast trades prevail throughout the year, but westerly blows can be expected during the winter months. The average wind velocity is 12 knots, with monthly averages of about 16 knots in December to 9½ knots in August. Gales have been experienced in July and September. Occasional heavy showers of short duration cut visibility to about 2 miles.

**Facilities.**—Vessels tie up to three dolphins off the shore in the turning basin at Tern Island. The two loading platforms have depths of 20 feet alongside. The largest vessel reported accommodated at Tern Island was

200 feet long and had a draft of 16 feet. Cranes and small craft assist in handling cargo. Minor repairs can be made. Water is available in limited quantities. There are some medical facilities at Tern Island. Somewhat brackish water has been found on some of the other islets by digging wells about 8 feet deep back from the beach.

**Chart 4182.**—Brooks Banks and St. Rogatien Bank are a group of five coral banks situated between French Frigate Shoals and Gardner Pinnacles. The banks extend 50 miles in a northwesterly direction, have depths of 11 to 40 fathoms, and are separated by channels several miles wide and more than 100 fathoms deep. The largest of these banks lies 60 miles 305° from La Perouse Pinnacle, is about 12 miles in diameter, and has depths of 12 to 20 fathoms. The southeasternmost bank, the smallest in the group, is 27 miles 297° from La Perouse Pinnacle, is about 2 miles in diameter, and has depths of 28 fathoms. The northwesternmost bank is 75 miles 311° from La Perouse Pinnacle, is about 6 miles long and 4 miles wide, and has depths of 30 to 40 fathoms.

Unprotected anchorage can be had on the shoaler areas, but the holding ground is only fair. The sand and coral bottom is plainly visible. There are no dangers.

**Currents.**—The oceanic flow is variable, but usually sets westward. Sixty half-hourly current observations indicate a northwestward nontidal current of about ½ knot, combined with a tidal current of ¼ knot at strength. The tidal current is somewhat rotary, turning clockwise, with northeastward strengths occurring about 6 hours after the local transit of the moon and southeastward strengths occurring near the time of the local transit. The largest velocity observed was nearly 1½ knots setting westward.

**Chart 4173.**—Gardner Pinnacles (25°00' N., 168°00' W.), lie 120 miles northwest of La Perouse Pinnacle. They were discovered by Captain Allen of the whaler MARO in June 1820. The pinnacles are a solid, volcanic rock islet, 190 feet high and about 200 yards in diameter, and a smaller rock about 100 yards from the northwest side of the larger. The rocks are barren of vegetation and are covered with guano, giving them a snow-capped appearance. The only off-lying dangers are a small rock just off the northwest side of the larger pinnacle and two 20-foot patches, one of which is about 100 yards south of the larger pinnacle and the other just north of the smaller pinnacle.

Anchorage can be had anywhere on the bank which surrounds the pinnacles, but there is no protection; in general, the holding ground is poor. In comparatively smooth weather, landings can be made just north of the bight on the west side of the larger pinnacle.

**Currents.**—Current observations taken at a number of locations in the vicinity of Gardner Pinnacles show a west-northwestward oceanic drift of about ¼ knot combined with a rotary tidal current, turning clockwise, of ¼ knot at strength. Northeastward tidal current strengths occur about 5 hours before the local transit of

the moon and southwestward strengths about 1 hour after the local transit. Velocities of about 2 knots setting west-southwest were measured during easterly winds.

Gardner Pinnacles lie near the northeastern side of a bank about 50 miles long, in a north-south direction, and about 20 miles wide near the northern end. The bank has depths of 10 to 25 fathoms, and the sand and coral bottom is plainly visible.

**Chart 4182.—Raita Bank (25°32' N., 169°28' W.),** lies about 85 miles 291° from Gardner Pinnacles. It was discovered in 1921 by the French schooner RAITA. The bank is about 20 miles long in a north-northeast direction and has a maximum width of about 10 miles. Depths range from 9 to 20 fathoms and the sand and coral bottom is plainly visible under ordinary weather conditions. At the 20-fathom curve, the bottom drops off rapidly to great depths. In heavy weather, the swells seem to lump up slightly over the shoaler areas, but there are no dangers. Large schools of Ulua fish and sharks have been observed on the bank. Anchorage can be had on the bank in the open sea with fair holding ground.

**Currents.**—Variable currents are reported in the vicinity of Raita Bank. Current observations in the vicinity indicate a rotary tidal current turning clockwise.

**Chart 4174.—Maro Reef (25°25' N., 170°35' W.)** lies about 60 miles westward of Raita Bank. It was discovered by Captain Allen of the whaler MARO in June 1820. The large, oval-shaped, coral bank is about 31 miles long in a northwesterly direction and about 18 miles wide. The center of the bank is a large area of reefs awash. This broken area, about 12 miles long in a northwesterly direction and 5 miles wide, is extremely foul, with many coral heads awash and channels of deep water between. Only one very small rock, about 2 feet high and on the north side of the reef, shows above high water. Outside the broken portion of the reef, which is practically always marked by breakers, is the wide shelf of the bank with depths of 12 to 20 fathoms.

The bow of a T-2 tanker, stranded on the southwestern side of the reef, shows 54 feet above the water and is the only visible mark on the reef. Breakers, or the light blue-green color of the area within the broken portions of the reef, give the first warning of the proximity of danger. All maneuvering in the vicinity of the broken area must be done with extreme caution and with the sea and light such that shoal spots can be seen and avoided. Ordinarily, spots with less than 6 fathoms of water are plainly visible.

There are no dangers more than 2 miles from the general outline of broken portions of Maro Reef, thus leaving a navigable shelf with depths of 12 to 20 fathoms on all sides but the northeast where depths of 7 to 10 fathoms are found.

Vessels may anchor in the shelter of the broken portion of the reef on any side; the closer to the reef the more caution is necessary to avoid the isolated coral heads which can usually be seen in favorable sunlight. Good shelter from the northeast trades can be had on the west

side between two long arms of the reef which project, one to the northwest and one to the southwest, from the main reef area. Care must be taken to avoid the 5½-fathom spot off the middle of the entrance and the 3½-fathom spot well inside. Vessels entering should keep within 0.5 mile of the southwest arm of the reef. However, unless the navigator is familiar with the area, he should remain as far as he can from the broken area on all sides and still obtain the desired shelter.

**Currents.**—In the vicinity of Maro Reef the prevailing current sets westward but variable currents have been noted. Over the bank a rotary tidal current, turning clockwise, has been reported.

**Chart 4186.—Laysan Island (25°46' N., 171°44' W.),** is a low sand island about 65 miles west-northwest of Maro Reef. The island is 1.6 miles long in a north-south direction, about 1 mile wide, and 35 feet in elevation at its highest point near the north end. In the center of the island is a salt-water lagoon about 0.9 mile long. The island is mostly white sand, although it is partly covered with low vines and grass. The island is marked by two coconut trees and ironwood trees which are close to the ruins of a small building on the west side of the island. Water can be obtained by digging shallow wells, and sea fowl, eggs, and fish are abundant. The island is uninhabited and is seldom visited.

A coral reef, a few hundred yards wide, fringes the island. About 0.3 mile off the western shore is a small, sharp rock, about 3 feet high. Coral heads, covered with 4 to 7 fathoms of water, are numerous in the area within 1 mile of the island. The sand and coral bottom can usually be seen in depths less than 10 fathoms, and often in greater depths. When approaching closer than 1 mile, a sharp lookout must be maintained to detect the coral heads.

Vessels can anchor in depths of 8 to 15 fathoms 1 to 1.5 miles off the island on all sides, depending upon which side affords the best protection. During the trades, anchorage can be had 0.5 to 1 mile off the west side in depths of 8 to 15 fathoms, fair holding ground. Small craft drawing not over 12 feet can lie at anchor inside the reef and off the coconut trees on the west side of the island, but this anchorage affords no protection from westerly winds. During northeasterly and southeasterly weather the best landing can be made off the coconut trees on the west side of the island. A poor landing can be made near the northeasterly end of the island during light westerly winds. The summer months are the best for landing, as the northeast trades prevail during this period.

**Currents.**—A current velocity of about 1 knot and a rotary tidal current, turning clockwise, have been reported. The current is believed to depend to a great extent upon the wind.

**Chart 4182.—Laysan Island** is just southeastward of the center of a circular bank 14 miles in diameter, with depths of 15 to 20 fathoms, beyond which the water deepens rapidly.

**Northampton Banks,** unsurveyed banks with a least

known depth of 17 fathoms, lie about 35 miles southwest of Laysan Island.

**Chart 4186.—Lisianski Island (26°04' N., 173°58' W.),** is a small, low, sandy island, about 120 miles westward of Laysan Island. Captain Lisianski, of the Russian ship NEVA, discovered the island on October 15, 1805, when his ship grounded on the reef and was nearly wrecked. The island is about 1.2 miles long in a north-northwest direction, 0.5 mile wide, and 20 feet in elevation at its highest point on the northeastern side. The shores are white sand except for two stretches of rock ledge at the waterline on the east side of the island. Behind the sand beach, the island is overgrown with vines and bushes. Two coconut palm trees in the northeast part of the island are prominent from northward. Brackish water may be obtained by digging shallow wells. Sea fowl, eggs, fish, and turtles are abundant. The island is uninhabited and seldom visited. Visits should be made only during the summer months when the northeast trades prevail.

A reef circles around to the southwestward from off the north side of the island. It is marked near its offshore end by a coral ledge which bares at times and over which the seas break. The southern end of this ledge is 1.7 miles 260° from the northern end of the island. About 0.6 mile southwestward of this point is another ledge which is marked by a large breaker in most weather. Midway between these ledges or breakers is a passage leading to the lagoon between the island and the reef. The passage has an uneven bottom with depths of 11 to 37 feet. About 350 yards southwestward of the northern ledge is a small shoal with a depth of 3 feet over it. These shoal spots are easily seen and avoided by small boats making the passage into the lagoon, but vessels should not enter without local knowledge. Once inside, anchorage can be had in depths of 3 to 6 fathoms, taking care to avoid the scattered coral heads with only a few feet of water over them. Landings can be made on the west side and south end of the island in all but southwesterly and westerly weather.

**Neva Shoal,** with innumerable coral ledges, extends about 8 miles southeastward from Lisianski Island. This reef, which is about 4 miles wide, has its western extremity about 4 miles south-southwestward of the island. The southerly end of the reef is usually marked by breakers, and many of the ledges break in almost all weather. The shoal has areas of deeper water between the ledges, and small boats can maneuver over many parts of the reef, but it must be avoided by larger vessels.

In addition to Neva Shoal, there are many coral heads with depths of 3 to 6 fathoms over them within 3 miles of all sides of the island. A small coral ledge, with an islet on it and nearly always marked by breakers, lies 2.7 miles 254° from the south end of the island. Between this ledge and the island are depths as great as 8 fathoms and a scattering of coral heads, some of which are nearly awash. The lagoon could be entered between this ledge and the ledge marking the south side of the previously described opening 1 mile northward. A 14-foot rock,

about 1.5 miles north-northeastward of the island, is marked by breakers only during heavy weather. Under favorable conditions dangerous coral heads can be seen for several hundred yards.

**Anchorage** can be had in trade wind weather about 3 miles west of the island in depths of 11 to 15 fathoms, sand and coral bottom, with the north end of the island bearing 080°. During southwest weather, vessels can find anchorage 3 to 4 miles east of the north end of the island in depths of 8 to 15 fathoms. Small boats can anchor in the lagoon, as described previously.

Vessels may approach to within 3 miles of Lisianski Island from the northward on courses between 270° and 090°. The island and Neva Shoal should be given a wide berth when passing southward of them, as the island is seldom seen from the southern limits of the shoal. Vessels approaching from the southwestward should keep about 5 miles westward of the meridian of the island until the island bears 090°, and then approach the anchorage.

**Currents.**—One-half day of current observations taken 3 miles west of Lisianski Island indicate a rotary tidal current, turning clockwise, of  $\frac{3}{4}$  knot velocity at strength. North-northeastward strengths occur about 5 hours before the local transit of the moon and south-southwestward strengths about 1 hour after the local transit. A prevailing northwestward current is reported in the vicinity of the island.

**Chart 4183.—Lisianski Island and Neva Shoal** lie just southeast of the center of a bank about 25 miles long in a northwesterly direction and about 15 miles wide. Outside the reefs, general depths on the bank are 12 to 20 fathoms.

**Pioneer Bank (26°02' N., 173°26' W.),** lies about 30 miles eastward of Lisianski Island. The bank is about 8 miles in diameter and soundings of 18 fathoms have been obtained near its center. No breakers or dangers were observed during a preliminary survey, but, as the least depth may not have been obtained, vessels should avoid the area.

An unsurveyed bank with least known depths of 39 fathoms is reported to be about 32 miles northwest of Lisianski Island.

**Chart 4175.—Pearl and Hermes Reef,** lying about 145 miles northwest of Lisianski Island, is an extensive oval-shaped atoll about 40 miles in circumference, 17 miles long in a northeasterly direction, and 9 miles wide. The reef was discovered on April 26, 1822, by the British whalers PEARL and HERMES, which were wrecked on the same night within 10 miles of each other. Within the outer reef is a lagoon in which are numerous coral reefs with deep water between. A wreck lies stranded on the eastern side of the reef. There are no known dangers outside the heavy breakers on the outer reef.

On the outer reef are seven small islets, six of which are on the southern side and one, **North Island,** on the northeastern side. There are also several sand banks that are awash at high water. **Southeast Island (27°47' N., 175°49' W.),** is the largest of the group. Westward

from Southeast Island are the other five islands on the southern side of the reef; **Bird and Sand Islands** are 1.3 and 2.6 miles westward, respectively. The islands are uninhabited, and except for a few ironwood trees, they are bare of shrubbery. There is a small pier on the north side of Southeast Island. At one time pearl fishers built several houses on Southeast Island but they are now in ruins. The cisterns built to catch and hold rainwater are now crumbling. Turtles and fish are abundant.

The 6-mile opening on the western side of the outer reef has depths of 1 to 6 feet and is studded with numerous coral heads. On the south side of the reef are two openings; the one between Southeast and Bird Islands is a small-boat opening with a least depth of 7 feet, and the other between Bird and Sand Islands has a channel with a least depth of 19 feet. Because of the numerous coral heads, extreme caution must be exercised when entering or navigating the lagoon.

**Anchorage** can be had off the western entrance to the lagoon in depths of 8 to 12 fathoms, or on the easterly side of the reef. Vessels have anchored midway between the southern entrances and about 0.6 mile off Bird Island in depths of 25 fathoms.

**Currents.**—The current appears to set northward between Lisianski Island and Pearl and Hermes Reef.

**Chart 4183.**—**Salmon Bank**, unsurveyed, lies about 60 miles southwestward from Southeast Island on Pearl and Hermes Reef. The least known depth on the bank is 30 fathoms.

**Gambia Shoal**, position doubtful, lies about 50 miles west-northwest of Southeast Island on Pearl and Hermes Reef. The shoal has a depth of 14 fathoms and the bottom can be plainly seen. About 22 miles northward of the charted position of Gambia Shoal is a bank with a least known depth of 39 fathoms.

**Charts 4185, 4188.**—**Midway Islands**, about 1,150 miles west-northwestward of Honolulu, were discovered in 1859 by Capt. N. C. Brooks, an American shipmaster on the Hawaiian vessel GAMBIA; possession was taken on behalf of the United States on September 30, 1867, by Capt. William Reynolds of the U.S.S. LACKAWANNA. The circular atoll is about 6 miles in diameter and encloses two islands. The encircling coral reef does not completely enclose the lagoon, but has a natural opening on the west side and a dredged opening on the south side. The reef is highest on the north side, where it is 3 feet or more above high water, and gradually lowers toward the south on the east and west sides. On the south side the reef is mostly submerged to a depth of as much as 3 feet at low water. Breakers are constantly in evidence on the seaward side of all parts of the reef. The reef rises abruptly from deep water and there are no off-lying rocks or shoals. The enclosed islands, which formerly were as much as 45 feet above the water, have been leveled off to maximum heights of 12 feet. There are patches of ironwood trees and some shrub growing in the sand. Midway Islands has a naval installation, commercial

airline facilities, and a cable station. Numerous birds find sanctuary and breeding grounds on the islands.

**Defensive sea areas.**—An executive order dated February 14, 1941, establishing defensive sea areas and airspace reservations at Johnston, Midway, and Wake Islands and Kingman Reef is quoted in part, as follows:

The territorial waters between the extreme high-water marks in the 3-mile marine boundaries surrounding Johnston, Midway, and Wake Islands and Kingman Reef, in the Pacific Ocean, are hereby established and reserved as naval defensive sea areas for purpose of national defense. Such areas to be known, respectively, as Johnston Island Naval Defensive Sea Area, Midway Island Naval Defensive Sea Area, Wake Island Naval Defensive Sea Area, and Kingman Reef Naval Defensive Sea Area; and the airspaces over the said territorial waters and islands are hereby set apart and reserved as naval airspace reservations for purposes of national defense, such reservations to be known, respectively, as Johnston Island Naval Airspace Reservation, Midway Island Naval Airspace Reservation, Wake Island Naval Airspace Reservation, and Kingman Reef Naval Airspace Reservation.

At no time shall any person, other than persons on public vessels of the United States, enter any of the naval defensive sea areas herein set apart and reserved, nor shall any vessel or other craft, other than public vessels of the United States, be navigated into any of said areas, unless authorized by the Secretary of the Navy.

At no time shall any aircraft, other than public aircraft of the United States, be navigated into any of the naval airspace reservations herein set apart and reserved unless authorized by the Secretary of the Navy.

The provisions of the preceding paragraphs shall be enforced by the Secretary of the Navy, with the cooperation of the local law-enforcement officers of the United States and of the Territory of Hawaii; and the Secretary of the Navy is hereby authorized to prescribe such regulations as may be necessary to carry out such provisions.

Any person violating any of the provisions of this order relating to the above-named naval defensive sea areas shall be subject to the penalties provided by section 44 of the Criminal Code as amended (U.S.C., title 18, sec. 96), and any person violating any of the provisions of this order relating to the above-named naval airspace reservations shall be subject to the penalties prescribed by the Civil Aeronautics Act of 1938 (52 Stat. 973).

**Restricted submarine haven area.**—The area, serving as a submarine haven, enclosed by lines joining the following points is restricted to all shipping unless otherwise authorized by naval authorities:

- (a) Latitude 28°06' N., longitude 177°21' W.
- (b) Latitude 27°42' N., longitude 177°21' W.
- (c) Latitude 27°42' N., longitude 177°48' W.
- (d) Latitude 28°01' N., longitude 177°48' W.
- (e) Latitude 28°06' N., longitude 177°30' W.

**Eastern Island** at the southeast end of the atoll, is triangular in shape, about 1.2 miles long, 6 to 12 feet high, and covered with trees, shrubbery, and coarse grass. Prominent from seaward are the low towers on the east-

ern side of the island and a large rectangular-shaped building on the northwestern side. A dredged channel leads from westward to a basin on the northwestern side of the island.

**Sand Island**, on the southerly side of the atoll, is about 2 miles long in a northwesterly direction, and is composed of white coral sand. Prominent from offshore are the numerous high towers, tanks, and radio towers of the naval and commercial installations, and a group of trees on the northern side of the island. An aviation light is in the north central part of the island.

**Welles Harbor** is the area inside the gap in the barrier reef on the west side of the atoll. The harbor was formerly used to a considerable extent as an anchorage by ships calling at Midway, but since the dredging of the ship channel and harbor between Sand and Eastern Islands, Welles Harbor is little used. Navigation in this area should not be attempted without local knowledge. The harbor is safe during the summer when the northeast trades blow steadily, but from October to April when gales are frequent with a rough westerly sea, the bar across the entrance breaks almost constantly. It is reported that vessels of not over 14-foot draft may cross the bar into Welles Harbor during smooth weather. There are no navigational aids and anchorage is not tenable in moderate to fresh winds. A depth of 6 feet may be taken from Welles Harbor to the main anchorage basin if a constant watch is maintained for coral heads.

**Channels.**—An entrance channel has been dredged through the southerly reef to a basin on the east side of Sand Island, a mooring basin northeastward of Sand Island, a small-boat basin at the northeast end of Sand Island, and a channel to Eastern Island with a basin on the northwest side. In June 1958 the controlling depth in the entrance channel was 37 feet; however, the depth is subject to change due to the shifting sands. For the latest information about the depth in the entrance channel and the controlling depths of the other channels, consult with the local naval authorities.

The entrance channel is marked by a lighted range, and lighted and unlighted buoys. A stranded LST is just outside the channel near Buoy 4. The other channels are marked with lights, and lighted and unlighted buoys.

**Anchorage.**—The main anchorage area northeastward of Sand Island provides several 500- and 750-foot radius berths. Mooring buoys have been established in depths of 31 feet, sand and coral bottom.

Outside the reef fair anchorage can be had during northeasterly winds in depths of 15 to 25 fathoms south of the western tip of Eastern Island. In winds from other directions, vessels should not attempt anchorage outside the reef.

The cable between San Francisco, Honolulu, Guam, and Manila touches at Midway Islands. To avoid fouling the cable anchorage is prohibited south and west of Sand Island.

**Directions.**—Vessels approaching Midway Islands are warned that the islands and surrounding waters out to the 3-mile limit are restricted. In approaching from any direction vessels will remain 3 miles off until south of

the entrance. They should then steer a northerly course heading directly between Sand and Eastern Islands until the channel is made out, then steer on the range. Due to the prevailing easterly winds and westerly set of current, caution must be exercised in entering. Drift and leeway should be anticipated and sufficient speed should be maintained at all times to control the vessel. See discussion of currents in the channel.

**Tides.**—The mean range of tide at Midway Islands is about 1 foot. The water inside the reef, generally calm, occasionally has strong surge and becomes extremely agitated by winter gales.

**Currents.**—The current off the main entrance channel usually sets to the westward, and is normally  $\frac{1}{4}$  to 1 knot. At the channel entrance the current sets southeastward, while in the channel it sets southward with a velocity of 2 to 6 knots. There is generally little current in Welles Harbor and it usually sets westward; it is reported that during heavy gales the harbor is full of strong currents caused by the sea being forced over the reefs.

**Weather.**—During the summer months the winds are generally variable and light, either from northeast, southeast, or southwest until about the middle of July, when fresh to strong northeast trades set in, continuing through July and August. Southwest winds are always accompanied with a low barometer, rain, and squalls. Rain also comes occasionally with northeast and southeast winds and a high barometer. Northwest winds following southwest storms generally indicate clearing weather.

During the winter months from October to April, gales frequently occur, working around from southeast through southwest to northwest. Occasionally a few days of fine weather will prevail but a rough westerly sea is always present.

**Harbor regulations.**—Vessels approaching Midway identify themselves with the NOB harbor control tower, Sand Island. All vessels must await positive permission from the tower to enter or leave the harbor. Pilots will board incoming vessels south of the entrance. No vessel except those operating locally from Midway will enter the channel without pilots.

The following harbor control signals are displayed from the signal tower on Sand Island:

One ball.—Channel open for entering.

One cone, point up.—Channel open for leaving.

One ball over a cone, point up.—Channel closed.

Two cones, points together.—Channel open for two-way traffic.

**Terminal facilities.**—At the northeastern end of Sand Island are two piers which have fuel and water connections, with depths of about 30 feet at the outer ends. In the submarine basin on the east side of Sand Island are several piers with depths of 21 to 30 feet alongside; these piers have fuel and water connections. There is also a pier in the basin on the northwest side of Eastern Island. Cranes, tugs, barges, and launches are available.

**Supplies.**—Provisions are available. Fuel oil, diesel oil, and water are not available for commercial use, except in case of emergency. Limited medical facilities are available.

**Repairs.**—Repairs can be made to small vessels.

**Communications.**—Telephone, teletype, radio, and cable systems are operated. A commercial airline stops at the islands.

**Chart 4185.**—**Nero Bank**, unsurveyed, lies about 30 miles west-southwestward from Sand Island, Midway Islands. The least known depth is 62 fathoms. Westward from Nero Bank is **Pogy Bank**, an extensive unsurveyed bank with a least known depth of 41 fathoms.

**Chart 4177.**—**Kure (Ocean) Island (28°25' N., 178°20' W.)**, an atoll that lies about 50 miles west-northwestward from Sand Island, Midway Islands. The atoll, closely resembling Midway Islands in both formation and appearance, is about 15 miles in circumference and somewhat oval in shape. A nearly continuous coral reef encloses the lagoon in which are coral heads and reefs with deeper water between. A break in the enclosing coral reef on the southwest side provides a shallow entrance about 1 mile wide.

**Green Island**, the largest on the atoll, is on the southeastern side of the reef. The island is about 20 feet high, covered with small shrubs, and is similar in appearance to Eastern Island of the Midway group. There is a tower, with radar reflector, at the Astronomical Station on the west side of the island. Westward of Green Island are several small islets, the largest of which is **Sand Island**, about 10 feet high. A landing can be made on the southwest end of Green Island by passing through a small break in the reef. Depths off the landing are 5 to 6 feet, with small coral heads and ledges.

The best anchorage is on the westerly side, near the northwesterly point of the breakers, in depths of 8 to 12 fathoms, rocky bottom. Vessels have anchored about 0.5 mile south-southwest of the south tip of Green Island in depths of 15 fathoms, sand and coral bottom. A bank with depths of 20 to 30 fathoms surrounds Kure Island. No dangers have been observed outside the reef. From the appearance of the islands, it may be assumed that they are sometimes visited by severe storms, the sand being thrown into numerous cones and pyramids.

**Currents.**—A set to the southward has been observed between Kure Island and Midway Islands. In the vicinity of Kure Island a continuous eastward current of about 2 knots during westerly weather has been reported.

**Chart 4183.**—**Bensaleux Reef (26°18' N., 178°44' W.)**, was reported in 1920 by the master of the American steamer **BENSALEUX** to be about 127 miles southward of Kure Island. Breakers appeared to be about 0.5 mile in extent in an east-west direction and indicated the existence of a reef. About 65 miles southeast of Bensaleux Reef breakers were observed in latitude 25°23' N., longitude 178°04' W., by the American steamer **ETHAN ALLEN** in 1923. The master reported that the swell appeared to mount up and occasionally break, as though over a shoal extending for about 2 or 3 miles in an east-west direction.

**Chart 4000.**—**Johnston (Cornwallis) Island (H.O. Chart 5356) (16°45' N., 169°31' W.)**, lies about 715 miles west-southwestward from Honolulu. The island was discovered in 1807 by Captain Johnston of H.M.S. **CORNWALLIS**; Lt. J. M. Brooke of the U.S. schooner **FENIMORE COOPER** landed and examined the island in 1859. The atoll formation consists of two islets lying on a reef, which extends in an arc for about 8 miles in a northeasterly direction. Northwestward of the reef the depths drop off rapidly, the 100-fathom curve being about 700 yards off. Southeastward and eastward of the reef the area is foul, with very irregular bottom, and the 100-fathom curve is as much as 10 miles from the reef.

**Johnston Island**, the southwesterly of the two islets, is about 0.8 mile long in a northeast direction and 200 to 600 yards wide. **Sand Island**, the northeasterly and smaller, is a mere sandbank about 500 yards in diameter and 1 mile from Johnston Island. The islets are covered with bunch grass and herbs, but have no bushes or brushwood. An airfield is located on Johnston Island and a seaplane landing area is in the lagoon between the islets and the barrier reef to the northwestward.

**Defensive sea area.**—Johnston Island, a Naval defensive sea area and airspace reservation, is closed to the public. No vessels or aircraft, except those authorized by the Secretary of the Navy, shall be navigated in or above the area within the 3-mile limit. The executive order establishing the area is quoted in the discussion of Midway Islands.

**Prominent features.**—Several towers and tanks on Johnston Island and a tower on Sand Island are prominent from offshore. An aviation light is near the center of Johnston Island.

**Channels.**—A channel has been dredged through the coral reef from southeastward of Johnston Island to a turning basin, within the lagoon, midway between Johnston and Sand Islands. From the turning basin, channels lead to Johnston Dock and Sand Dock. In August 1958 the controlling depth in the entrance channel was 16 feet. This channel is marked by a lighted range, buoys, and daybeacons.

For the latest information about the depth in the entrance channel and the controlling depths of the other channels, consult with the local naval authorities.

**Anchorage.**—Vessels drawing more than 19 feet should anchor in the approach area south of the entrance channel. This area has been swept to a depth of 25 feet as far as the 100-fathom curve, which is about 4 miles south of the turning basin. Vessels able to use the entrance channel may anchor in the turning basin or tie up at the Johnston or Sand Island docks.

**Directions.**—Vessels approaching Johnston Island are warned that the island and surrounding waters out to the 3-mile limit are restricted. The island should be approached from the southeastward. When near the entrance buoy vessels should heave-to and await the pilot. While heave-to, a drift to the west will be experienced. This drift must be checked as the exact limits of the foul area on the port hand are not determined. From the

entrance buoy the rangemarkers in line and bearing 000° lead through the channel and into the turning basin.

Care must be exercised to correct for currents and winds in the channel. See discussion of currents. An exposed coral head is on the starboard hand 300 feet before entering the turning basin. Vessels should diminish headway abreast this coral head. Shipmasters should depend on the pilot who is familiar with local ship movements and weather conditions to decide upon the proper anchorage.

**Tides.**—The mean range of the tide is about 2 feet.

**Currents.**—A current generally sets south in the channel. The velocity of the current seems to increase slightly with the ebb, but it is influenced by the amount of water piling into the lagoon over the barrier reef; it is estimated to be between 1 and 2 knots. Vessels with low power or with a relatively high wind area should favor the eastern side of the channel. A minimum speed of 8 knots should be maintained to overcome the effect of wind and current and this should be increased proportionally with unusual conditions. With heavy breakers on the barrier reef, there is a 2- to 3-foot surge in the lagoon.

**Weather.**—The weather is usually excellent for navigation. Winds average 10 to 15 knots in summer and about 15 knots in winter, blowing from the northeast about 90 percent of the time. During kona weather the winds shift to the south. Brief showers occur frequently but protracted bad weather is rare. Average annual rainfall is about 23 inches. Visibility is good, usually over 12 miles. There is no fog.

**Pilots.**—No vessel may enter or leave Johnston Island without a pilot. Vessels awaiting a pilot are requested to heave-to southward of the entrance.

**Harbor regulations.**—Entrance to the harbor at Johnston Island is not permitted at night. Vessels approaching the island after daylight and wanting to enter the harbor are requested to anchor 3 miles southward of Johnston Island and wait for daylight.

**Terminal facilities.**—Johnston Dock is about 400 feet long and will accommodate vessels with a maximum draft of 19 feet. Vessels tie up starboard side to. A breakwater is located eastward of the dock. Westward of the main dock is a small-boat dock with five 50-foot slips and a depth of 8 feet alongside. At Sand Island is a 60-foot quay wall in poor condition which is used only by station craft. Cargo-handling facilities include 3 small cranes of 30-ton maximum capacity.

**Supplies and repairs.**—Fuel oil and diesel oil can be obtained for small craft only. Repair facilities are available for local small craft. Limited medical facilities are available.

A bank with a depth of 7 to 8 fathoms over it lies about 7.7 miles eastward of the eastern end of Johnston Island.

**Novelty Shoal** was discovered by Capt. F. Herriman, master of the schooner NOVELTY, on May 21, 1897. He reported that with the eastern end of Johnston Island bearing 257°, distant 12 miles, he obtained soundings of 5½ fathoms, rocky coral bottom. The bottom was visible

for half an hour after this sounding was taken, while the vessel ran north for 2 miles. Light breakers were seen about 3 miles eastward while the vessel was passing over the shoal.

**Schjetman Reef (16°08' N., 173°58' W.)** was discovered by Captain Schjetman of the Norwegian ship ANNA on October 19, 1868. He reported that he passed at a distance of half a mile from a coral reef over which the sea was breaking. The reef appeared to be about 1.5 miles long north and south, about 0.5 mile wide, and level with the sea. Unsuccessful searches were made in 1880 and 1923 for the reef. In 1945, the reef was searched for by airplane within a radius of 20 miles from the charted position but was not found.

In 1945, sonar ranging gear gave distinct echoes of a suspected shoal or reef in latitude 16°25'10" N., longitude 178°22'10" W., a position about 40 miles northeastward of the charted position of Schjetman Reef.

A shoal, the existence of which is doubtful, has been reported in latitude 13°32' N., longitude 170°20' W. Another shoal, the existence of which is also doubtful, was reported in latitude 6°53' N., longitude 169°43' W.

**Wilder Shoal (8°17' N., 173°25' W.)** was sighted by Capt. W. Olsen, master of the schooner S. G. WILDER, on March 6, 1919. He reported passing close to a shoal about 100 feet in diameter, the depth over which, as close as soundings could be taken, was about 3 fathoms.

**H.O. Chart 5357.—Kingman Reef (6°25' N., 162°24' W.)** is a triangular atoll with its apex to the northward. The area within the 100-fathom curve is about 9.5 miles long in an east-west direction and 5 miles wide. The reef dries at low water on its northeastern, eastern, and southeastern edges. A small islet 3 feet high is on the eastern side. Along the southern and northeastern sides for a distance of about 2 miles westward of the portion which bares at low water are patches of 3 fathoms or less over which the sea breaks occasionally. Along the western side of the reef the encircling ridge has depths of 4 to 10 fathoms. In the lagoon the depths range from 10 to 45 fathoms, with numerous patches of 3 to 4 fathoms. Outside the encircling ridge the bank drops off rapidly to depths of 300 to 400 fathoms. Pending further surveys, the utmost caution should be used when navigating or anchoring in the area of Kingman Reef.

**Defensive sea area.**—Kingman Reef, a naval defensive sea area and airspace reservation, is closed to the public. No vessels or aircraft, except those authorized by the Secretary of the Navy, shall be navigated in or above the area within the 3-mile limit. The executive order establishing the area is quoted in the discussion of Midway Islands.

**Currents.**—Kingman Reef is within the belt of the east-going Equatorial Counter Current, which may reach a velocity of 1½ to 2 knots in the vicinity of the reef, par-

ticularly from September to March. The velocity does not usually exceed 1 knot from March to May.

**H.O. Chart 1839.—Palmyra Island** ( $5^{\circ}53'$  N.,  $162^{\circ}05'$  W.) is an atoll consisting of many small islets on a barrier reef that encloses three lagoons. The atoll was discovered by Captain Sawle of the American vessel PALMYRA on November 7, 1802; it was claimed by Hawaii in 1882 and by Great Britain in 1889, but it was annexed to the United States with Hawaii in 1898.

The barrier reef is about 5 miles long in an east-west direction and 1.5 to 2 miles wide. Extending about 2 miles eastward from the reef is shoal ground over which heavy blind rollers that occasionally break make it possible only to define the edges. The depths drop off rapidly to more than 100 fathoms, so soundings give no warning when approaching this danger.

A mass of small coral heads extends about 1 mile westward from the edge of the reef. These coral heads, either awash or nearly awash, lie so close together that it is almost impossible for a small boat to navigate between them. A bank extends westward from the coral heads for about 2.5 miles. The depth on the center of the bank is about 15 fathoms but surrounding the center is a ridge with depths of 6 to 10 fathoms. Outside the ridge the depths increase rapidly to 100 fathoms or more. The dredged channel enters through the western part of the reef and the deep-draft anchorage is on the western bank.

On the north and south sides of the reef the depths increase rapidly, the 100-fathom curve generally being within 500 yards of the reef.

The islets on the barrier reef are low, the highest being only about 6 feet above sea level, and are covered with coconut and other trees which are 30 to 100 feet high. **Barren Island**, the easternmost of the islets, is the only one not connected by the causeway which links the others.

**Warning.**—It is reported that fish caught at Palmyra Island may be poisoned. Many cases of violent fish poisoning have occurred, some with fatal consequences.

**H.O. Chart 5736.—Cooper Island**, the largest of the islets, is on the northern side of the atoll. **Menge Island** is immediately northwestward of Cooper Island and connected to it by a wide strip of land which gives the two the appearance of one continuous island. **Strawn Island** is the northwesternmost of the connected islets. **Sand Island**, at the southwest corner of the atoll, is connected to **Home Island** by the causeway. **Paradise Island** is eastward of Home Island. **Portsmouth Point**, the easternmost point of the connected islets, is on **Eastern Island**.

**West Lagoon**, the westernmost of the three lagoons, is the first entered from the dredged channel. The lagoon has large anchorage areas and a turning basin with a least width of 1,100 feet. **Center Lagoon** is connected to West Lagoon by a dredged channel. **East Lagoon** is completely surrounded by islets and reefs.

**Prominent features.**—The trees on the islets are usually

visible 12 to 15 miles. From a distance the islets appear to surround a single lagoon. A group of five radio towers, four of which may show lights at night, are located on Paradise Island. A radio tower on the northwestern side of Menge Island occasionally shows a light at night. An aviation light is shown from a water tower on Menge Island. An airport control tower may be seen on the western side of Cooper Island.

**Channels.**—A channel has been dredged through the southwestern part of the barrier reef to West Lagoon. The channel was dredged to a depth of 19 feet for a width of 200 feet, but is said to have shoaled to a depth of about 16 feet. Depths of 13 feet have been reported on the range line in the lagoon, but drafts able to use the entrance channel will find no difficulty in West Lagoon if a close watch is kept for shoal areas. A channel dredged to 10 feet connects West Lagoon and Center Lagoon. The entrance channel is marked by a range, buoys, and daybeacons.

**Anchorage.**—The best anchorage for deep-draft vessels is on the ledge westward of the atoll in depths of 9 fathoms, sand and coral bottom, with Strawn Island bearing  $073^{\circ}$ , distant about 2.5 miles, and the southwestern extremity of Sand Island bearing  $100^{\circ}$ . Vessels anchoring on the bank should endeavor to pick a light spot clear of a dark shadow. It is advisable not to attempt to anchor between sunset and sunrise.

Vessels of drafts able to use the entrance channel can anchor in West Lagoon, but the holding ground is only fair. While the mooring provided in the lagoon is considered sufficient, vessels should always be prepared to drop anchor if the wind picks up.

**Directions.**—Large vessels should approach the anchorage west of Palmyra Island with the island bearing  $090^{\circ}$ . When within 5 miles of the island on this course, it has the appearance of a horseshoe and the bight between the islands is easily discernible. Proceed directly for the center of the bight until the depth is about 9 fathoms approximately 2.5 miles from the extreme end of the islands. Except on the advice of the boarding officer, vessels should not pass northeastward of a line drawn from the fairway buoy and the buoy marking the foul ground westward of the island.

Vessels approaching the dredged channel should bring the aviation light to bear  $053^{\circ}$  well before reaching the fairway buoy. From the fairway buoy to the area beyond the daybeacon, vessels must use extreme care to stay on the range. Because of the northwestern set of the current, vessels are in danger of running aground on the northwestern side of the channel if not kept carefully on the range. This current is especially strong in the buoyed area before the daybeacons are reached. If visibility prevents seeing the range from the fairway buoy, vessels should keep centered using the daybeacons off Sand Island. If the daybeacons cannot be seen no attempt should be made to enter until the visibility improves. Once inside the lagoon, a watch must be maintained for shoal areas.

**Tides.**—The mean range of tide is about 2 feet.

**Currents.**—Strong and variable currents may be expected. Generally the current sets across the dredged channel from southeast to northwest, and is especially strong in the buoyed area before the daybeacons off Sand Island are reached.

**Tide rips.**—Dangerous tide rips have been reported 5 miles southwest of Palmyra Island.

**Weather.**—Palmyra Island has unfavorable weather, and is the only island in its latitude where fresh west-10 erlies occur. A tropical front which hovers in the vicinity of the island is caused by the meeting of the northeast and southeast trades. Northeast trades prevail, with an average velocity of 10 to 12 knots. There are frequent squalls of short duration and occasional wind up to 22 15

knots, but typhoons are very infrequent.

Rainfall is heavy and the humidity is high. The average annual rainfall is 142 inches. Rain occurs almost daily. Heavy rain squalls come up suddenly from the southwest. The only severe storm recorded was in the tropical cyclone of September 27, 1921. Cumulus and rain clouds cause frequent overcasts, but there is almost no fog.

**Terminal facilities.**—A 400-foot ship's pier, boat slips and a boat pier are located in West Lagoon. The ship's pier was reported in poor condition in 1951. A 4-ton movable crane is located on Cooper Island.

**Supplies.**—A limited supply of drinking water is available.

**Communications.**—There is occasional air service to Hawaii.

## APPENDIX

**COAST AND GEODETIC SURVEY.**—United States Coast Pilots, Tide Tables, Tidal Current Tables, and Tidal Current Charts: For sale by U.S. Coast and Geodetic Survey, Washington 25, D.C., also at its district offices and sales agencies, which are listed quarterly in the Notice to Mariners.

**United States Coast Pilots:**

- 1, Atlantic Coast, St. Croix River to Cape Cod, 1950.
  - 2, Atlantic Coast, Cape Cod to Sandy Hook, 1950.
  - 3, Atlantic Coast, Sandy Hook to Cape Henry, 1953.
  - 4, Atlantic Coast, Cape Henry to Key West, 1948.
  - 5, Gulf Coast, Puerto Rico, and Virgin Islands, 1958.
  - 7, Pacific Coast—California, Oregon, Washington, and Hawaii, 1959.
  - 8, Southeast Alaska, Dixon Entrance to Yakutat Bay, 1952.
  - 9, Alaska, Cape Spencer to Arctic Ocean, 1954.
- Distances between United States Ports, 1938.

A Coast Pilot for which a supplement has been issued should not be used except with reference to the latest issue of its supplement. Supplements may be obtained from the U.S. Coast and Geodetic Survey, Washington 25, D.C., or any of its district offices.

**Tide Tables:**

- Europe and West Coast of Africa.
- East Coast, North and South America.
- West Coast, North and South America.
- Central and Western Pacific Ocean and Indian Ocean.

**Tidal Current Tables:**

- Atlantic Coast, North America.
- Pacific Coast, North America and Asia.

**Tidal Current Charts:**

- Boston Harbor (1949).
- Narragansett Bay to Nantucket Sound (1955).
- Long Island Sound and Block Island Sound (1954).
- New York Harbor (1956).
- Delaware Bay and River (1948).
- Tampa Bay (1951).
- San Francisco Bay (1947).
- Puget Sound, Northern Part (1952).
- Puget Sound, Southern Part (1948).

**District Offices.**—**Los Angeles District**, 535 Subway Terminal Building, 417 South Hill St., Los Angeles 13, Calif. The Los Angeles District includes all of the State of Arizona; Clark County, Nev., and the following counties of California: San Bernardino, Kern, Santa Barbara, Ventura, Los Angeles, Orange, Riverside, San Diego, and Imperial.

**San Francisco District**, Room 121, Customhouse, San Francisco 26, Calif. The district includes all the State of Utah, and the parts of Nevada and California not assigned to the Los Angeles District.

**Portland District**, Room 314 U.S. Courthouse, Portland 5, Oreg. The district includes all the States of Montana, Idaho, and Oregon; and the following counties of Washington adjacent to the Columbia and Snake Rivers: Wahkiakum, Cowlitz, Clark, Skamania, Klickitat, Benton, Franklin, Walla Walla, Columbia, Garfield and Asotin.

**Seattle District**, Room 705, Federal Office Building, Seattle 4, Wash. The district includes the State of Washington except for those counties assigned to the Portland District, and the State of Alaska.

**Honolulu District**, Room 244, Federal Office Building, Honolulu 12, Hawaii. The district includes all the Hawaiian Islands.

**Coast and Geodetic Survey Sales Agents.**—Agents marked with an (\*) asterisk also handle certain U.S. Navy Hydrographic Office publications, and those marked with a (†) dagger also handle certain U.S. Coast Guard publications.

**California:**

- Berkeley:** R. L. Hinds Boat Co., 801 University Avenue.
- Crescent City:** Nielsen Hardware & Electric Co., 240 "T" Street.
- Downey:** Lakewood Boulevard Marina, Inc., 8863 South Lakewood Boulevard.
- Eureka:** † C. O. Lincoln & Co., 615 Fifth Street.
- Long Beach:** B & B Supply Co., 1845 West Anaheim Street; Bahia Brokerage & Boat Sales, 6262 East Pacific Coast Highway.
- Los Angeles:** Coast and Geodetic Survey District Office, 535 Subway Terminal Building, 417 South Hill Street; California Map Centre, 1100 South Hope Street.
- Monterey:** † Cincotta Bros., 203 Alvarado Street.
- Morro Bay:** Hortons, Box 635.
- Moss Landing:** Moss Landing Marine Supply, Post Office Box 55.
- Newport Beach:** Newport Supply Co., 2700 West Coast Highway; † South Coast Co., 23d at Central Avenue; Balboa Marine Hardware Co., 2537 West Coast Highway.
- North Hollywood:** \*† Pan American Navigation Service, 12021 Ventura Boulevard.
- Oakland:** † Harbor Marine Supply, 1025 Harrison Street.
- Oxnard:** Oxnard Sporting Goods, 235 West Fifth Street.

- Palo Alto: Glover Motor & Marine, 3705 El Camino Real.  
 Pittsburg: Pittsburg Yacht Harbor, Cutter and Waterfront.
- Richmond: Anchor Marine Co., 111 West Cutting Boulevard. 5
- San Carlos: Marine Air Crafts, 777 El Camino Real.  
 San Diego: \*†Arey-Jones Co., 983 Fourth Avenue; \*†Nuttall-Styris Co., 825 Columbia Street.
- San Francisco: Coast and Geodetic Survey District Office, Room 121, Customhouse; \*†Geo. E. Butler Co., Alaska Commercial Building, 356 California Street; \*†C. J. Hendry Co., 27 Main Street; \*†San Francisco Instrument Co., 510 Battery Street. 10
- San Pedro: \*†Marine Hardware Co., 304 South Beacon Street; \*†C. J. Hendry Co., 111-121 South Front Street; \*†Southwest Instrument Co., 235 West Seventh Street; \*†Globe Nautical Instrument Co., Inc., 121 West Seventh Street. 15
- San Rafael: The Anchorage, 115 Third Street.  
 Santa Barbara: John Wright & Sons, Marine Supplies-Service, Breakwater. 20
- Sausalito: †Bauman Bros. Yacht Service, Sausalito Yacht Harbor.
- Stockton: Morris Bros., 15 North Hunter Street.  
 Tahoe City: Tahoe Boat Co., Box 45D. 25
- Vallejo: Vallejo Boat Center, 823 Wilson Avenue.  
 Venice: Jeffries Boats, Inc., 4160 Lincoln Boulevard.
- Oregon:**  
 Astoria: Englund Marie Supply Co., foot of 15th Street.  
 Coos Bay: Independent Stevedore Co., Inc. 30  
 Newport: †Englund Marine Supply Co., 252 Southwest Bay Boulevard.  
 North Bend: Oregon-Pacific Co., Inc.  
 Portland: †Coast and Geodetic Survey District Office, Room 314 U.S. Courthouse, 620 Southwest Main Street; \*†Frank H. Parks, 213 Southwest Washington Street; †Portland Instrument Co., 330 Southwest Fifth Avenue. 35
- Washington:**  
 Anacortes: †Marine Supply & Hardware; †Transmission Supply, 902 Commercial Street. 40  
 Bellingham: †Griggs, Stationers & Printers, 120 East Holly Street.  
 Bremerton: Bremerton Marine Supply, Inc., 2332 Sixth Street. 45  
 Everett: Black & King, 2944 Colby Avenue; Robinson Marina, 19th and Norton Streets.  
 Friday Harbor: †Friday Harbor Drug Co.  
 Hoquiam: Industrial & Marine Supply Co., 701 Levee Street. 50  
 Kelso: Cowlitz Marina, 88 Catlin West.  
 Neah Bay: Washburns General Merchandise.  
 Oak Harbor: Chuck Dann's Sporting Goods, Inc., 1150 West Pioneer Way.  
 Olympia: The Marina, Columbia and B. 55  
 Port Angeles: †Willson Hardware Co., 111 West First Street.  
 Seattle: Coast and Geodetic Survey District Office, Room 705, Federal Office Building; †Marina Mart Hardware, 1520 Westlake Avenue North; \*†Northwest 60
- Instrument Co., Inc., 2313 Third Avenue; †Shrock, The Compass Adjuster, Fisherman's Dock; †Shrock, The Compass Adjuster, 1117 East North Lake Avenue; \*†Max Kuner Co., 1324 Second Avenue; \*†Metsker Maps, 1020 Third Avenue.
- Tacoma: †The Stationers, Inc., 926 Pacific Avenue; \*†Metsker Maps, 111 South 10th Street.
- Hawaii:**  
 Honolulu: Coast and Geodetic Survey District Office, Federal Office Building; †McWayne Marine Supply, Ltd., Kewalo Basin.
- PUBLICATIONS.**—A résumé of the U.S. Government publications of navigational value is included for the ready reference of the mariner. In addition to the agents located in the principal seaports handling sales publications, certain libraries have been designated by the Congress of the United States to receive the publications as issued for public review.
- Nautical Charts.**—Coasts of the United States and Possessions: published by U.S. Coast and Geodetic Survey; for sale by C&GS and its sales agents.  
 Mississippi River (Cairo, Ill., to Gulf of Mexico): Published and for sale by Mississippi River Commission, Vicksburg, Miss.  
 Mississippi River (Cairo, Ill., to Minneapolis, Minn.) and Illinois Waterway (Mississippi River to Lake Michigan): published and for sale by U.S. Army Engineer District, Chicago, Ill.  
 Great Lakes, Lake Champlain, New York State Canals, and the St. Lawrence River-St. Regis to Cornwall, Canada: Published and for sale by U.S. Lake Survey, Detroit, Mich.  
 Foreign countries: Published by U.S. Navy Hydrographic Office; for sale by H.O. and its sales agents.
- Coast Pilots.**—Coasts of the United States and Possessions: Published by U.S. Coast and Geodetic Survey; for sale by C&GS and its sales agents.  
 Great Lakes Pilot published and for sale by U.S. Lake Survey, Detroit, Mich.
- Foreign countries.**—Sailing Directions: Published by U.S. Navy Hydrographic Office; for sale by H.O. and its sales agents.
- Tide and Tidal Current Tables, and Tidal Current Charts.**—Published by U.S. Coast and Geodetic Survey; for sale by C&GS and its sales agents.
- Notices to Mariners** may be obtained free from the following: Local Notices to Mariners—District Commander of the local Coast Guard district; Weekly Notice to Mariners, Part I (Western Hemisphere Edition)—Commandant, U.S. Coast Guard; Weekly Notice to Mariners, Part II (Eastern Hemisphere Edition)—U.S. Navy Hydrographic Office; Weekly Notice to Mariners, Great Lakes—Commander, Ninth Coast Guard District, Cleveland, Ohio.
- Light Lists.**—United States and Possessions: Published by Coast Guard; for sale by the Superintendent of Documents and his sales agents.  
 Foreign countries: Published by U.S. Navy Hydrographic Office; for sale by H.O. and its sales agents.

**Radio.**—Radio Navigational Aids (H.O. Pub. No. 205), Radio Weather Aids (H.O. Pub. No. 206), Weather Station Index (H.O. Pub. No. 207), and International Code of Signals, Vol. II. Radio (H.O. Pub. No. 88) : Published by U.S. Navy Hydrographic Office; for sale by H.O. and its sales agents.

**Miscellaneous.**—American Nautical Almanac and American Ephemeris and Nautical Almanac : Published by United States Naval Observatory; for sale by Superintendent of Documents and his sales agents.

American Practical Navigator (Bowditch) (H.O. Publication No. 9), and International Code of Signals, Volume I—Visual (H.O. Publication No. 87) : Published by U.S. Navy Hydrographic Office; for sale by H.O. and its sales agents.

Rules to Prevent Collisions of Vessels and Pilot Rules for Certain Inland Waters of the Atlantic and Pacific Coasts and of the Coast of the Gulf of Mexico (CG-169), Pilot Rules for the Western Rivers and the Red River (CG-184), and Pilot Rules for the Great Lakes and Their Connecting and Tributary Waters and the St. Marys River (CG-172) : Published by and free on application to the U.S. Coast Guard.

Port Series of the United States : Prepared by the Corps of Engineers, U.S. Army, in cooperation with the Maritime Administration, U.S. Department of Commerce; for sale by the Superintendent of Documents.

**CORPS OF ENGINEERS, U.S. ARMY, Districts.**—Los Angeles District Office: 751 South Figueroa Street, Los Angeles 17, Calif.

The district comprises those drainage basins tributary to the Pacific Ocean that are in California between the Mexican boundary and Cape San Martin (about 265 miles north of the entrance to Los Angeles Harbor); the entire Colorado River drainage basin, which is in southeastern California, southeastern Nevada, southern and eastern Utah, southwestern Wyoming, western Colorado, western New Mexico, and Arizona; that part of the Great Basin that is in southwestern Utah, southern Nevada, and southeastern California; and the U.S. parts of those small drainage basins in southern Arizona and southwestern New Mexico west of the Continental Divide that drain southward into Mexico.

**San Francisco District Office:** 180 New Montgomery Street, San Francisco 19, Calif.

The district comprises parts of southern Oregon and northern and western California embraced in the drainage basins tributary to the Pacific Ocean from the Oregon-California State line on the north to Cape San Martin, Calif. (about 150 miles south of the entrance to San Francisco Bay), on the south, except the waters of Suisun Bay and the Sacramento and San Joaquin Rivers and their tributaries.

**Sacramento District Office:** 1209 Eight Street, Sacramento 8, Calif.

The district comprises the basins of Suisun Bay and the San Joaquin and Sacramento Rivers, in California, and Goose Lake in Oregon; the basins of the Great Salt

Lake and Sevier Lake, in Utah; and the intervening portion of the Great Basin in northern Nevada and northern California.

**Portland District Office:** 628 Pittock Block, Southwest, 10th Avenue and Washington Street, Portland 5, Oreg.

The district includes the southerly portion of the State of Washington which lies within the watershed of Columbia River and tributaries downstream from a point between the Klickitat River and Rock Creek; that portion of the State of Oregon within the Columbia River watershed below the John Day damsite and west of the watershed of John Day River and tributaries, together with south central Oregon west of Malheur River and Steens Mountain, but not including that part which drains into Klamath Lake and River. The coastal drainage area of Oregon is also included.

**Seattle District Office:** 1519 South Alaskan Way, Seattle 4, Wash.

The district comprises all of Washington except the southern and southeastern portions, northern Idaho, and northwestern Montana embraced in the drainage basins tributary to the Pacific Ocean south of the international boundary to Cape Disappointment, and to the Columbia River above the Yakima River, inclusive.

**Walla Walla District Office:** Building 602, City-County Airport, Walla Walla, Wash.

The district comprises southeastern Washington, exclusive of the watershed of the Columbia River and tributaries above and including the Yakima River, Wash.; all of Idaho except the northern part and a small southeastern portion; a portion of western Wyoming; a small part of northwestern Utah; part of northeastern Nevada; and a part of eastern Oregon.

**Honolulu District Office:** Ala Moana and South Street, Honolulu 4, Hawaii.

The district comprises the Hawaiian, Line, Gilbert, Marshall, Midway, Wake, and Johnston Islands, and such islands in the South Pacific Ocean lying between the 159th meridian of east longitude and 108th meridian of west longitude as may be under the jurisdiction of the United States.

**COAST GUARD.**—Commander, 11th District. The 11th Coast Guard District, with district office at 706 Times Building, Long Beach 2, Calif., shall comprise: Arizona; Clark County in Nevada, and the southern part of California comprising the counties of Santa Barbara, Kern and San Bernardino, and all counties south thereof.

Captain of the Port Office, Coast Guard Air Station, P.O. Box 2409, San Diego 12, Calif. All navigable waters of the United States and contiguous land areas within the following boundaries: A line extending from Point Loma Light north to 32°45'00" N., thence east to 117°05'00" W., thence south to 32°35'00" N., thence west to 117°08'00" W., thence in a northwesterly direction to Point Loma Light.

Captain of the Port Office, Los Angeles, P.O. Box 1251, Long Beach, Calif. All navigable waters of the United States and contiguous land areas within the following

boundaries: On the south the 33°42.00' N. parallel, on the west the 118°18'00' W. meridian, on the north the 33°47'00' N. parallel, and on the east the 118°05'00' W. meridian.

**Commander, 12th District.** The 12th Coast Guard District, with district office at 630 Sansome Street, San Francisco 26, Calif., shall comprise: Utah, Nevada, except Clark County; and the northern part of California comprising the counties of San Luis Obispo, Kings, Tulare and Inyo, and all counties north thereof.

Captain of the Port Office, Pier 45½, San Francisco 11, Calif. All navigable waters of the United States and contiguous land areas within the following boundaries: A line extending from Point Reyes Light in a north-northeasterly direction to a point located at 38°16'00' N., 122°42'00' W., thence in a general northeasterly direction to 38°38'00' N., 121°24'00' W., thence in a south-south-easterly direction to 37°57'00' N., 121°12'00' W., thence in a southwesterly direction to 37°15'00' N., 121°54'00' W., thence in a northwesterly direction to Point Reyes Light.

**Commander, 13th District.** The 13th Coast Guard District, with district office at 618 Second Avenue, Seattle 4, Wash., shall comprise: Washington, Oregon, Idaho, and Montana.

Captain of the Port Office, P.O. Box 7743, Albina Station, Portland 12, Oreg. All navigable waters of the United States and contiguous land areas within the following boundaries: A line extending from a point at 46°20'00' N., 123°05'00' W., southeasterly to a point at 46°00'00' N., 122°30'00' W., thence south to the 45°45'45' N. parallel; thence east to the 121°05'00' W. meridian; thence south to the 45°20'00' N. parallel; thence west to the 122°45'00' W. meridian; thence northwesterly to a point at 45°45'00' N., 123°05'00' W.; thence north to the 46°20'00' N. parallel. Additionally the following area in the vicinity of Astoria, Oreg.: All navigable waters of the United States and contiguous land areas within the following boundaries: A line extending from the Columbia River Lightship northeasterly to a point at 46°20'00' N., 124°00'00' W.; thence east to the 123°15'00' W. meridian; thence south to the 46°05'00' N. parallel; thence west to the 123°56'00' W. meridian; and thence northwesterly to the Columbia River lightship.

Captain of the Port Office, Pier 70, Foot of Broad Street, Seattle 1, Wash. All navigable waters of the United States and contiguous land areas within the following boundaries: A line extending from a point located at 47°00'00' N., 122°00'00' W., north to the United States-Canadian International Boundary line; thence west and southerly along said boundary line to a junction with the 123°20'00' W. meridian; thence south to the 47°00'00' N. parallel; thence east to the point of beginning.

**Commander, 14th District.** The 14th Coast Guard District, with district office at 1347 Kapiolani Boulevard, Honolulu, comprises: Hawaii and the Pacific Islands belonging to the United States south of latitude 40° N., and west of a line running from 40° N., 150° W. through latitude 5° S., 110° W.

Captain of the Port Office, Pier 11, Honolulu. All nav-

igable waters of the United States and contiguous land areas within the following boundaries: On the east the 154°00'00' W. meridian, on the south the 18°00'00' N. parallel, on the west the 162°00'00' W. meridian, and on the north the 23°00'00' N. parallel.

**Lifeboat Stations.**—The lifeboat stations operated by the Coast Guard on the Pacific coast are:

Monterey, Calif. (No. 308), 36°36.5' N., 121°53.8' W. At the foot of Monterey Breakwater.

Fort Point, Calif. (No. 310), 37°48.3' N., 122°27.9' W. On Presidio, 0.8 mile east of Fort Point Light.

Point Reyes, Calif. (No. 313), 37°59.8' N., 122°58.3' W. Drakes Bay, 2.6 miles east of Point Reyes Light.

Humboldt Bay, Calif. (No. 316), 40°46.0' N., 124°13.0' W. East side of North Spit at entrance to Humboldt Bay.

Port Orford, Oreg. (No. 318), 42°44.3' N., 124°30.5' W. At head of Nelly Cove.

Coos Bay, Oreg. (No. 320), 43°20.9' N., 124°19.8' W. South side of entrance to Coos Bay, about 0.3 mile east of Coos Head.

Umpqua River, Oreg. (No. 321), 43°39.9' N., 124°11.9' W. Southeast side of river entrance near light.

Yaquina Bay, Oreg. (No. 323), 44°37.6' N., 124°03.3' W. Newport waterfront, northerly side of bay, near bridge.

Tillamook Bay, Oreg. (No. 325), 45°33.5' N., 123°55.2' W. North shore at Garibaldi.

Point Adams, Oreg. (No. 326), 46°12.0' N., 123°56.8' W. At Hammond, 0.8 mile southeast of Fort Stevens.

Cape Disappointment, Wash. (No. 327), 46°16.8' N., 124°02.9' W. Southwest side of Baker Bay.

Willapa Bay, Wash. (No. 329), 46°42.5' N., 124°58.0' W. At end of Toke Point.

Grays Harbor, Wash. (No. 330), 46°54.5' N., 124°06.6' W. About 0.1 mile southwest of Point Chehalis Range Rear Light.

Quillayute River, Wash. (No. 331), 47°54.5' N., 124°38.0' W. About 0.8 mile east-northeast of James Island Light.

Neah Bay, Wash. (No. 332), 48°22.2' N., 124°35.8' W. About 0.4 mile south of southwesterly tip of Waada Island.

**UNITED STATES CUSTOMS DISTRICTS.**—The first-named ports in the following list are the headquarters ports. An asterisk (\*) precedes the names of ports authorized to issue marine documents.

**San Diego District:** The limits are the counties of San Diego and Imperial in the State of California.

Port of entry: \*San Diego.

**Los Angeles District:** The limits are that part of the State of California lying south of the northern boundaries of the counties of San Luis Obispo, Kern, and San Bernardino, except the counties of San Diego and Imperial.

Ports of entry: \*Los Angeles (including San Pedro, Wilmington, Long Beach, El Segundo); Port San Luis.

**San Francisco District:** The limits are that part of the State of California lying north of the northern boundaries of the counties of San Luis Obispo, Kern, and San Bernardino.

Ports of entry: \*San Francisco-Oakland (including all points on the San Francisco Bay); \*Eureka.

**Portland District:** The limits are the State of Oregon and that part of the State of Washington which embraces the waters of Columbia River and the north bank of said river west of longitude 119° W.

Ports of entry: \*Portland, \*Astoria, \*Coos Bay, Longview, Newport.

**Seattle District:** The limits are the State of Washington except that part which embraces the waters of the Columbia River and the north bank of the said river west of longitude 119° W.

Ports of entry: \*Seattle, \*Aberdeen, Anacortes, \*Bellingham, Blaine, Everett, Friday Harbor, Neah Bay, Northport, Olympia, \*Port Angeles, \*Port Townsend, \*Tacoma, South Bend-Raymond.

**Honolulu District:** The limits include all of Hawaii.

Ports of entry: \*Honolulu, Hilo, Kahului, Port Allen.

**PUBLIC HEALTH SERVICE.—Quarantine Stations** where supervision of quarantine and medical examination of aliens are performed:

**San Diego:** Medical Officer in charge, Room 208, New Post Office Building, San Diego 1, Calif.

**San Pedro:** Medical Officer in charge, Terminal Island, P.O. Box 97, San Pedro, Calif.

**San Francisco:** Medical Officer in charge, foot of Hyde Street, San Francisco 9, Calif.

**Seattle:** Medical Officer in charge, Room 35, Federal Office Building, Seattle 4, Wash.

**Honolulu:** Medical Officer in charge, P.O. Box 1410, Honolulu, Hawaii.

Additional ports of entry at which quarantine inspection and/or medical examination of aliens are performed:

Port Hueneme, Port San Luis, Eureka, Fort Bragg, Calif.; Coos Bay, Longview, Newport, Portland, Ore.; Aberdeen, Anacortes, Bellingham, Blaine, Everett, Olympia, Port Angeles, Port Townsend, South Bend-Raymond, Spokane, Tacoma, Wash.; Hilo, Kahului, Port Allen, Hawaii.

**Hospitals:**

San Francisco: 15th Avenue and Lake Street, San Francisco 18, Calif.

Seattle: 1131 14th Avenue, South, Seattle 14, Wash.

**Outpatient Clinics:**

San Diego: 208 New Post Office Building, San Diego 1, Calif.

San Pedro: 308 Federal Building, 825 South Beacon Street, San Pedro, Calif.

Los Angeles: 424 Federal Building, 312 North Spring Street, Los Angeles 12, Calif.

Portland: 220 U.S. Courthouse, Broadway and Main Streets, Portland 5, Ore.

Honolulu: 208 Federal Building, Honolulu 7, Hawaii.

**Outpatient Offices:**

Eureka, Calif.: Medical-Dental Building, 630 Seventh Street.

Astoria, Ore.: 486 12th Street.

Coos Bay, Ore.: 510 Hall Building, 320 West Central Avenue.

Newport, Ore.: 625 South Hubert Street.

5 Aberdeen, Wash.: 700 Becker Building, 110 South First Street.

Anacortes, Wash.: Medical-Dental Building, 418 Commercial Avenue.

Bellingham, Wash.: 511 Herald Building, 1155 State Street.

Everett, Wash.: 3202 Colby Avenue.

Olympia, Wash.: 529 West Fourth Street.

Port Townsend, Wash.: 1136 Water Street.

Tacoma, Wash.: 1408 Medical Arts Building, 3701 Sixth Avenue.

**IMMIGRATION and NATURALIZATION.—Offices of these services are in the following places:**

20 **California:**

San Diego: Room 121, 325 West F Street, San Diego 1, Calif.

Los Angeles: 458 South Spring Street, Los Angeles 13, Calif.

25 **San Pedro:** Terminal Island.

San Luis Obispo: 793 Higuerra Street, San Luis Obispo, Calif.

San Francisco: Appraisers Building, 630 Sansome Street, San Francisco 11, Calif.

30 **Sacramento:** 470 Federal Building, Sacramento 9, Calif.

**Oregon:**

Portland: Room 333, U.S. Courthouse Building, Broadway and Main Streets, Portland 5, Ore.

**Washington:**

35 **Aberdeen:** U.S. Post Office Building, Second and G. Streets, Aberdeen, Wash.

Anacortes: U.S. Post Office Building, Sixth and Commercial Streets, Anacortes, Wash.

Bellingham: U.S. Post Office Building, 217 Samish Highway, Bellingham, Wash.

40 **Port Angeles:** U.S. Post Office Building, First and Oak Streets, Port Angeles, Wash.

Seattle: 815 Airport Way, Seattle 4, Wash.

Tacoma: U.S. Post Office Building, 11th and A Streets, Tacoma 1, Wash.

45 **Hawaii:**

Honolulu: Ala Moana Boulevard, Honolulu 9.

50 **LEGAL HOLIDAYS.—**In the areas covered by this Coast Pilot, the following holidays are observed throughout:

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; Labor Day; November 11, Veterans Day; Thanksgiving Day; December 25, Christmas Day.

In addition, Hawaii observes: March 26, Kuhio Day; Good Friday; and June 11, Kamehameha Day. Cali-

California observes its Admission Day, September 9. California, Oregon, and Washington observe Lincoln's Birthday, February 12.

**YACHT CLUBS.**—Yacht clubs active in the area covered by this Coast Pilot include:

**California:**

Alameda: Aeolian Yacht Club; Encinal Yacht Club.  
Alviso: South Bay Yacht Club.  
Belmont: Carlmont Yacht Club.  
Beverly Hills: Emerald Bay Yacht Club, 9510 Cherokee Lane.

Long Beach: Alamitos Bay Yacht Club, 5437 East Ocean Boulevard; Corsair Yacht Club.

Los Angeles Harbor: California Cruising Club; Los Angeles Yacht Club, foot of Barracuda Street, Terminal Island; Transpacific Yacht Club; West Coast Yacht Club; Cabrillo Beach Yacht Club, foot of Miner Street.

Manhattan Beach: Blue Water Cruising Club, 1966 Ardmore Street.

Moss Landing: Elkhorn Yacht Club.

Newport Bay: Balboa Yacht Club, 1801 Bayside Drive; Jonathan Yacht Club; Lido Isle Yacht Club, 701 via Lido Sud; Newport Harbor Yacht Club, 720 West Bay Avenue.

Pebble Beach: Stillwater Yacht Club.

Sacramento: Sacramento Yacht Club, Miller Park.

San Diego Bay: Coronado Yacht Club, Glorietta Bay; La Jolla Corinthian Yacht Club, Mission Bay; Mission Bay Yacht Club; San Diego Yacht Club, Point Loma; Silver Gate Yacht Club, 990 Yacht Harbor Drive; Southwestern Yacht Club, 2702 Qualtrough Street.

San Francisco Bay: Berkeley Yacht Club, foot University Avenue; Corinthian Yacht Club of San Francisco, Tiburon; Oakland Yacht Club, 1045 19th Avenue; Palo Alto Yacht Club, South Bay; Point San Pablo Yacht Club, Point Richmond.

San Rafael: Marin Yacht Club.

Santa Barbara: Santa Barbara Yacht Club.

Santa Cruz: Santa Cruz Yacht Club, Municipal Pier.

Santa Monica Bay: South Coast Corinthian Yacht Club, Santa Monica; Win'ard Yacht Club, foot of 10th Street, Redondo Harbor.

Stockton: Delta Yacht Club, Tule Isle; Stockton Sailing Club; Stockton Yacht Club, Calaveras River.

Vallejo: Vallejo Yacht Club, Mare Island Boulevard.

Ventura: Ventura County Boat Club, 692 Front Street.

**Oregon:**

Eugene: Eugene Yacht Club, Fern Ridge Lake.

Portland: Columbia River Yacht Club, 7919 Northeast Marine Drive; Oregon Yacht Club, Oaks Park; Portland Yacht Club, 1241 Northeast Marine Drive; Rose City Yacht Club, 7903 Northeast Marine Drive.

St. Helens: St. Helens Yacht Club.

**Washington:**

Anacortes: Anacortes Yacht Club.

Bellingham: Bellingham Yacht Club, foot of Cornwall Avenue.

Everett: Everett Yacht Club, foot of Bond Street.

Franklin D. Roosevelt Lake: Grand Coulee Dam Yacht Club.

Lake Washington: Meydenbauer Bay Yacht Club.

Longview: Longview Yacht Club, Fisher Island Channel.

Olympia: Olympia Yacht Club, foot of Simmons Street.

Seattle: Corinthian Yacht Club of Seattle, 120 Lakeside

South; Seattle Yacht Club, 1807 Hamlin Street; Tyee Yacht Club.

Tacoma: Tacoma Yacht Club, Point Defiance Park.

**Hawaii:**

Honolulu: Hawaii Yacht Club, Ala Moana Road; Waikiki Yacht Club, Ala Moana Yacht Harbor.

Kaneohe: Kaneohe Yacht Club, Kaneohe, Oahu.

**FEDERAL COMMUNICATIONS COMMISSION.**—Dis-

trict field offices:

Los Angeles: Room 1425, U.S. Post Office Building, Los Angeles 12, Calif.

San Francisco: Room 323A, U.S. Customhouse, 555 Battery Street, San Francisco 26, Calif.

Portland: Room 507, New U.S. Courthouse Building, 620 Southwest Main Street, Portland 5, Oreg.

Seattle: Room 802, Federal Office Building, Seattle 4, Wash.

Honolulu: Room 502, Federal Building, Honolulu 1, Hawaii.

**WEATHER BUREAU.**—Offices: Barometers may be compared with standards at the following offices:

San Diego, Calif.: Lindbergh Municipal Airport.

Los Angeles, Calif.: Room 1752, Post Office Building.

San Francisco, Calif.: Room 216, Customhouse, 555 Battery Street.

Oakland, Calif.: Oakland Municipal Airport.

Eureka, Calif.: Weather Bureau Office.

Astoria, Oreg.: Clatsop County Airport.

Portland, Oreg.: Customhouse Building.

Seattle, Wash.: Room 703, Federal Building.

Honolulu, Hawaii: Weather Bureau Office, Pier 2.

**Radiotelephone broadcasts by U.S. Coast Guard.**—Im-

portant notices to mariners, hydrographic information, storm warnings, advisories, and other urgent information are broadcast at scheduled times on indicated frequencies. Emergency broadcasts are made immediately following receipt of the information by the radio station; the information will be reported on the next scheduled broadcast unless cancelled or superseded.

All broadcasts are preceded by preliminary announcement on 2182 kcs.

NMQ, Long Beach, Calif., 2694 kc., 0900 and 2100 PST.

NMC, San Francisco, Calif., 2662 kc., 0830 and 2030 PST.

NMW, Seattle, Wash., 2702 kc., 0930 and 2130 PST.

NMO, Honolulu, Hawaii, 2686 kcs., 1130 and 2330 HST.

**Radiotelegraph broadcasts by U.S. Coast Guard.**—Storm and hurricane warnings, advisories, and other urgent marine information are broadcast by radiotelegraph at the scheduled times and indicated frequencies, preceded by an initial call on 500 kcs. Emergency broadcasts are made during the first silent period after receipt.

NMQ, Long Beach, Calif., 472 kc., 0920 and 2020 PST.

NMC, San Francisco, Calif., 486 kc., 0900 and 2000 PST.

NMW, Seattle, Wash., 440 kc., 0900 and 2030 PST.

NMO, Honolulu, Hawaii, 440 kc., 1100 and 1930 HST.

**Weather Broadcasts by Commercial Radio Stations.**—The following commercial radio stations have installed microphones in nearby Weather Bureau offices, from which forecasts and summaries are broadcast on the schedules indicated:

San Diego, Calif., KGB, 1360 kc., 0815, 1445, 1530 daily; 0745 and 1445 Saturdays and Sundays. KFSD, 600 kc., 25 0735 and 0830 every day; 1215 weekdays.

Los Angeles, Calif., KMPC, 710 kc., 0540 every day.

Long Beach, Calif., KGER, 1390 kc., 1655 daily.

Eureka, Calif., KIEM, 1480 kc., 0610, 1206, 1605, 2130 every day. KENL, 1340 kc., 0650, 1206, 1605, and 2130 30 every day.

Portland, Oreg., KPOJ, 1330 kc., 0800, and 1430 daily. KOIN, 970 kc., 1215 daily and Saturday. KLIQ, 1290 kc., 0730, 1230, and 1530 daily and Saturday. KGW, 620 kc., 0725, 1815 daily; 1815 Saturdays.

Astoria, Oreg., KVAS, 1230 kc., 1215 daily and Saturday. KAST, 1370 kc., 1840 daily; 1845 Saturdays and Sundays.

Seattle, Wash., KOMO, 1000 kc., 0720, 0805, 1230, 1730, and 2220 daily; 0730, 1230, 1730, and 2220 Saturdays; 1030, 1830, and 2220 Sundays. KIRO, 710 kc., 0710, 0820, 1730, and 2200 daily; 0710, 1730, and 2200 Saturdays; 2200 Sundays. KAYO, 1150 kc., 0655, 0835, 1230, 1741, and 2155 daily; 0655, 0835, 1230, 1741, and 2155 Saturdays; 0955, 1755, and 2200 Sundays.

Olympia, Wash., KGY., 1240 kc., 1230 every day.

Longview, Wash., KWLK, 1400 kc., 1825 daily.

Bremerton, Wash., KBRO, 1490 kc., 0655, 0955, 1155, 1755, 2155, and 2355 daily; 0655, 0955, 1155, 1755, and 2355 Saturdays; 0955, 1155, 1755, 2155, and 2355 Sundays. Aberdeen, Wash., KXRO, 1320 kc., 1225 daily and Saturdays.

Honolulu, Hawaii, KHVH, 1040 kc., 0710, 0740, and 1215 daily and Saturdays. KGU, 760 kc., 0710, 0740, 1210, and 1810 daily; 0710, 0740, and 1210 Saturdays; 0900 Sundays. Hilo, Hawaii, KIPA, 1110 kc., 0710 and 1210 daily and Saturdays; 0900 Sundays. KILA, 850 kc., 0710 and 0740 daily and Saturdays.

Lihue, Hawaii, KTOH, 1490 kc., 0710, 0740, 1210, and 1830 daily and Saturdays; 0900 and 1825 Sundays.

Wailuku, Hawaii, KMVI, 550 kc., 0710, 0740, 1210, and 60

1810 daily; 0710, 0740, and 1210 Saturdays; 0900 Sundays.

**STORM WARNING STATIONS.**—Weather Bureau listing of display stations in the area covered by this coast pilot follow. DN indicates day and night display; D, day display only; W, no display, posted warnings only.

**California:**

- DN Cabrillo National Monument; 32°40.3', 117°14.4'.  
 10 D Coronado Yacht Club; 32°40.8', 117°10.5'.  
 D Point Loma Navy Electronics Lab.; 32°42.0', 117°15.0'.  
 DN San Diego, Shelter Island; 32°42.5', 117°14.0'.  
 D San Diego, Naval Air Station; 32°42.6', 117°11.7'.  
 15 DN San Diego, Municipal Pier No. 2; 32°43.0', 117°10.5'.  
 DN San Diego, Mission Beach; 32°45.6', 117°14.8'.  
 DN Avalon, Pleasure Pier; 33°20.6', 118°19.5'.  
 DN Newport Beach Harbor; 33°36.2', 117°53.0'.  
 DN San Pedro; 33°43.2', 118°16.2'.  
 20 D Los Angeles, Terminal Island; 33°43.9', 118°15.8'.  
 DN Long Beach; 33°44.9', 118°12.9'.  
 D Wilmington; 33°46.0', 118°15.0'.  
 DN Long Beach, Long Beach Marina; 33°45.0', 118°06.8'.  
 D Long Beach, City Yacht Anchorage; 33°46.4', 118°13.2'.  
 D Redondo Beach; 33°51.0', 118°24.0'.  
 DN Santa Monica Pier; 34°00.5', 118°30.0'.  
 DN Port Hueneme; 34°09.0', 119°12.0'.  
 DN Santa Barbara; 34°24.7', 119°41.3'.  
 30 D Port San Luis; 35°10.7', 120°44.0'.  
 DN Monterey Lifeboat Station; 36°36.5', 121°53.7'.  
 D Palo Alto Yacht Harbor; 37°27.4', 122°06.5'.  
 D San Francisco Lightship; 37°45.0', 122°41.5'.  
 DN San Francisco, Telephone Building; 37°47.2', 122°24.0'.  
 35 D San Francisco, Aquatic Park; 37°48.5', 122°25.5'.  
 D Sausalito; 37°51.2', 122°28.7'.  
 D Berkeley Yacht Harbor; 37°52.0', 122°19.0'.  
 D Antioch; 38°01.0', 121°45.0'.  
 40 W Fort Bragg; 39°26.5', 123°48.0'.  
 D Blunts Reef Lightship; 40°26.4', 124°30.2'.  
 DN Humboldt Bay Lifeboat Station; 40°46.0', 124°13.0'.  
 D Eureka; 40°48.3', 124°10.3'.

**Oregon:**

- 45 DN Cape Arago Light; 43°20.5', 124°22.5'.  
 D North Bend (City Dock); 43°24.3', 124°13.1'.  
 DN Coos Head; 43°21.0', 124°20.1'.  
 DN Charleston Small-Boat Basin; 43°20.8', 124°19.4'.  
 DN Umpqua River Lifeboat Station; 43°40.0', 124°12.0'.  
 DN Yaquina Bay Lifeboat Station; 44°37.6', 124°03.3'.  
 50 DN Yaquina Head Light; 44°40.8', 124°04.7'.  
 D Depoe Bay Coast Guard Mooring; 44°48.6', 124°03.5'.  
 D Florence; 43°58.0', 124°06.3'.  
 D Tillamook Bay Lifeboat Station; 45°33.5', 123°55.2'.  
 55 D Columbia River Lightship; 46°11.0', 124°11.0'.  
 DN Point Adams Lifeboat Station; 46°12.0', 123°56.7'.

**Washington:**

- D Ilwaco; 46°18.3', 124°02.4'.  
 DN Tatoosh Island, Weather Bureau; 48°23.5', 124°44.0'.  
 60 DN South Bend; 46°40.4', 123°46.2'.

- DN Willapa Bay Lifeboat Station; 46°43.5', 124°05.0'.  
 DN Aberdeen; 46°58.0', 123°51.3'.  
 DN Olympia, Main Dock; 47°03.2', 122°54.2'.  
 D Tacoma, Narrows Marina; 47°14.7', 122°33.4'.  
 D Port of Tacoma, Pier 2; 47°16.6', 122°24.7'.  
 D Tacoma, Point Defiance Boathouse; 47°18.4',  
 122°31.0'.  
 DN Seattle Yacht Club; 47°38.7', 122°18.4'.  
 D Seattle, Leschi Park; 47°36.1', 122°17.0'.  
 D Seattle, U.S. Locks; 47°40.0', 122°23.7'.  
 DN Destruction Island Light; 47°40.5', 124°29.0'.  
 D Quillayute River Lifeboat Station; 47°54.4',  
 124°38.0'.  
 D Umatilla Reef Lightship; 48°10.0', 124°50.4'.  
 D Swiftsure Bank Lightship; 48°32.5', 124°59.5'.  
 DN Neah Bay Lifeboat Station; 48°22.3', 124°35.7'.  
 DN Port Angeles; 48°07.1', 123°26.0'.  
 DN New Dungeness Light; 48°10.9', 123°06.5'.  
 DN Everett; 47°58.8', 122°13.2'.
- DN Port Townsend; 48°07.0', 122°45.3'.  
 DN Bellingham; 48°44.3', 122°29.2'.  
 DN Blaine; 48°59.8', 122°45.1'.
- Hawaii:**
- 5 D Kaneohe Bay, Kaneohe Yacht Club; 21°25.1',  
 157°46.3'.  
 D Kaneohe Bay, Mokapu Peninsula; 21°26.5', 157°46.0'.  
 D Kaunakakai, Molokai; 21°05.0, 157°01.9'.  
 D Honolulu, Ala Wai Yacht Harbor; 21°17.4', 157°50.6'.  
 10 D Honolulu, Kewalo Basin; 21°17.7', 157°51.4'.  
 D Honolulu, Aloha Tower; 21°18.6', 157°52.1'.  
 D Lahaina, Maui; 20°52.5', 156°40.9'.  
 D Makapuu Light, Oahu; 21°18.8', 157°39.1'.  
 D Upolu Point, Hawaii; 20°15.3', 155°53.4'.  
 15 D Hilo, Hawaii, Coast Guard Moorings; 19°43.7',  
 155°04.4'.  
 D Kailua-Kona, Hawaii; 19°38.6', 156°00.0'.  
 D Nawiliwili, Coast Guard Group; 21°57.4', 159°21.3'.

CLIMATOLOGICAL TABLES

These tables were compiled from U. S. Weather Bureau data.

Sky cover is expressed in a range of 0 for no clouds to 10 for complete sky cover. The number of clear days is based on average cloudiness of 0 to 3, partly cloudy days on 4 to 7, and cloudy days on 8 to 10.

Heavy fog includes data referred to at various times in the past as "Dense" or "Thick." The upper visibility limit for heavy fog is 1/4 mile.

(a) means length of record in years.

\* means less than one-half.

T means trace, an amount too small to measure.

SAN DIEGO, CALIF. (Lindbergh Field) 32°44' N., 117°10' W. Elevation (ground) 19 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				17	17		17	17	17	17	17	9	14	17	17	17	17	17	17	17	17	17
Jan.	64.3	45.5	54.9	88	29	1.69	2.65	T	58	61	4.8	NE	34 SW	66	5.1	13	7	11	8	0	*	4
Feb.	65.0	47.5	56.3	88	36	2.26	1.71	0.0	56	58	5.2	NE	29 SW	70	4.9	11	7	10	6	0	*	3
Mar.	66.5	49.8	58.2	86	41	1.52	2.40	0.0	57	58	5.9	W	39 SW	70	4.9	11	11	9	7	0	*	2
Apr.	67.8	53.1	60.5	92	41	0.83	1.22	0.0	62	61	6.3	WNW	29 SW	60	5.8	8	10	12	5	0	*	1
May	69.6	56.7	63.2	96	48	0.26	0.42	0.0	62	62	6.4	WNW	23 SW	59	5.5	9	12	10	2	0	*	1
June	71.5	59.6	65.6	97	50	0.04	0.26	0.0	66	64	6.3	SSW	23 S	58	5.3	9	13	8	1	0	*	1
July	75.5	63.1	69.3	89	55	0.01	0.08	0.0	68	64	5.8	WNW	15 SW	66	4.4	12	14	5	*	0	*	1
Aug.	76.5	64.0	70.3	98	57	0.05	0.83	0.0	67	65	5.6	WNW	20 SW	67	4.2	14	13	4	*	0	*	1
Sep.	75.9	61.5	68.7	104	51	0.17	0.37	0.0	65	65	5.4	NW	22 W	68	3.8	16	10	4	*	0	*	4
Oct.	73.0	56.9	65.0	94	45	0.63	1.20	0.0	62	65	5.2	WNW	23 W	64	4.3	14	10	7	3	0	*	3
Nov.	70.9	50.6	60.8	96	40	0.83	2.44	0.0	52	59	4.6	N	44 SE	76	3.7	16	8	6	4	0	*	4
Dec.	66.4	47.4	56.9	85	36	2.57	3.07	0.0	55	60	4.5	NE	29 S	69	4.8	13	8	10	6	0	1	4
Year	70.2	54.6	62.4	104	29	10.86	3.07	T	61	62	5.5	WNW	44 SE	66	4.7	146	123	96	44	0	3	30

LOS ANGELES, CALIF. (International Airport) 33°56' N., 118°23' W. Elevation (ground) 99 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days							
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog	
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy					
(a)				21	21		22	22	14	14	9	22	8		9	22	22	22	22	22	22	15	25
Jan.	63.3	43.0	53.2	86	23	2.01	6.19	T	57	63	5.2	W	42 SW	5.5	12	8	11	7	0	*	6		
Feb.	63.3	44.8	54.1	91	32	2.75	3.79	T	55	61	5.5	W	49 N	4.6	12	6	10	7	0	*	4		
Mar.	65.2	47.8	56.5	87	34	1.91	2.03	0.0	55	62	6.0	W	54 W	4.9	12	8	11	5	0	*	5		
Apr.	66.8	51.5	59.2	90	39	0.96	1.42	0.0	62	66	6.2	W	51 N	5.8	9	9	12	4	0	*	3		
May	68.9	55.3	62.1	97	43	0.30	0.56	0.0	63	66	6.2	WSW	39 N	5.3	10	9	12	1	0	0	2		
June	71.5	57.8	64.7	100	48	0.07	0.07	0.0	66	67	5.9	WSW	28 W	4.9	8	11	11	1	0	0	2		
July	74.4	60.8	67.6	93	49	T	0.05	0.0	65	68	5.6	WSW	25 W	4.0	10	13	8	1	0	*	2		
Aug.	75.0	61.3	68.2	98	51	0.02	0.06	0.0	65	69	5.5	WSW	29 SE	4.1	11	12	8	*	0	*	4		
Sep.	74.6	58.7	66.7	108	47	0.21	4.20	0.0	64	69	5.0	WSW	23 SW	3.9	13	11	6	*	0	0	5		
Oct.	72.3	54.5	63.4	101	41	0.43	1.21	0.0	60	70	4.8	W	40 N	4.3	13	9	9	2	0	*	7		
Nov.	70.2	48.4	59.3	95	34	1.10	2.91	0.0	50	63	4.7	W	48 N	4.2	15	8	7	3	0	*	7		
Dec.	65.9	45.3	55.6	89	33	2.16	3.01	0.0	52	63	4.9	W	43 S	4.5	12	9	10	6	0	*	6		
Year	69.3	52.4	60.9	108	23	12.37	6.19	T	60	66	5.5	W	54 W	4.7	137	113	115	37	0	3	53		

SAN FRANCISCO, CALIF. (International Airport) 37° 37' N., 122° 23' W. Elevation (ground) 8 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				30	30		30	20	18	18	30	30	20		16	30	30	30	30	20	30	20
Jan.	55.8	39.9	47.9	72	24	3.47	2.07	T	77	69	6.0	WNW	52 SW		6.0	8	9	14	12	0	*	4
Feb.	58.9	42.6	50.8	78	25	3.44	2.31	T	74	68	7.4	WNW	54 SW		5.7	9	8	11	10	0	*	4
Mar.	61.3	44.2	52.8	85	30	2.44	2.11	T	69	66	9.4	WNW	45 NW		5.5	10	9	12	9	0	*	*
Apr.	62.8	45.4	54.1	88	31	1.29	1.92	0.0	69	69	10.4	WNW	42 W		5.4	10	10	10	6	0	*	*
May	65.3	47.8	56.6	94	36	0.40	1.54	0.0	68	68	11.3	W	49 W		4.7	13	11	7	3	0	*	*
June	68.9	50.4	59.7	101	41	0.13	0.49	0.0	66	66	12.2	W	42 W		3.7	16	9	5	2	0	*	*
July	69.2	51.5	60.4	104	43	0.01	0.15	0.0	70	68	12.1	NW	43 W		3.2	20	8	3	*	0	*	*
Aug.	69.6	51.6	60.6	92	42	0.01	0.21	0.0	71	69	11.3	NW	39 WNW		3.5	19	9	3	*	0	*	*
Sep.	72.2	51.7	62.0	102	38	0.11	0.84	0.0	68	65	9.6	NW	37 WNW		3.3	18	9	3	1	0	*	2
Oct.	69.4	49.3	59.4	94	34	0.92	1.57	0.0	70	66	8.0	WNW	44 SW		4.0	16	9	6	4	0	*	2
Nov.	64.1	44.7	54.4	84	25	1.62	1.46	0.0	72	66	5.9	WNW	48 SSW		5.1	12	9	9	6	0	*	4
Dec.	56.9	41.6	49.3	74	20	3.59	3.33	T	77	72	5.6	WNW	46 S		6.2	9	8	14	11	0	*	5
Year	64.5	46.7	55.6	104	20	17.43	3.33	T	71	68	9.3	WNW	54 SW		4.7	160	108	97	63	0	2	22

EUREKA, CALIF. (Post Office Building) 40° 48' N., 124° 10' W. Elevation (ground) 43 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days							
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	4:30 a.m. PST	4:30 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog	
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy					
(a)				47	47		47	47	30	30	47	40	47		47	15	47	47	47	47	47	47	47
Jan.	53.6	40.8	47.2	75	25	6.20	4.42	0.2	87	77	6.0	SE	47 S		39	7.2	6	6	19	17	*	1	4
Feb.	54.6	42.2	48.4	85	27	5.65	4.60	T	87	75	6.2	SE	38 S		44	7.2	6	6	16	14	0	1	3
Mar.	55.0	43.2	49.1	78	29	4.64	3.09	T	88	75	6.6	SE	42 SW		49	7.3	6	8	17	15	0	*	2
Apr.	56.0	45.2	50.6	79	32	2.88	2.38	T	86	75	6.9	N	43 N		53	7.2	6	9	15	12	0	*	1
May	57.7	48.1	52.9	84	37	1.82	2.23	0.0	90	78	6.9	N	35 NW		54	6.8	7	10	14	9	0	*	1
June	60.2	51.0	55.6	85	41	0.66	1.73	0.0	92	79	6.5	N	34 NW		57	6.4	8	10	12	5	0	*	2
July	60.6	52.2	56.4	76	45	0.09	1.18	0.0	92	80	6.0	NW	30 N		52	6.5	6	12	13	2	0	*	3
Aug.	61.3	52.7	57.0	73	44	0.11	0.89	0.0	94	81	5.0	NW	29 N		46	7.0	5	11	15	2	0	*	5
Sep.	61.5	50.9	56.2	85	41	0.67	1.18	0.0	93	80	4.8	N	38 N		51	6.1	9	9	12	5	0	*	8
Oct.	60.0	48.4	54.2	82	34	2.70	5.83	0.0	91	82	4.9	N	37 SW		46	6.5	9	8	14	9	0	*	9
Nov.	57.8	44.8	51.3	77	29	4.64	4.55	0.0	89	79	5.2	SE	37 S		42	7.0	7	7	16	12	0	1	7
Dec.	55.0	42.2	48.6	70	22	6.09	4.17	T	86	79	5.6	SE	49 S		38	7.6	6	7	18	16	0	1	4
Year	57.8	46.8	52.3	85	22	36.15	5.83	0.2	90	78	5.9	N	49 S		46	6.9	81	103	181	118	*	4	49

APPENDIX

PORTLAND, OREGON (Customhouse Building) 45°32' N., 122°40' W. Elevation (ground) 30 Feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				55	55		55	55	17	17	9	9	9	8	9	9	9	9	55	55	17	15
Jan.	44.2	34.7	39.5	65	6	5.43	4.61	5.3	81	78	8.6	ESE	47 S	21	8.5	3	3	25	19	2	*	2
Feb.	49.5	38.0	43.8	68	7	4.87	2.67	1.8	80	70	7.2	SE	49 S	33	8.3	3	4	21	16	1	*	2
Mar.	55.6	41.1	48.4	83	22	4.15	2.50	0.5	69	62	7.0	SSW	37 S	33	8.4	3	4	24	17	*	*	1
Apr.	62.2	44.9	53.6	93	30	2.43	1.96	0.1	66	54	5.6	NW	52 S	50	7.3	5	6	19	14	*	*	1
May	68.6	49.6	59.1	99	36	1.87	1.83	T	66	54	5.3	NW	35 SW	48	7.1	5	7	19	12	0	2	*
June	73.1	54.4	63.8	102	41	1.62	2.16	0.0	66	48	5.4	NW	30 S	44	7.3	5	6	19	9	0	1	*
July	79.2	57.8	68.5	107	43	0.42	1.32	0.0	62	47	6.0	NW	27 S	66	4.7	13	9	9	3	0	1	*
Aug.	78.8	57.9	68.4	102	44	0.61	1.29	0.0	66	49	5.5	NW	25 SW	58	5.3	10	11	10	4	0	1	*
Sep.	73.4	54.4	63.9	102	35	1.83	2.88	0.0	67	50	4.9	NW	27 S	61	5.3	11	8	11	7	0	1	3
Oct.	63.5	48.7	56.1	90	29	3.53	2.43	T	80	68	5.3	ESE	43 SW	35	7.4	5	7	19	12	0	*	6
Nov.	52.7	41.7	47.2	71	15	6.05	4.43	0.2	83	76	6.5	ESE	49 SW	27	8.0	4	4	22	17	*	*	6
Dec.	46.8	37.9	42.4	65	3	7.10	5.01	1.3	84	79	8.3	ESE	50 S	18	9.0	2	2	27	19	*	*	3
Year	62.3	46.8	54.6	107	3	39.91	5.01	9.2	73	61	6.3	NW	52 S	44	7.2	69	71	225	149	3	7	26

ASTORIA, OREGON (Clatsop County Airport) 46°09' N., 123°53' W. Elevation (ground) 8 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				4	4		4	4	4	4	4	4		4	4	4	4	4	4	4	4	4
Jan.	44.0	36.1	40.1	58	15	10.66	3.55	2.9	85	81	6.6	E		8.2	3	3	25	23	2	2	5	
Feb.	48.4	37.8	43.1	65	20	9.44	2.08	0.3	80	77	7.0	SE		8.1	4	3	21	20	0	*	3	
Mar.	50.8	39.8	45.3	68	26	8.27	2.66	1.0	75	70	7.1	SE		7.7	4	6	21	21	1	1	1	
Apr.	55.1	44.2	49.7	83	29	5.15	1.34	T	72	70	6.3	SE		7.8	5	5	20	18	0	*	3	
May	58.8	48.2	53.5	86	30	3.53	1.35	0.0	73	71	5.9	NW		7.4	3	10	18	14	0	*	3	
June	63.2	52.0	57.6	93	38	2.66	1.59	0.0	76	72	5.6	NW		8.3	2	5	23	17	0	*	1	
July	66.7	54.8	60.8	89	42	1.07	1.43	0.0	74	71	6.0	NW		6.8	5	11	15	9	0	1	1	
Aug.	67.6	55.9	61.8	82	43	1.45	1.64	0.0	76	72	5.3	NW		6.6	7	10	14	9	0	1	3	
Sep.	66.8	53.8	60.3	92	38	3.04	2.63	0.0	76	70	4.6	SE		6.2	9	6	15	10	0	*	5	
Oct.	59.2	49.0	54.1	78	30	7.15	1.76	0.0	81	75	5.5	SE		7.2	6	6	19	21	0	1	5	
Nov.	51.6	42.6	47.1	66	15	10.36	2.36	0.6	83	80	5.8	SE		7.6	5	5	20	18	*	1	4	
Dec.	46.7	38.6	42.7	62	22	13.21	3.03	0.6	85	82	7.3	SE		8.4	3	3	25	22	*	2	6	
Year	56.6	46.1	51.4	93	15	75.99	3.55	5.4	78	74	6.0	SE		7.5	56	73	236	202	3	9	40	

TATOOSH ISLAND, WASH. 48°23' N., 124°44' W. Elevation (ground) 101 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				55	55		55	55	40	55	26	18	55	47	51	55	55	55	55	55	55	55
Jan.	44.9	39.0	42.0	64	14	10.19	3.67	3.8	83	83	17.3	E	76 S	26	7.9	4	5	22	22	1	1	1
Feb.	46.5	39.8	43.2	64	16	8.70	4.57	1.6	80	81	15.1	E	73 NE	36	7.4	5	5	18	18	1	*	1
Mar.	48.3	41.0	44.7	69	25	7.82	4.76	1.0	81	80	13.4	E	79 E	39	7.4	5	7	19	20	*	*	1
Apr.	51.5	43.5	47.5	75	33	5.23	2.23	T	80	80	11.3	W	61 S	44	7.2	5	7	18	17	0	*	2
May	54.8	46.9	50.9	81	36	3.31	2.22	T	82	82	9.7	W	57 S	47	7.1	5	8	18	14	0	*	3
June	57.7	50.2	54.0	84	43	2.58	2.75	0.0	86	84	8.5	W	61 S	46	7.1	4	8	18	12	0	*	5
July	59.2	51.7	55.5	88	44	1.99	3.72	0.0	89	87	8.4	S	46 S	47	6.8	6	8	17	10	0	*	11
Aug.	59.5	51.9	55.7	78	45	2.01	2.30	0.0	90	90	8.4	S	38 NE	44	7.0	5	8	18	10	0	*	16
Sep.	58.7	50.2	54.5	80	40	3.64	3.79	0.0	87	87	9.6	S	59 NE	47	6.5	7	7	16	11	0	*	11
Oct.	55.5	48.2	51.9	77	33	8.72	5.91	T	85	85	12.9	E	63 S	38	7.0	6	7	18	17	0	1	6
Nov.	50.6	44.1	47.4	68	19	9.52	4.38	0.5	83	84	15.6	E	82 S	26	7.9	4	5	21	21	*	1	2
Dec.	47.1	41.1	44.1	61	20	12.04	4.03	0.8	83	84	17.2	E	74 S	23	8.0	4	5	22	23	*	1	1
Year	52.9	45.6	49.3	88	14	75.75	5.91	7.7	84	84	12.2	E	82 S	41	7.3	60	80	225	195	3	5	60

SEATTLE, WASH. (Seattle-Tacoma Airport) 47°27' N., 122°18' W. Elevation (ground) 386 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				13	13		13	13	8	8	9	9		13	13	13	13	13	13	13	13	
Jan.	43.0	31.4	37.2	60	0	4.73	2.22	8.7	85	83	10.0	SSW		8.2	3	5	23	19	2	*	5	
Feb.	47.8	34.0	40.9	66	1	3.95	3.41	2.8	83	75	10.0	SW		8.3	2	4	22	16	1	*	4	
Mar.	52.4	36.6	44.5	72	11	3.40	2.19	2.8	77	68	10.2	SW		8.0	2	7	22	17	1	1	3	
Apr.	58.2	40.0	49.1	82	29	2.12	0.84	T	67	55	9.9	SW		7.7	3	7	20	13	0	1	2	
May	64.9	45.2	55.1	87	28	1.64	1.66	0.0	65	53	9.4	SW		7.1	5	9	17	10	0	1	1	
June	69.8	50.0	59.9	96	38	1.30	1.53	0.0	68	56	9.3	SW		7.3	4	7	19	11	0	1	1	
July	75.0	52.8	63.9	96	43	0.58	0.74	0.0	69	50	8.3	SW		5.5	9	11	11	6	0	1	3	
Aug.	74.1	53.0	63.6	92	44	0.88	1.36	0.0	72	53	7.6	SW		5.8	8	10	13	6	0	1	5	
Sep.	68.3	49.1	58.7	88	36	1.65	1.77	0.0	74	58	7.9	N		6.1	7	10	13	8	0	1	8	
Oct.	59.4	43.9	51.7	80	28	3.32	2.27	T	82	73	8.9	SW		7.6	3	8	20	16	0	1	9	
Nov.	50.1	37.7	43.9	74	6	4.55	2.22	1.6	84	80	9.0	SE		8.3	3	4	23	18	*	1	8	
Dec.	45.3	34.3	39.8	61	16	5.68	2.01	1.7	87	83	10.4	SSW		8.6	2	4	25	20	*	*	6	
Year	59.0	42.3	50.7	96	0	33.80	3.41	17.6	76	66	9.0	SW		7.4	51	86	228	160	5	9	55	

APPENDIX

SEATTLE, WASH. (Federal Office Building) 47° 36' N., 122° 20' W. Elevation (ground) 14 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	10 a.m. PST	4 p.m. PST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				24	24		24	24	18	18	24	24	24	24	24	24	24	24	24	24	24	24
Jan.	45.2	36.2	40.7	66	11	4.49	2.46	5.2	80	74	8.7	SE	54 SW	28	8.0	3	5	23	18	2	*	*
Feb.	48.8	38.1	43.5	70	12	3.74	2.69	1.5	78	69	8.7	SE	56 S	34	7.7	3	6	19	15	*	*	*
Mar.	53.4	40.5	47.0	75	22	3.06	2.32	0.7	70	60	8.7	S	52 SW	42	7.4	4	8	19	16	*	*	*
Apr.	59.4	44.1	51.8	87	31	1.94	1.53	T	63	52	8.2	S	56 S	49	6.9	5	9	16	13	0	*	*
May	65.6	48.9	57.3	92	35	1.61	1.35	0.0	61	50	7.6	N	39 SW	53	6.4	7	10	14	11	0	1	1
June	70.2	53.4	61.8	100	45	1.25	1.08	0.0	63	52	7.3	S	47 SW	48	6.4	7	8	15	10	0	1	1
July	75.1	56.1	65.6	100	48	0.52	1.22	0.0	63	47	6.9	N	33 SW	61	4.9	12	10	9	5	0	1	1
Aug.	74.2	56.2	65.2	96	49	0.87	0.79	0.0	67	51	6.3	N	29 SW	56	5.3	10	10	11	6	0	1	1
Sep.	68.8	53.2	61.0	92	42	1.56	1.91	0.0	72	56	6.4	N	36 S	54	5.6	9	8	13	7	0	1	1
Oct.	60.5	48.2	54.4	78	30	3.08	1.97	T	79	68	7.4	SE	55 S	36	7.2	5	8	18	14	0	1	1
Nov.	51.8	42.1	47.0	70	13	4.46	3.20	0.7	82	76	8.2	SE	49 SW	28	8.0	3	6	21	17	*	*	*
Dec.	47.3	38.9	43.1	65	21	5.34	3.31	0.8	83	77	8.9	SE	52 SW	24	8.1	3	5	23	19	*	*	*
Year	60.0	46.3	53.2	100	11	31.92	3.31	8.9	72	61	7.8	SE	56 S	45	6.8	71	93	201	151	3	6	6

HONOLULU, HAWAII (Federal Building) 21° 19' N., 157° 52' W. Elevation (ground) 12 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	8 a.m. HST	2 p.m. HST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				35	35		35	35	11	11	8	8	6	5	11	8	8	8	35	35	8	8
Jan.	76.7	67.2	72.0	83	57	4.31	8.06	0.0	80	62	8.5	ENE	47 W	67	5.5	9	12	10	12	0	1	0
Feb.	76.7	67.2	72.0	82	58	2.49	8.07	0.0	79	62	8.4	ENE	54 W	60	6.2	6	12	10	12	0	2	0
Mar.	76.8	67.6	72.2	83	58	2.30	4.08	0.0	75	59	9.9	ENE	51 SE	69	6.1	7	13	11	13	0	1	0
Apr.	77.7	68.8	73.3	83	59	2.05	7.98	0.0	71	57	10.2	ENE	29 NE	68	6.1	8	12	10	12	0	*	0
May	79.5	70.6	75.1	84	64	1.01	2.14	0.0	69	56	10.5	ENE	30 E	69	5.8	10	11	10	11	0	0	0
June	81.3	72.4	76.9	85	64	0.63	0.81	0.0	68	56	11.1	ENE	34 E	69	5.6	7	16	7	11	0	0	0
July	82.2	73.5	77.9	87	68	0.86	1.22	0.0	69	56	11.7	ENE	29 NE	73	5.0	10	17	4	13	0	0	0
Aug.	82.8	74.1	78.5	88	69	1.09	1.91	0.0	70	56	11.7	ENE	31 NE	74	5.0	10	16	5	13	0	0	0
Sep.	82.9	73.7	78.3	88	69	1.34	6.02	0.0	70	55	9.6	ENE	30 NE	76	4.7	12	14	4	12	0	*	0
Oct.	82.0	72.9	77.5	87	66	2.28	7.06	0.0	72	58	8.9	ENE	30 SE	72	5.3	10	13	8	13	0	1	0
Nov.	79.7	70.7	75.2	85	62	2.08	6.18	0.0	74	63	8.9	ENE	56 NE	65	5.5	9	12	9	13	0	1	0
Dec.	77.7	68.9	73.3	85	59	3.48	6.54	0.0	76	62	9.6	ENE	51 NE	59	5.5	8	12	11	14	0	1	0
Year	79.7	70.6	75.2	88	57	23.92	8.07	0.0	73	59	9.9	ENE	56 NE	69	5.5	106	160	99	149	0	7	0

HILO, HAWAII (General Lyman Airport) 19°43' N., 155°04' W. Elevation (ground) 31 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	8 a.m. HST	2 p.m. HST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				11	11	15	15	8	8	8	8		7	11	11	11	11	15	15	12	12	
Jan.	78.4	62.4	70.4	89	56	14.13	9.94	0.0	82	69	6.0	SW		49	6.9	5	11	15	20	0	*	0
Feb.	79.0	62.4	70.7	88	55	9.48	13.41	0.0	83	71	6.1	SW		42	7.1	3	10	15	19	0	2	0
Mar.	78.5	63.1	70.8	88	55	15.72	9.18	0.0	83	69	6.1	SW		39	8.1	2	8	21	24	0	1	0
Apr.	79.2	64.0	71.6	87	56	13.27	9.39	0.0	81	70	5.8	SW		36	8.3	1	7	22	25	0	1	0
May	81.1	65.1	73.1	85	58	9.00	5.94	0.0	82	71	5.6	WSW		32	8.2	1	9	21	25	0	*	0
June	82.5	66.3	74.4	88	60	6.75	2.25	0.0	80	67	5.6	WSW		40	7.8	1	10	19	24	0	0	0
July	82.6	67.0	74.8	87	62	9.89	5.42	0.0	83	69	5.4	WSW		44	8.0	1	10	20	27	0	*	0
Aug.	83.1	67.7	75.4	93	63	11.92	9.27	0.0	83	70	5.6	SW		39	8.0	1	9	21	27	0	*	0
Sep.	83.0	67.5	75.3	92	62	10.42	3.22	0.0	79	66	5.5	WSW		46	7.1	2	13	15	23	0	0	0
Oct.	82.2	66.8	74.5	88	62	11.02	8.88	0.0	82	69	5.4	SW		41	7.4	2	11	18	24	0	1	0
Nov.	80.3	65.7	73.0	88	58	12.39	9.54	0.0	83	72	5.6	WSW		36	7.5	2	10	18	23	0	1	0
Dec.	78.8	64.0	71.4	85	56	15.99	10.50	0.0	83	72	6.0	WSW		36	7.8	2	9	20	24	0	1	0
Year	80.7	65.2	73.0	93	55	139.98	13.41	0.0	82	70	5.7	SW		40	7.7	23	117	225	285	0	7	0

LIHUE, HAWAII (Lihue Airport) 21°59' N., 159°21' W. Elevation (ground) 115 feet. WB-1957

Month	Air temperature (°F.)					Precipitation (inches)			Humidity (percent)		Wind (knots)			Percent of possible sunshine	Mean sky cover sunrise to sunset	Mean number of days						
	Normal			Extreme		Normal total	Maximum in 24 hrs.	Snow, sleet, mean total	8 a.m. HST	2 p.m. HST	Mean speed	Prevailing direction	Maximum speed and direction			Sunrise to sunset			Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest											Clear	Partly cloudy	Cloudy				
(a)				7	7	7	8	8	8	7	7	7	7	8	7	7	7	7	8	7	8	
Jan.	77.4	62.7	70.1	84	53	6.23	11.09	0.0	85	60	8.8	ENE	31 SW	45	6.2	7	11	13	14	0	2	0
Feb.	77.7	62.5	70.1	82	53	4.44	7.28	0.0	83	68	9.9	NE	29 E	44	6.6	5	11	12	17	0	2	0
Mar.	77.7	63.5	70.6	83	51	4.07	4.34	0.0	80	66	9.7	NE	31 N	44	6.8	4	13	14	17	0	2	0
Apr.	78.2	65.7	72.0	84	57	3.03	1.50	0.0	77	67	10.0	NE	25 NE	46	6.9	4	13	13	16	0	*	0
May	79.8	68.3	74.1	85	59	2.51	0.66	0.0	75	66	10.4	NE	24 NE	50	6.9	4	13	14	16	0	*	0
June	81.2	71.1	76.2	87	64	1.65	0.54	0.0	76	66	10.6	NE	26 NE	55	6.8	3	13	14	19	0	0	0
July	82.4	72.4	77.4	88	65	1.87	5.04	0.0	76	65	10.6	NE	27 NE	57	6.4	3	19	9	20	0	0	0
Aug.	83.3	72.9	78.1	87	66	2.27	1.48	0.0	77	66	10.6	NE	26 NE	59	6.5	3	18	10	19	0	*	0
Sep.	83.6	72.0	77.8	88	65	2.20	1.92	0.0	77	66	8.9	NE	25 NE	65	5.5	7	16	7	15	0	1	0
Oct.	82.6	70.3	76.5	90	63	4.63	4.99	0.0	79	68	8.9	NE	28 E	56	6.1	5	14	12	18	0	1	0
Nov.	79.7	67.5	73.6	85	60	4.24	11.20	0.0	82	70	9.7	NE	37 S	45	6.5	4	13	13	19	0	1	0
Dec.	77.8	65.2	71.5	85	52	5.35	4.65	0.0	81	69	9.9	NE	50 NE	44	6.8	4	14	13	19	0	1	0
Year	80.1	67.8	74.0	90	51	42.49	11.20	0.0	79	67	9.9	NE	50 NE	51	6.5	53	168	144	209	0	10	0

MEAN SURFACE WATER TEMPERATURES AND SALINITIES

Station	Years	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Mean	
		Temp. °F.	Sal. ‰																								
San Diego, Calif....	4	56.2	33.2	56.7	33.2	58.2	33.3	59.3	33.5	62.5	33.7	64.0	33.8	67.2	34.1	67.3	34.0	65.1	33.8	63.0	33.5	59.7	33.6	58.1	33.3	61.4	33.6
La Jolla, Calif.....	41	57.0	33.6	56.8	33.5	57.9	33.5	59.6	33.6	62.7	33.6	65.4	33.7	68.1	33.7	69.3	33.7	66.6	33.6	64.2	33.6	61.2	33.6	58.9	33.6	62.3	33.6
Los Angeles (Outer Harbor) Calif.....	34	56.5	33.2	56.9	33.2	57.9	33.3	59.0	33.6	60.9	33.7	63.7	33.7	65.8	33.7	66.9	33.7	65.5	33.7	63.9	33.6	61.0	33.6	58.4	33.5	61.4	33.6
Santa Monica, Calif.....	12	55.5	33.5	55.6	33.3	56.5	33.5	58.2	33.7	59.9	33.7	63.8	33.8	66.6	33.8	67.1	33.7	65.3	33.7	62.6	33.6	59.7	33.6	57.4	33.5	60.7	33.6
Avila Beach, Calif..	12	53.1	33.5	52.8	33.5	52.7	33.7	53.4	33.8	54.5	34.0	56.2	34.1	58.5	34.1	59.1	34.1	59.0	34.0	57.3	33.8	55.9	33.6	54.4	33.6	55.6	33.8
San Francisco (Pt. Point), Calif.....	36	50.8	28.5	51.6	27.1	53.2	26.4	54.4	26.7	55.7	27.6	57.3	28.6	58.7	30.8	59.5	31.9	60.2	32.3	59.0	32.1	55.6	31.5	52.5	30.3	55.7	29.5
Alameda, Calif.....	18	50.3	23.4	52.8	21.3	56.6	21.0	60.6	22.0	64.1	23.0	66.9	24.7	68.9	27.2	68.4	29.1	68.0	30.2	63.8	29.8	57.4	28.5	52.4	26.5	60.8	25.6
Crescent City, Calif.....	22	49.4	28.1	49.7	28.1	50.2	28.8	51.3	29.7	52.7	30.4	54.2	31.2	56.1	32.3	57.2	32.4	56.2	32.4	53.7	32.1	51.5	30.7	50.4	29.4	52.7	30.4
Astoria (Tongue Point), Oreg.....	33	40.1	1.7	41.4	1.1	45.6	0.6	51.3	0.4	56.5	0.3	60.6	0.4	66.0	0.6	67.2	0.9	64.2	1.7	57.3	2.8	48.7	2.6	43.4	2.2	53.5	1.3
Tokeland, Willapa Bay, Wash.....	5	44.6	20.1	44.0	21.7	47.9	21.2	51.4	21.6	55.8	23.7	60.5	23.8	63.3	26.3	63.6	28.9	60.3	29.0	55.9	28.8	49.9	26.0	46.8	23.7	53.7	24.6
Raymond, Willapa Bay, Wash.....	7	44.2	6.4	45.0	6.8	48.2	5.9	53.5	7.5	59.8	8.8	64.2	11.5	68.5	15.8	68.4	20.8	64.7	19.5	58.3	17.9	48.9	11.4	46.0	8.0	55.8	11.6
Neah Bay, Wash....	22	45.1	30.6	44.9	30.4	46.1	30.7	48.4	31.0	51.1	31.4	52.9	31.4	53.2	32.1	52.7	32.4	52.2	32.4	51.2	31.9	49.1	31.2	47.1	30.6	49.5	31.4
Seattle (Elliott Bay), Wash.....	35	47.5	28.1	46.7	27.8	46.7	27.3	47.9	26.8	50.5	26.8	53.3	27.2	55.3	28.4	55.8	29.1	55.2	29.5	53.8	29.7	51.5	29.4	49.3	28.8	51.1	28.2
Friday Harbor, San Juan I., Wash.	17	45.4	30.3	44.8	30.3	45.2	30.4	46.6	30.4	48.5	30.3	50.3	30.1	51.7	29.8	51.9	30.2	51.0	30.4	49.6	30.8	48.1	30.7	46.9	30.4	48.3	30.3
Hilo, Hawaii.....	11	70.2	23.9	70.0	23.4	69.5	22.0	69.5	20.8	70.1	20.4	71.0	21.0	71.7	21.0	72.1	21.0	72.6	22.0	72.7	22.7	71.9	22.9	70.8	22.1	71.0	22.0
Honolulu, Hawaii....	13	75.7	34.0	76.0	34.4	75.8	34.2	76.4	34.6	77.5	34.8	78.4	34.8	79.5	34.8	80.0	34.9	80.3	34.8	80.2	34.9	78.7	34.6	77.1	34.5	78.0	34.6
Midway I., Hawaii...	13	67.4	35.4	67.3	35.4	68.3	35.5	70.0	35.7	72.7	35.8	77.1	35.8	79.4	35.9	80.3	35.7	80.1	35.8	77.4	35.7	73.7	35.7	70.7	35.5	73.7	35.7
Johnston I., Hawaii..	10	77.6	35.1	76.6	35.1	76.3	35.1	77.3	35.3	78.2	35.3	79.5	35.1	80.8	35.4	81.4	35.4	81.7	35.5	81.2	35.5	80.4	35.4	78.5	35.3	79.1	35.3

For temperature and salinity data in greater detail, see Coast and Geodetic Survey publication Surface Water Temperatures, Pacific Ocean, North and South America, and Pacific Ocean Islands, and Density of Sea Water, Pacific Ocean, North and South America, and Pacific Ocean Islands, respectively.

APPENDIX

HOURS OF OPERATION OF FOG SIGNALS  
(U. S. Coast Guard)

348

Light station	8 Calendar Years - 1950 thru 1957														Pre - 1950		
	Average													Max. 1 yr.	Ave.	For yrs.	Max. 1 yr.
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year				
Point Loma, Calif. 32°39.9' N., 117°14.5' W.	93	91	55	55	25	43	32	34	109	109	92	87	825	1291	423	32	859
Ballast Point, Calif. 32°41.2' N., 117°14.0' W.	51	52	25	28	8	17	9	12	48	51	50	46	397	612	224	40	619
Los Angeles, Calif. 33°42.5' N., 118°15.0' W.	132	116	79	69	42	47	65	96	122	152	149	148	1217	1889	805	32	2806
Point Vicente, Calif. 33°44.5' N., 118°24.6' W.	43	61	29	38	25	27	33	39	66	68	68	67	564	860	482	5	573
Point Hueneme, Calif. 34°08.7' N., 119°12.5' W.	53	57	39	75	73	71	105	118	120	124	65	80	980	1343	534	33	1008
Anacapa Island, Calif. 34°00.9' N., 119°21.5' W.	73	76	51	110	99	89	137	137	135	155	92	86	1240	1705	954	13	1707
Point Conception, Calif. 34°26.9' N., 120°28.2' W.	40	37	20	44	59	47	68	83	95	81	44	48	666	1054	304	61	647
Point Arguello, Calif. 34°34.6' N., 120°39.0' W.	73	65	56	66	95	85	182	221	200	155	63	61	1322	2197	1014	44	1991
San Luis Obispo, Calif. 35°09.6' N., 120°45.6' W.	71	69	51	76	109	119	211	254	222	173	80	65	1500	1927	1106	57	2170
Piedras Blancas, Calif. 35°39.9' N., 121°17.1' W.	104	109	73	100	125	127	218	256	213	205	107	105	1742	2167	1028	44	1604
Point Sur, Calif. 36°18.4' N., 121°54.0' W.	58	80	51	60	79	96	236	223	161	136	75	53	1308	1996	1048	59	1958
Point Pinos, Calif. 36°38.2' N., 121°56.1' W.	29	47	36	38	35	66	143	174	135	129	61	27	920	1204	756	9	1032
Pigeon Point, Calif. 37°10.9' N., 122°23.6' W.	87	109	71	73	70	92	209	196	206	183	114	98	1508	1963	863	65	1889
Point Montara, Calif. 37°32.2' N., 122°31.1' W.	50	68	42	39	50	75	150	149	124	127	77	73	1024	1672	914	65	1325
Farallon, Calif. 37°41.8' N., 123°00.1' W.	141	145	87	81	97	135	284	304	209	219	174	165	2041	2479	984	65	1886
San Francisco Lightship, Calif. 37°45.0' N., 122°41.5' W.	100	98	53	50	65	97	206	214	160	155	113	97	1408	1674	1066	46	1802
Point Bonita, Calif. 37°48.9' N., 122°31.7' W.	123	108	50	60	68	82	212	223	176	163	130	131	1526	2220	1041	65	1284
Alcatraz, Calif. 37°49.5' N., 122°25.2' W.	34	50	9	14	13	17	63	74	55	61	32	34	456	703	443	44	719
Carquinez Strait, Calif. 38°04.2' N., 122°14.6' W.	65	69	8	3	2	0	5	5	6	33	77	93	366	491	230	39	420

APPENDIX

HOURS OF OPERATION OF FOG SIGNALS  
(U. S. Coast Guard)

Light station	8 Calendar Years - 1950 thru 1957													Pre - 1950			
	Average													Max. 1 yr.	Ave.	For yrs.	Max. 1 yr.
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year				
Point Reyes, Calif. 37°59.7'N., 123°01.3'W.	138	143	116	92	115	151	355	384	264	247	168	131	2304	2920	1493	65	2360
Point Arena, Calif. 38°57.3'N., 123°44.4'W.	80	105	46	60	72	97	257	310	202	205	150	127	1711	2108	1109	65	1660
Point Cabrillo, Calif. 39°20.9'N., 123°49.5'W.	52	79	43	42	58	86	238	259	196	164	124	89	1430	1750	925	40	1833
Blunts Reef Lightship, Calif. 40°26.4'N., 124°30.3'W.	96	105	69	69	94	119	244	277	236	197	157	120	1783	2328	1149	39	1943
St. George Reef, Calif. 41°50.2'N., 124°22.5'W.	75	71	60	62	66	122	198	251	218	176	118	106	1523	1833	865	57	1348
Cape Arago, Oreg. 43°20.5'N., 124°22.5'W.	19	30	28	38	46	86	149	196	170	104	74	45	985	1467	777	52	1793
Columbia River Lightship, Oreg. 46°11.1'N., 124°11.0'W.	71	69	45	31	26	32	46	87	82	68	65	46	668	885	647	55	1230
Grays Harbor, Wash. 46°54.5'N., 124°07.0'W.	259	187	145	108	83	121	159	199	253	246	244	245	2249	2866	1308	20	2271
Destruction Island, Wash. 47°40.5'N., 124°29.1'W.	32	41	34	24	38	51	84	103	104	47	55	50	663	762	619	56	1169
Umatilla Reef Lightship, Wash. 48°10.0'N., 124°50.4'W.	30	26	20	35	29	58	77	114	92	36	39	34	590	917	761	47	2169
Cape Flattery, Wash. 48°23.5'N., 124°44.1'W.	78	56	52	36	48	92	140	194	142	64	49	67	1018	1504	769	65	1318
Swiftsure Bank Lightship, Wash. 48°32.0'N., 124°59.7'W.	29	32	32	31	35	45	117	169	130	63	36	42	761	1066	1113	37	1694
Slip Point, Wash. 48°15.9'N., 124°14.9'W.	80	47	32	18	18	47	71	121	115	86	89	85	809	1298	382	44	855
Ediz Hook, Wash. 48°08.4'N., 123°24.1'W.	29	36	15	12	7	30	72	104	126	79	49	44	603	991	492	46	894
Point Wilson, Wash. 48°08.7'N., 122°45.2'W.	28	23	13	12	8	24	74	92	112	73	48	19	526	802	441	65	833
West Point, Wash. 47°39.7'N., 122°26.1'W.	18	16	7	4	2	5	15	19	48	41	30	42	247	375	390	62	811
Browns Point, Wash. 47°18.4'N., 122°26.6'W.	73	46	21	13	10	7	13	24	63	107	85	68	530	868	804	44	1504
Burrows Island, Wash. 48°28.6'N., 122°42.7'W.	22	11	10	6	4	22	48	69	75	48	16	8	339	511	446	43	1004
Lime Kiln, Wash. 48°31.0'N., 123°09.1'W.	15	10	6	1	1	13	14	29	49	59	24	4	225	361	194	30	408
Patos Island, Wash. 48°47.3'N., 122°58.2'W.	29	20	12	2	3	14	7	13	38	52	34	26	250	388	255	55	526

APPENDIX

### Radio Bearing Conversion Table

*Table of corrections, in minutes*

[DIFFERENCE OF LONGITUDE IN DEGREES]

Mid. L.	½°	1°	1½°	2°	2½°	3°	3½°	4°	4½°	5°	5½°	6°	6½°	7°	7½°	8°	8½°	9°	9½°	10°
15°	4	8	12	16	19	23	27	31	35	40	43	47	50	54	58	62	66	70	74	78
16°	4	8	12	17	21	25	29	33	37	41	45	50	54	58	62	66	70	74	79	83
17°	4	9	13	18	22	26	31	35	39	44	48	53	57	61	66	70	75	79	83	88
18°	5	9	13	19	23	28	32	37	42	46	51	56	60	65	70	74	79	83	88	93
19°	5	10	15	20	24	29	34	39	44	49	54	59	63	68	73	78	83	88	93	98
20°	5	10	15	21	26	31	36	41	46	51	56	62	67	72	77	82	87	92	98	103
21°	5	11	16	21	27	32	38	43	48	54	59	64	70	75	81	86	91	97	102	108
22°	6	11	17	22	28	34	39	45	51	56	62	67	73	79	84	90	96	101	107	112
23°	6	12	18	23	29	35	41	47	53	59	64	70	76	82	88	94	100	106	111	117
24°	6	12	18	24	31	37	43	49	55	61	67	73	79	85	92	98	104	110	116	122
25°	6	13	19	25	32	38	44	51	57	63	70	76	82	89	95	101	108	114	120	127
26°	7	13	20	26	33	39	46	53	59	66	72	79	85	92	99	105	112	118	125	131
27°	7	14	20	27	34	41	48	54	61	68	75	82	89	95	102	109	116	123	129	136
28°	7	14	21	28	35	42	49	56	63	70	77	84	92	99	106	113	120	127	134	141
29°	7	15	21	29	36	44	51	58	65	73	80	87	95	102	109	116	124	131	138	145
30°	7	15	22	30	38	45	53	60	68	75	83	90	98	105	113	120	127	135	143	150
31°	8	15	23	31	39	46	54	62	70	77	85	93	100	108	116	124	131	139	146	155
32°	8	16	24	32	40	48	56	64	72	79	87	95	103	111	119	127	135	143	151	159
33°	8	16	25	33	41	49	57	65	74	82	90	98	106	114	123	131	139	147	155	163
34°	8	17	25	34	42	50	59	67	75	84	92	101	109	117	126	134	143	151	159	168
35°	9	17	26	34	43	52	60	69	77	86	95	103	112	120	129	138	146	155	163	172
36°	9	18	26	35	44	53	62	71	79	88	97	106	115	123	132	141	150	159	168	176
37°	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	163	172	181
38°	9	18	28	37	46	55	65	74	83	92	102	111	120	129	139	148	157	166	175	185
39°	9	19	28	38	47	57	66	75	85	94	104	113	123	132	142	151	160	170	179	189
40°	10	19	29	39	48	58	68	77	87	96	106	116	125	135	145	154	164	174	183	193
41°	10	20	30	39	49	59	69	79	89	98	108	118	128	138	148	157	167	177	187	197
42°	10	20	30	40	50	60	70	80	90	100	110	120	130	140	151	161	171	181	191	201
43°	10	20	31	41	51	61	72	82	92	102	113	123	133	143	153	164	174	184	194	205
44°	10	21	31	42	52	63	73	83	94	104	115	125	135	146	156	167	177	188	198	208
45°	11	21	32	42	53	64	74	85	95	106	117	127	138	149	159	170	180	191	201	212
46°	11	22	32	43	54	65	76	86	97	108	119	129	140	151	162	173	183	194	205	216
47°	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	186	197	208	219
48°	11	22	33	45	56	67	78	89	100	111	123	134	145	156	167	178	190	201	212	223
49°	11	23	34	45	57	68	79	91	102	113	125	136	147	158	170	181	192	204	215	226
50°	11	23	34	46	57	69	80	92	103	115	126	138	149	161	172	184	195	207	218	230
51°	12	23	35	47	58	70	82	93	105	117	128	140	152	163	175	186	198	210	221	233
52°	12	24	35	47	59	71	83	95	106	118	130	142	154	165	177	189	201	213	225	236
53°	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
54°	12	24	36	49	61	73	85	97	109	121	133	146	158	170	182	194	206	218	231	243
55°	12	25	37	49	61	74	86	98	111	123	135	147	160	172	184	197	209	221	233	246
56°	12	25	37	50	62	75	87	100	112	124	137	149	162	174	187	199	211	224	236	249
57°	13	25	38	50	63	75	88	101	113	126	138	151	164	176	189	201	214	226	239	252
58°	13	25	38	51	64	76	89	102	115	127	140	153	165	178	191	204	216	229	242	254
59°	13	26	39	51	64	77	90	103	116	129	141	154	167	180	193	206	219	231	244	257
60°	13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260

**Example.** A ship in latitude 39°51' N., longitude 67°35' W., by dead reckoning, obtains a radio bearing of 299° true on the radiobeacon located in latitude 40°37' N., longitude 69°37' W.

Radiobeacon station..... Latitude 40°37' N.  
 Dead-reckoning position of ship..... Latitude 39°51'

Middle latitude..... 40°14'

Radiobeacon station..... Longitude 69°37' W.  
 Dead reckoning position of ship..... Longitude 67°35'

Longitude difference..... 2°02'

Entering the table with difference of longitude equals 2°, which is the nearest tabulated value and opposite 40° middle latitude, the correction of 39' is read.

As the ship is east of the radiobeacon, a minus correction is applied. The Mercator bearing then will be 299° - 000°39' = 298°21'. To facilitate plotting, subtract 180° and plot from the position of the radiobeacon the bearing 298°21' - 180°, or 118°21' (Mercator bearing reckoned clockwise from true north).

**Distance of Visibility of Objects at Sea**

The following table gives the approximate geographic range of visibility for an object which may be seen by an observer whose eye is at sea level; in practice, therefore, it is necessary to add to these a distance of visibility corresponding to the height of the observer's eye above sea level.

Height, feet	Nautical miles								
6	2.8	48	7.9	220	17.0	660	29.4	2,000	51.2
8	3.1	50	8.1	240	17.7	680	29.9	2,200	53.8
10	3.6	55	8.5	260	18.5	700	30.3	2,400	56.2
12	4.0	60	8.9	280	19.2	720	30.7	2,600	58.5
14	4.3	65	9.2	300	19.9	740	31.1	2,800	60.6
15	4.4	70	9.6	320	20.5	760	31.6	3,000	62.8
16	4.6	75	9.9	340	21.1	780	32.0	3,200	64.9
18	4.9	80	10.3	360	21.7	800	32.4	3,400	66.9
20	5.1	85	10.6	380	22.3	820	32.8	3,600	68.6
22	5.4	90	10.9	400	22.9	840	33.2	3,800	70.7
24	5.6	95	11.2	420	23.5	860	33.6	4,000	72.5
26	5.8	100	11.5	440	24.1	880	34.0	4,200	74.3
28	6.1	110	12.0	460	24.6	900	34.4	4,400	76.1
30	6.3	120	12.6	480	25.1	920	34.7	4,600	77.7
32	6.5	130	13.1	500	25.6	940	35.2	4,800	79.4
34	6.7	140	13.6	520	26.1	960	35.5	5,000	81.0
36	6.9	150	14.1	540	26.7	980	35.9	6,000	88.8
38	7.0	160	14.5	560	27.1	1,000	36.2	7,000	96.0
40	7.2	170	14.9	580	27.6	1,200	39.6	8,000	102.6
42	7.4	180	15.4	600	28.0	1,400	42.9	9,000	108.7
44	7.6	190	15.8	620	28.6	1,600	45.8	10,000	114.6
46	7.8	200	16.2	640	29.0	1,800	48.6		

**Conversion Table, Degrees to Points and Vice Versa**

° ' Points	° ' Points	° ' Points	° ' Points
0 00 N	90 00 E	180 00 S	270 00 W
2 49	92 49	182 49	272 49
5 38 N ½ E	95 38 E ½ S	185 38 S ½ W	275 38 W ½ N
8 26	98 26	188 26	278 26
11 15 N x E	101 15 E x S	191 15 S x W	281 15 W x N
14 04	104 04	194 04	284 04
16 53 N x E ½ E	106 53 ESE ½ E	196 53 S x W ½ W	286 53 WNW ½ W
19 41	109 41	199 41	289 41
22 30 NNE	112 30 ESE	202 30 SSW	292 30 WNW
25 19	115 19	205 19	295 19
28 08 NNE ½ E	118 08 SE x E ½ E	208 08 SSW ½ W	298 08 NW x W ½ W
30 56	120 56	210 56	300 56
33 45 NE x N	123 45 SE x E	213 45 SW x S	303 45 NW x W
36 34	126 34	216 34	306 34
39 23 NE ½ N	129 23 SE ½ E	219 23 SW ½ S	309 23 NW ½ W
42 11	132 11	222 11	312 11
45 00 NE	135 00 SE	225 00 SW	315 00 NW
47 49	137 49	227 49	317 49
50 38 NE ½ E	140 38 SE ½ S	230 38 SW ½ W	320 38 NW ½ N
53 26	143 26	233 26	323 26
56 15 NE x E	146 15 SE x S	236 15 SW x W	326 15 NW x N
59 04	149 04	239 04	329 04
61 53 NE x E ½ E	151 53 SSE ½ E	241 53 SW x W ½ W	331 53 NNW ½ W
64 41	154 41	244 41	334 41
67 30 ENE	157 30 SSE	247 30 WSW	337 30 NNW
70 19	160 19	250 19	340 19
73 08 ENE ½ E	163 08 S x E ½ E	253 08 WSW ½ W	343 08 N x W ½ W
75 56	165 56	255 56	345 56
78 45 E x N	168 45 S x E	258 45 W x S	348 45 N x W
81 34	171 34	261 34	351 34
84 23 E ½ N	174 23 S ½ E	264 23 W ½ S	354 23 N ½ W
87 11	177 11	267 11	357 11



DISTANCES IN STRAIT OF JUAN DE FUCA  
AND STRAIT OF GEORGIA  
CAPE FLATTERY, WASH., TO SEATTLE, WASH.,  
AND VANCOUVER, CANADA

February 21, 1959

Figure at intersection of columns opposite ports  
in question is the nautical mileage between the  
two. Example: Port Angeles, Wash., is 69  
nautical miles from Seattle, Wash.

	CAPE FLATTERY, WASH. 48°26.0'N., 124°47.0'W.		SWIFTSURE BANK, WASH. 48°31.0'N., 129°00.0'W.		Neah Bay, Wash. 48°22.4'N., 124°36.5'W.		Port Angeles, Wash. 48°07.5'N., 123°26.4'W.		Victoria, Canada 48°23.0'N., 123°23.5'W.		Port Townsend, Wash. 48°06.8'N., 122°45.2'W.		Port Ludlow, Wash. 47°55.3'N., 122°41.0'W.		Port Gamble, Wash. 47°51.3'N., 122°34.7'W.		Everett, Wash. 47°50.3'N., 122°13.2'W.		Seattle, Wash. 47°36.2'N., 122°23.7'W.		Eagle Harbor, Wash. 47°37.2'N., 122°20.3'W.		Bremerton, Wash. 47°33.5'N., 122°30.7'W.		Tacoma, Wash. 47°16.0'N., 122°38.0'W.		Olympia, Wash. 47°03.1'N., 122°26.0'W.		Roche Harbor, Wash. 48°36.6'N., 122°54.3'W.		Friday Harbor, Wash. 48°32.2'N., 123°09.1'W.		Anacortes, Wash. 48°31.4'N., 123°00.9'W.		Bellingham, Wash. 48°45.1'N., 122°36.7'W.		Blaine, Wash. 48°50.5'N., 122°29.0'W.		Nanaimo, Canada 49°10.1'N., 122°45.9'W.		New Westminster, Canada 49°12.0'N., 123°56.0'W.		Vancouver, Canada 49°17.4'N., 123°06.6'W.																																																																																																																																																																																																															
10	10	20	61	71	54	62	71	55	19	86	96	79	32	34	100	110	93	46	48	16	104	114	97	50	53	21	10	117	127	110	63	66	34	26	28	111	121	103	56	59	27	19	21	16	124	134	116	69	72	40	32	34	30	14	123	133	115	68	71	40	32	34	29	28	131	141	124	77	80	48	40	42	38	23	14	13	143	153	136	89	91	59	52	53	49	34	25	25	29	168	178	160	113	115	84	75	78	73	59	50	50	50	34	83	92	76	36	25	41	54	58	71	64	77	76	85	96	121	87	96	80	37	30	30	44	48	62	54	67	67	76	86	112	93	102	86	42	36	30	43	47	49	54	66	66	74	86	110	27	18	108	117	101	54	50	43	57	61	63	68	80	80	88	100	124	37	28	17	112	121	105	65	55	59	72	76	80	83	95	95	104	115	139	35	37	36	38	145	154	138	99	89	97	111	115	118	121	134	134	142	154	177	66	69	76	75	55	139	148	132	93	82	91	105	109	114	116	128	128	137	148	171	60	60	70	71	48	48	141	150	133	95	83	92	106	110	115	117	129	129	138	149	173	62	62	71	72	48	36	41

APPENDIX

## TRANS-PACIFIC DISTANCES

February 21, 1959

Figure at intersection of columns opposite ports in question is the nautical mileage between the two. Example: San Francisco, Calif., is 2091 nautical miles from Honolulu, Hawaii.

	Panama, Panama 8°53.0'N., 79°31.0'W.	San Diego, Calif. 32°43.0'N., 117°10.5'W.	Long Beach, Calif. 33°46.2'N., 118°13.3'W.	Los Angeles, Calif. 33°45.0'N., 118°16.2'W.	San Francisco, Calif. 37°48.5'N., 122°24.0'W.	Astoria, Oreg. 46°11.7'N., 123°50.0'W.	Portland, Oreg. 45°33.0'N., 122°41.7'W.	CAPE FLATTERY, WASH. 48°26.0'N., 124°47.0'W.	SWIFTSURE BANK, WASH. 48°31.0'N., 125°00.0'W.	Seattle, Wash. 47°36.2'N., 122°20.3'W.	CAPE SPENCER, ALASKA 58°10.0'N., 136°38.3'W.	Whittier, Alaska 60°46.8'N., 148°39.6'W.	Seward, Alaska 60°06.0'N., 149°26.0'W.	Unimak Pass, Alaska 54°20.0'N., 164°45.0'W.	Hilo, Hawaii 19°44.1'N., 155°03.5'W.	Honolulu, Hawaii 21°18.5'N., 157°52.3'W.	Midway Islands 28°13.0'N., 177°22.0'W.
2867																	
2939	94																
2939	95	3															
3270	455	374	371														
3803	989	908	904	567													
3888	1074	992	989	652	85												
3920	1104	1024	1020	683	153	238											
--	--	--	--	--	--	--	10										
4044	1228	1148	1144	807	278	362	124	134									
4603	1787	1707	1703	1366	883	968	--	739	976*								
4958	2142	2061	2058	1720	1251	1336	--	1107	1241	407							
4940	2124	2043	2040	1702	1242	1327	--	1100	1234	422	125						
5228	2412	2331	2328	1990	1626	1711	--	1510	1644	987	742	652					
4527	2175	2143	2140	2019	2214	2299	2260	--	2384	2447	2535	2439	2126				
4685	2278	2236	2233	2091	2246	2331	2285	--	2409	2411	2474	2373	2028	196			
5720	3097	3034	3031	2792	2721	2806	2694	--	2818	2472	2390	2257	1680	1364	1180		

\* Via inside route.



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*Number in parentheses immediately following any item in this Index is the number of the largest scale United States Coast and Geodetic Survey or Hydrographic Office chart on which that feature appears.*

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**INTERNATIONAL NAUTICAL MILES TO STATUTE MILES**

1 nautical mile = 6,076.10 feet or 1,852 meters      1 statute mile = 5,280 feet or 1,609.35 meters

Nautical miles	0	1	2	3	4	5	6	7	8	9
0	0.000	1.151	2.302	3.452	4.603	5.754	6.905	8.055	9.206	10.357
10	11.508	12.659	13.809	14.960	16.111	17.262	18.412	19.563	20.714	21.865
20	23.016	24.166	25.317	26.468	27.619	28.769	29.920	31.071	32.222	33.373
30	34.523	35.674	36.825	37.976	39.126	40.277	41.428	42.579	43.730	44.880
40	46.031	47.182	48.333	49.483	50.634	51.785	52.936	54.087	55.237	56.388
50	57.539	58.690	59.840	60.991	62.142	63.293	64.444	65.594	66.745	67.896
60	69.047	70.197	71.348	72.499	73.650	74.801	75.951	77.102	78.253	79.404
70	80.554	81.705	82.856	84.007	85.158	86.308	87.459	88.610	89.761	90.911
80	92.062	93.213	94.364	95.515	96.665	97.816	98.967	100.118	101.268	102.419
90	103.570	104.721	105.871	107.022	108.173	109.324	110.475	111.625	112.776	113.927

**STATUTE MILES TO INTERNATIONAL NAUTICAL MILES**

Statute miles	0	1	2	3	4	5	6	7	8	9
0	0.000	0.869	1.738	2.607	3.476	4.345	5.214	6.083	6.952	7.821
10	8.690	9.559	10.428	11.297	12.166	13.035	13.904	14.773	15.642	16.511
20	17.380	18.249	19.118	19.986	20.855	21.724	22.593	23.462	24.331	25.200
30	26.069	26.938	27.807	28.676	29.545	30.414	31.283	32.152	33.021	33.890
40	34.759	35.628	36.497	37.366	38.235	39.104	39.973	40.842	41.711	42.580
50	43.449	44.318	45.187	46.056	46.925	47.794	48.663	49.532	50.401	51.270
60	52.139	53.008	53.877	54.746	55.615	56.484	57.353	58.222	59.091	59.959
70	60.828	61.697	62.566	63.435	64.304	65.173	66.042	66.911	67.780	68.649
80	69.518	70.387	71.256	72.125	72.994	73.863	74.732	75.601	76.470	77.339
90	78.208	79.077	79.946	80.815	81.684	82.553	83.422	84.291	85.160	86.029

**FEET TO METERS**

Feet	0	1	2	3	4	5	6	7	8	9
0	0.00	0.30	0.61	0.91	1.22	1.52	1.83	2.13	2.44	2.74
10	3.05	3.35	3.66	3.96	4.27	4.57	4.88	5.18	5.49	5.79
20	6.10	6.40	6.71	7.01	7.32	7.62	7.92	8.23	8.53	8.84
30	9.14	9.45	9.75	10.06	10.36	10.67	10.97	11.28	11.58	11.89
40	12.19	12.50	12.80	13.11	13.41	13.72	14.02	14.33	14.63	14.93
50	15.24	15.54	15.85	16.15	16.46	16.76	17.07	17.37	17.68	17.98
60	18.29	18.59	18.90	19.20	19.51	19.81	20.12	20.42	20.73	21.03
70	21.34	21.64	21.95	22.25	22.55	22.86	23.16	23.47	23.77	24.08
80	24.38	24.69	24.99	25.30	25.60	25.91	26.21	26.52	26.82	27.13
90	27.43	27.74	28.04	28.35	28.65	28.96	29.26	29.57	29.87	30.17

**FATHOMS TO METERS**

Fathoms	0	1	2	3	4	5	6	7	8	9
0	0.00	1.83	3.66	5.49	7.32	9.14	10.97	12.80	14.63	16.46
10	18.29	20.12	21.95	23.77	25.60	27.43	29.26	31.09	32.92	34.75
20	36.58	38.40	40.23	42.06	43.89	45.72	47.55	49.38	51.21	53.03
30	54.86	56.69	59.52	60.35	62.18	64.01	65.84	67.67	69.49	71.32
40	73.15	74.98	76.81	78.64	80.47	82.30	84.12	85.95	87.78	89.61
50	91.44	93.27	95.10	96.93	98.75	100.58	102.41	104.24	106.07	107.90
60	109.73	111.56	113.39	115.21	117.04	118.87	120.70	122.53	124.36	126.19
70	128.02	129.85	131.67	133.50	135.33	137.16	138.99	140.82	142.65	144.47
80	146.30	148.13	149.96	151.79	153.62	155.45	157.28	159.11	160.93	162.76
90	164.59	166.42	168.25	170.08	171.91	173.74	175.56	177.39	179.22	181.05