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*FINAL REPORT*

**Evaluation of Dredge Fishing Activity  
on the Seaside of Virginia's Eastern Shore,  
December 1994 - November 1995**

Submitted to:

**Laura McKay  
Coastal Projects Coordinator  
Virginia Department of Environmental Quality  
Richmond, Virginia 23219**



By



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Virginia Institute of Marine Science  
College of William and Mary**

**Principal Investigators:**

**Mark W. Luckenbach  
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**Disclaimer**

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## Introduction

The system of barrier islands, coastal bays and salt marshes along the Atlantic coast of Virginia's Eastern Shore support natural resources which are invaluable assets to the Commonwealth and its citizens. The system is unique along the U.S. Atlantic seaboard in its extent of undeveloped barrier islands and pristine marsh habitats. These habitats serve as nursery sites for nearshore species and support resident species, including numerous commercially important finfish and shellfish. This region (subsequently termed the Seaside) differs from Chesapeake Bay in many important aspects, including tidal regime, habitat landscapes and living resource distributions, and these differences have implications for fisheries management. This uniqueness is reflected in fisheries practices and regulations on the Seaside which often differ significantly from those in the Bay. In some cases the regulations have evolved without a full appreciation of the impacts of the fishery's activities on the habitats and their living resources. Recently concerns have been raised related to the impacts of clam (*Mercenaria mercenaria*) and crab (*Callinectes sapidus*) dredge fishing activities in this area on habitat integrity and living resources.

Dredging has a long history in Virginia's commercial fisheries. In general, dredges are scraping or digging apparatuses that harvest as they are towed behind boats under power. Mechanical dredges have been used with sail power to harvest oysters since the mid-1800's. Crabs have been harvested by power dredges since at least 1900, while dredge fishing of clams, which reside deeper in the substrate, began somewhat later. Individual crab dredges in Virginia can be a maximum of 8 ft wide and are usually pulled in pairs for a maximum total width of 16 ft. The dredge has a scraping or combing forward bar with 4 to 6 inch-long teeth that dig crabs out of the bottom sediment. The crabs then move across the bar into a chain or mesh bag. In the dredging process many materials may become dislodged from the bottom (e.g. rocks, macroalgae, vascular plants and other shellfish); those greater than the bag mesh will be retained throughout the towing period. Oyster dredges are similar in design to the crab dredge; however, they are usually only 4 ft wide. Clam dredges were originally similar to oyster dredges, but over the years as clam populations have declined, the teeth in the clam dredge have been lengthened to dig deeper, and the bag is sometimes replaced with a heavy metal cage constructed of welded reinforcing bar.

Crabs can legally be dredged in Virginia in the mainstem of the Bay and on the Seaside from December 1 to March 31. Bycatch of horseshoe crabs (*Limulus polyphemus*), conchs (*Busycon* spp.), rock crabs (*Cancer irroratus*) and clams from this fishery can also be sold. Clam harvests, as by-catch in the crab dredge fishery in the Bay, are limited to 250 per boat per day, but a special permit on the Seaside allows an unlimited bycatch.

It is unlawful to harvest clams with a clam dredge from public grounds in the Bay; however, dredges can be used on private or leased bottoms. Again regulations differ for the Seaside where clam dredging is permitted year-round on private or leased grounds and from December 1 to March 31 on public and unassigned grounds. Approximately 21,000 acres of

submerged bottomland on the Seaside currently are leased privately from the State and dredging permits are held for about 10,000 acres. By-catch from the clam dredge fishery is not regulated on Seaside except for crabs from April 1 through November 30.

There has been concern by researchers, fisheries managers and some watermen for many years of possible detrimental effects of dredging in the Bay and on Seaside; however, systematic studies of the impacts from these fisheries have not been conducted. On the Seaside detailed data are not available on present dredge practices and impacts. Anecdotal information suggests that clam dredging is increasing, especially as the oyster harvest has declined.

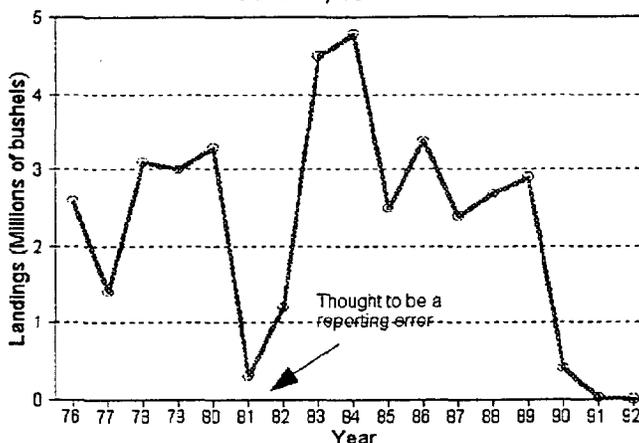
One source of concern in the clam dredge fishery is a recent pattern in lease holdings. Normally, shellfish grounds are leased for 10 year periods, but some clam leases are being dredged for a few years until most clams are caught and then the lease is abandoned and returns to the state. The State leases bottomlands for the "purpose of planting or propagating oysters" (later amended to include other shellfish) (Code of Virginia, Section 28.2-603), but it appears that this is being abused by some in the dredge fishery, who are making no effort to propagate shellfish or sustain the resource.

The reported crab dredge harvest on Seaside has plummeted from 3 - 4 million pounds annually ten years ago to almost zero during 1992 - 1993 (Fig. 1). Crab dredging still occurs on Seaside, however, because of the unlimited legal by-catch of clams. Presumably, this has added further pressure on clam populations.

Another concern about these practices arises from anecdotal evidence of damage and destruction to clams and crabs during the harvesting process. Comments from some harvesters suggest that as high as 50% of the clams in the path of a dredge may be damaged. Furthermore, observational evidence suggests significant habitat damage, often dramatically altering bottom topography (M. Castagna, pers. comm.). Reports received by VMRC staff allege that dredging is occurring on public oyster rocks and in areas less than 4 feet deep (both of which are illegal). Additionally, new efforts in aquaculture of clams, oysters and scallops are potentially threatened by nearby dredging

Sufficient concerns regarding these dredge practices were raised to the VMRC staff by late 1993 that the issue was brought before the Commission at monthly meetings in November

Figure 1. Hard crab landings on the Seaside, 1976-1992



1993 and January 1994. At the November meeting the issue of clam dredging practices on leased grounds on the Seaside was addressed, but there were insufficient data related to resource or habitat damage to deny a lease applicant. In January 1994 the Commission held a public hearing regarding a moratorium on crab dredging on Seaside. Despite apparent continued dredging activity even when crab landings were near zero, sufficient supporting data to close the fishery were not available.

With these concerns in mind we undertook a cooperative project between VIMS and VMRC to address some of the most pressing issues related to the environmental impacts of commercial dredge fishing on the Seaside of Virginia's Eastern Shore. Our primary objectives were to assess the scope of the activity and some of its impacts. Of particular interest was determining the temporal and spatial patterns of dredging activity along the Seaside in relation to the various seasonal restrictions on both public and leased bottom habitat.

## Methods

### *Aerial observations*

We quantified the number of boats working and their locations throughout the year using aerial reconnaissance. On the Seaside individual geomorphic features are small and interspersed on spatial scales considerably smaller than throughout most of the Bay. Mid-channel and creek banks are seldom separated by more than a few yards; intertidal oyster rocks and mudflats emerge in the middle of creeks adjacent to channels. Thus, accurately determining the position of dredge boats is essential to assessing activity patterns. We wished to establish not only large-scale patterns of dredging activity (from Chincoteague Bay to Magothy Bay) but also the small-scale patterns (channels vs flats, bays vs creeks). For this reason, we used aerial observations assisted by a Global Positioning System (GPS). Throughout the project year we attempted to make weekly flights along the entire length of the Seaside and establish the location and activity of all dredge boats. In addition, we noted the locations of all boats operating patent tongs, an alternative fishing approach for clams.

The locations of all observed fishing boats were plotted onto highly detailed shoreline maps constructed by the VMRC's Surveying and Engineering Division. These maps show the locations of shorelines, channels and tidal flats, and indicate areas of public and leased bottom. Summary maps of dredging activity were produced by plotting the coordinates of all boats onto USGS maps of the region. The locations of boats using patent tongs to harvest clams were also mapped.

### *Impacts of Dredge Fishing*

The impacts of dredging are apt to be numerous, perhaps long-term, and many are no doubt subtle. A complete accounting of these impacts was beyond the scope of this study. We addressed a few specific concerns regarding the fisheries' practices and their impacts which had been raised by the VMRC staff and by working watermen. First, by-catch from both the crab and clam dredge fisheries and the condition of animals brought onboard needed to be quantified. We accomplished this by placing observers on commercial boats and recording areas of operation, patterns of dredging, by-catch and condition of organisms caught in the dredges. There are, of course, limitations inherent in this approach. Commercial fisherman do not necessarily display normal activity when an observer is onboard (e.g., illegally pulling a crab dredge in less than 4 ft of water).

The impact of dredge fishing on bottom communities, including the target commercial species cannot be assessed in a single season. Annual patterns of population responses to repeated dredging activity would have to be addressed in a multi-year study. We attempted a first-order evaluation of the impacts of dredging by characterizing bottom communities before and after varying levels of dredging. Our first task in this evaluation was to identify a suitable experimental site which met several criteria: (i) it needed to have commercial quantities of clams; (ii) it must not have been dredged recently; and (iii) it either had to be leased bottom to which we could get access or public bottom which the Marine Resources Commission would be willing to close for the study duration. After considerable effort we managed to locate a site meeting all of these criteria. It is located in Hog Island Bay in a region called Spider Crab Bay. An area within Spider Crab Bay, approximately 142 acres, is leased by Mr. Buddy Bell, who has not permitted dredging at the site for over 10 years. He agreed to permit us to use the site for our study and to conduct controlled dredging experiments for us.

In June, 1995, we identified and demarcated four experimental plots in Spider Crab Bay. Each plot was a 1256 m<sup>2</sup> circle (20 m radius) marked with a center stake. Preliminary sampling was conducted using a Smith-MacIntyre grab, a mechanical dredge, a hydraulic dredge and a suction sampler to determine which gear provided the best quantitative sample of hard clams. The suction sampler, when used to extract the upper 15 cm of sediment within a 1.5 m diameter ring, proved to be the best for small- and medium-sized clams (shell height <2.5 inches); however, none of the methods proved adequate for quantitatively sampling larger clams. For sampling large clams we leased a hydraulically-operated escalator aboard a 45' vessel, the *Captain Josh*. This device allowed us to adjust the pressure of a hydraulic head as it moves along the bottom and jets water to extract sediment and fauna. Sample materials then move up a conveyor belt to the boat.

Three replicate suction samples were taken from randomly selected sites within each of the four plots during the second week of June, 1995. The contents of the samples were sieved

through a 3 mm mesh and transported live to the laboratory. All clams and other macrofauna were sorted live and preserved in 10% buffered formalin. During July we obtained estimates of initial density for large clams (shell height > 2.5 inches) from each of the 1256 m<sup>2</sup> plots by taking 3 2.79 m<sup>2</sup> (.46 m x 6.1 m) samples from each using the hydraulic escalator. Clams were collected from the conveyor belt as it moved along side the boat, placed into mesh bags and returned to the laboratory for enumeration and measuring.

We contracted the commercial fishing vessel *Three Brothers* to dredge these plots for clams in the manner typically used in the fishery. In this approach, the vessel first makes several loops around the center stake, travelling in concentric circles and using its propeller wake to dislodge macroalgae and hydroids. The fishermen term this "washing the bottom" and use it to reduce clogging of their dredge. The *Three Brothers* used a typical 4 ft wide clam dredge with a mesh bag attached. The teeth on this dredge were modified from the historical oyster dredge to about 6 inches for greater penetration into the sediment. This dredge had a standard mesh bag, rather than the modified cage, attached (see description of modified dredge on pg. 14). The dredge was deployed over the side of the boat and was then pulled in concentric circles around the center stake. Typically a single circular area of this size (radius approximately 20 m) will be dredged from 1 - 3 hours, depending upon the clams it is yielding and the stage of the tide. Although we contracted the *Three Brothers* to dredge only two of the four plots (leaving two as undredged controls), when few clams were found in the first two plots, the operator dredged the remaining two. As Table 1 indicates, the dredging time and numbers of clams recovered from each plot varied.

**Table 1. Dredging time, clam landings and bycatch for each of the experimental plots.**

Plot	Dredging time (min)	Clams Caught	Clams Damaged	Bycatch
A	53	8	2	20 blood clams, blue crabs, spider crabs, conch, horseshoe crabs
B	54	11	3	11 blod clams, blue crabs, spider crabs
C	27	30	0	5 blood clams
D	62	975	11	32 blood clams, 4 conch

Shortly after the dredging of the plots was completed, we returned to the site and repeated the sampling with the suction sampler. As before three replicate suction samples were taken from

each of the four plots. The contents of the samples were sieved through a 3 mm mesh screen and transported live to the laboratory. All clams and other macrofauna were sorted live and preserved in 10% buffered formalin. These samples were followed by another sampling with the hydraulic escalator to estimate post-dredging densities of large clams. As before 3 replicate 2.79 m<sup>2</sup> samples were taken from each of the 4 plots.

Underwater still photographs and video were taken of selected locations in all plots before and after dredging. Unfortunately, water clarity at that time of the year was very poor and little of the bottom was visible.

## Results

### *Dredging Activity*

Over the period from December 1, 1994 - November 30, 1995 we made a total of 39 flights along the entire length of the Seaside of Virginia's Eastern Shore and recorded the position and activity of all observed commercial fishing vessels (Table 2). Flights were necessarily restricted to times of good weather and visibility, and they were generally timed to correspond to high tides when fishing activity was presumed to be the greatest in these habitats. The precise locations of all clam dredging, crab dredging and patent tonging boats and the dates on which they were observed are shown in Appendix I plotted on the VMRC shoreline maps. These small-scale maps show the fishing activity in relation to shorelines, channels, leased bottom and public grounds. These plots are summarized on USGS shoreline maps for the entire Seaside (Figure 2) and smaller regions extending from Fisherman's Island in the south to Chincoteague Bay in the north (Figures 3-7). These results show that these fishing activities extend throughout the coastal bay system and indicate some regions where they are concentrated. We will discuss these results separately for crab and clam dredging activities.

Crab dredging - Crab dredge season extends from December 1 through March 31 during which time crabs may be legally dredged from public bottoms greater than 4 ft in depth. Crab dredge boats are easily recognized by the stern deployment of their dredge (in contrast to clam dredges which are deployed over the side of the boat). The average number of crab dredge boats observed in this study declined over the course of the season from approximately 7 boats/day in December to 2 in March; no crab dredge boats were observed after the close of the season in April (Fig. 8). Most of the observed activity was on public and unassigned ground with only an occasional crab dredger observed on leased grounds (Fig. 9). We observed crab dredgers widely distributed along the seaside (Fig. 2). Though we cannot determine precisely whether or not all boats were in 4 ft or greater water depth, crab dredgers were not generally observed in shallow water and many mapped to channels on the USGS shoreline maps (Figs. 3-7).

**Table 2. Observations of fishing activity from overflights of the Seaside, Dec. 1994-Nov. 1995. Numbers of boats crab dredging, clam dredging and patent tonging are indicated.**

Date	# Crab dredgers	#Clam dredgers	#Patent tongers
12/02/94	0	6	4
12/16/94	10	7	3
12/21/94	10	8	6
12/22/94	16	11	4
1/03/95	19	9	10
1/06/95	6	7	2
1/09/95	9	9	5
1/25/95	4	5	1
1/27/95	1	4	3
1/31/95	8	6	7
2/24/95	4	4	2
3/03/95	7	2	2
3/10/95	1	0	2
3/24/95	0	0	1
3/27/95	1	2	1
4/27/95	0	5	2
5/03/95	0	4	1
5/12/95	0	1	3
5/17/95	0	3	0
5/23/95	0	1	0
6/02/95	0	6	0
6/5/95	0	4	0
6/16/95	0	5	2
7/06/95	0	2	1
7/13/95	0	3	0
7/20/95	0	2	1
7/24/95	0	1	1
8/04/95	0	1	1
8/10/95	0	3	1
8/23/95	0	2	0
8/31/95	0	0	1
9/12/95	0	0	0
9/25/95	0	2	0
10/11/95	0	3	5
10/25/95	0	4	4
11/06/95	0	5	4
11/17/95	0	4	2
11/21/95	0	0	2
11/30/95	0	1	2

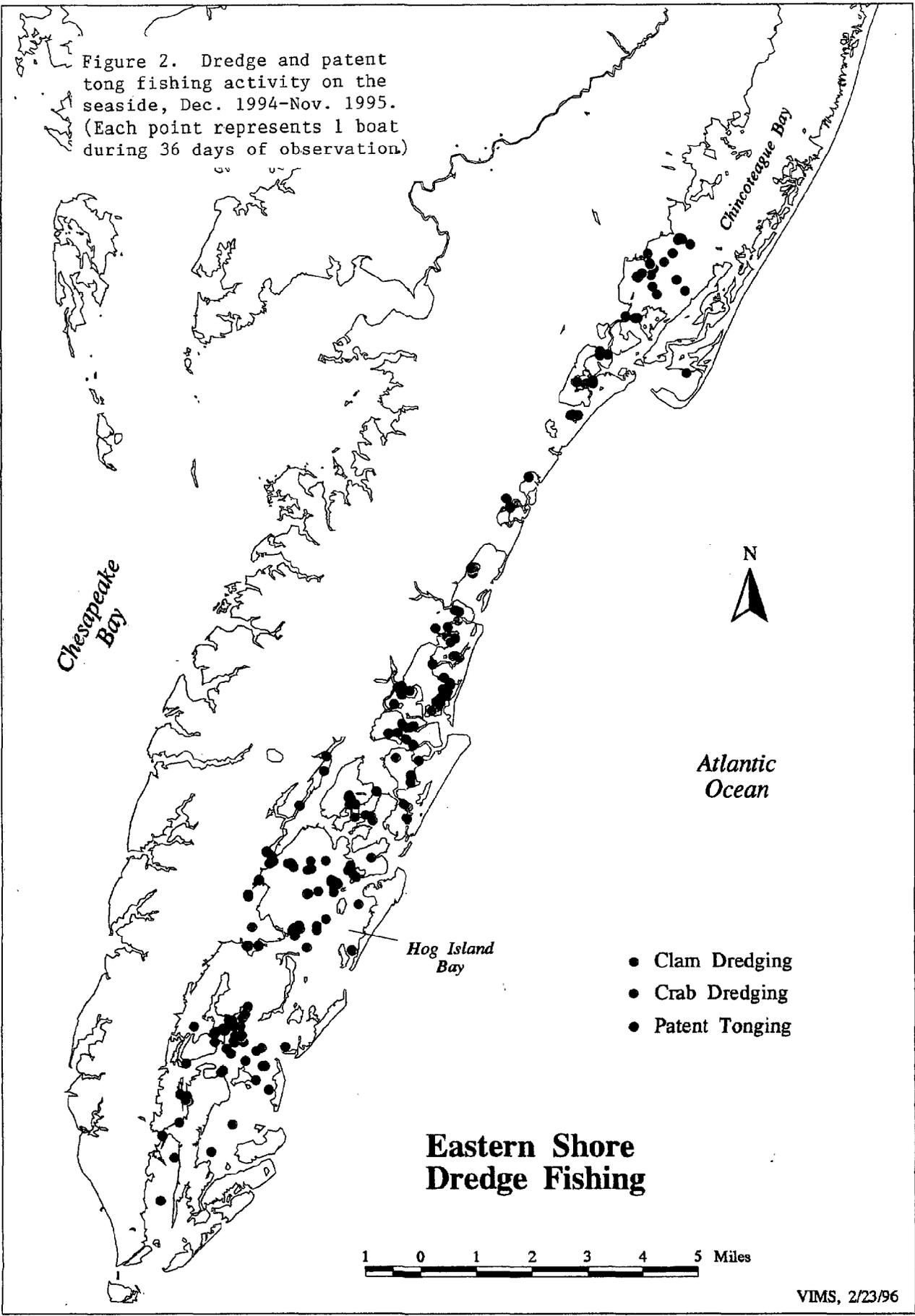
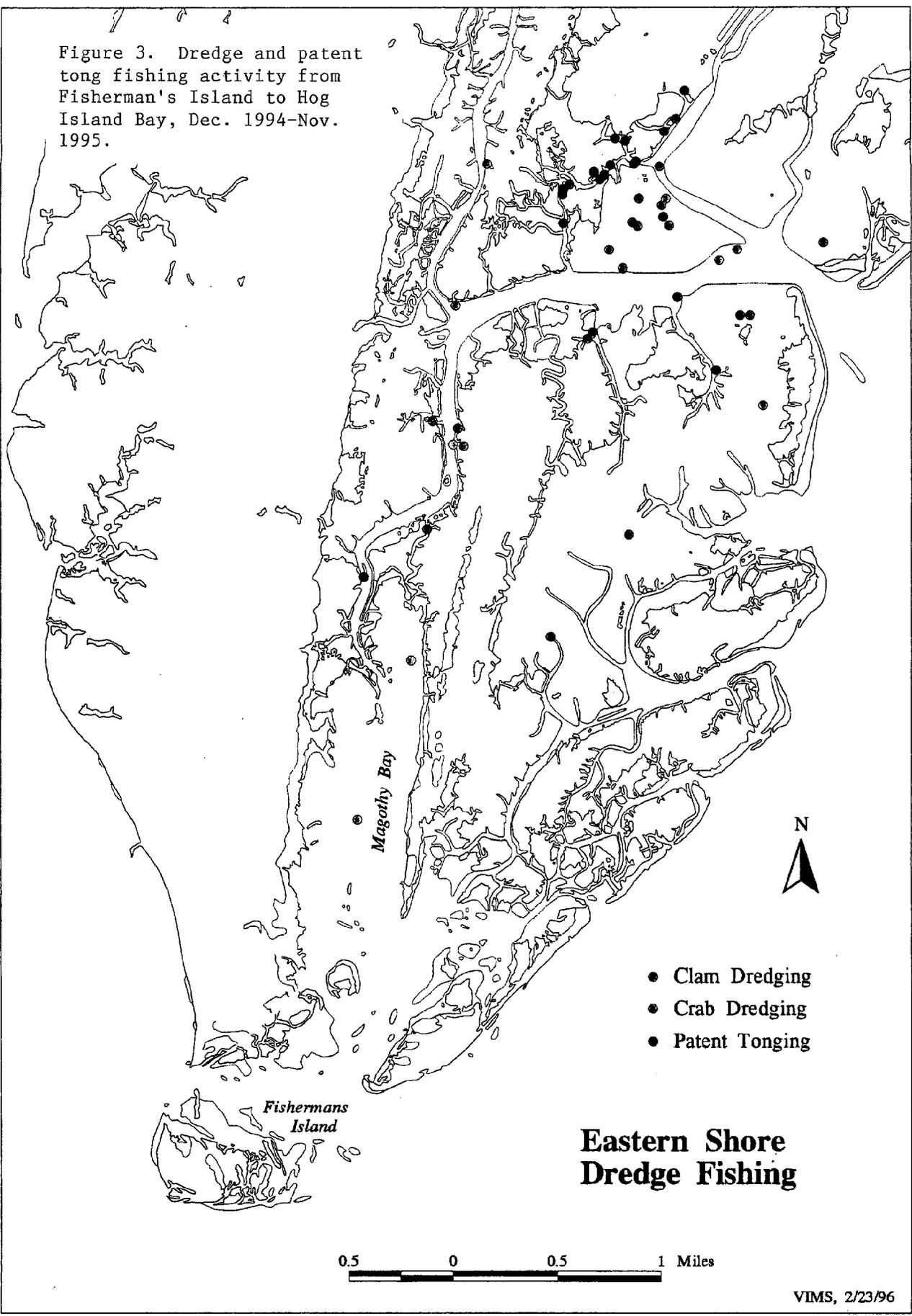


Figure 3. Dredge and patent tong fishing activity from Fisherman's Island to Hog Island Bay, Dec. 1994–Nov. 1995.



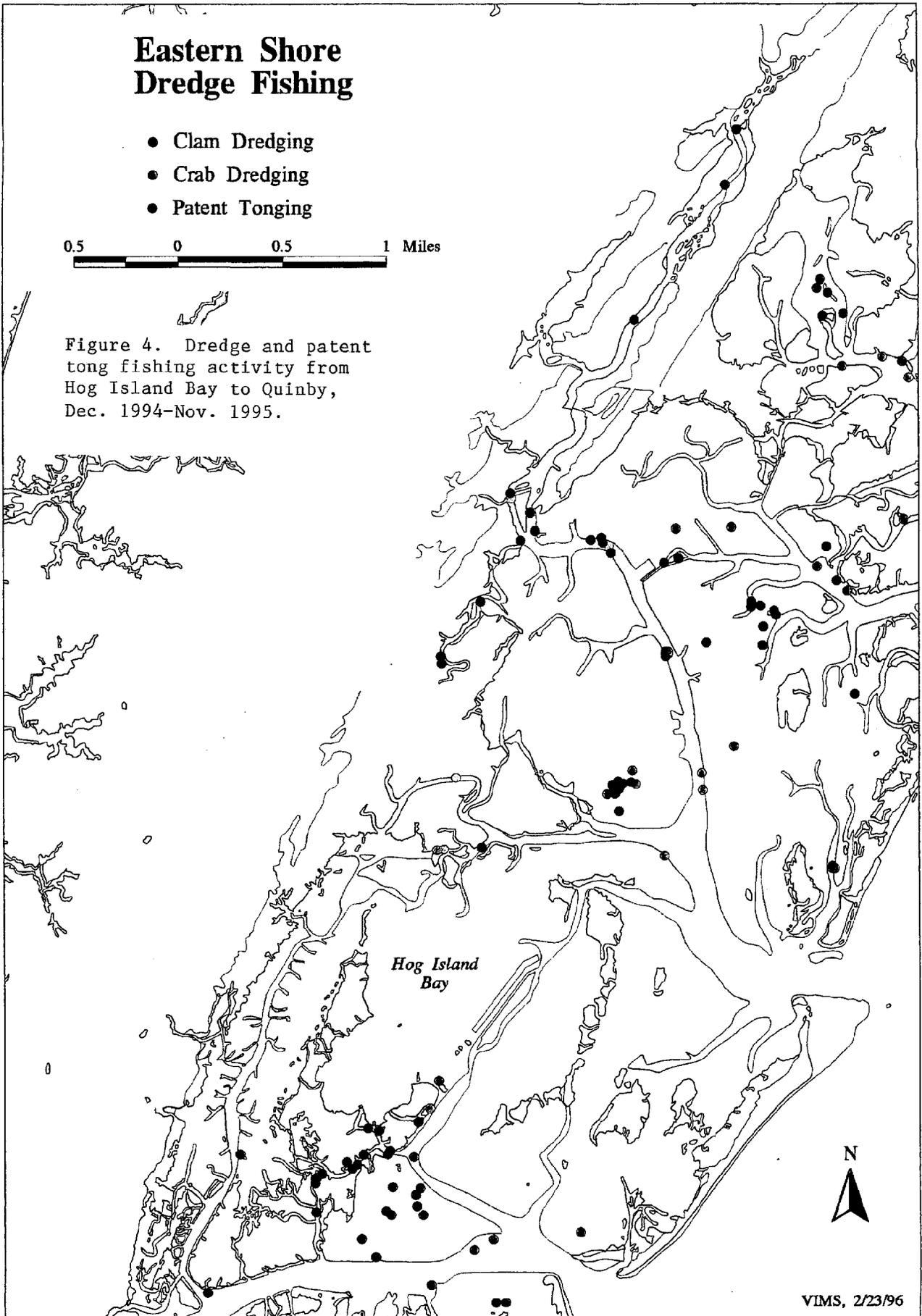
# Eastern Shore Dredge Fishing

- Clam Dredging
- Crab Dredging
- Patent Tonging

0.5 0 0.5 1 Miles



Figure 4. Dredge and patent tong fishing activity from Hog Island Bay to Quinby, Dec. 1994–Nov. 1995.



VIMS, 2/23/96

# Eastern Shore Dredge Fishing

- Clam Dredging
- Crab Dredging
- Patent TONGING

0.5 0 0.5 1 Miles

Figure 5. Dredge and patent tong fishing activity from Quinby Inlet to Metomkin Inlet, Dec. 1994–Nov. 1995.

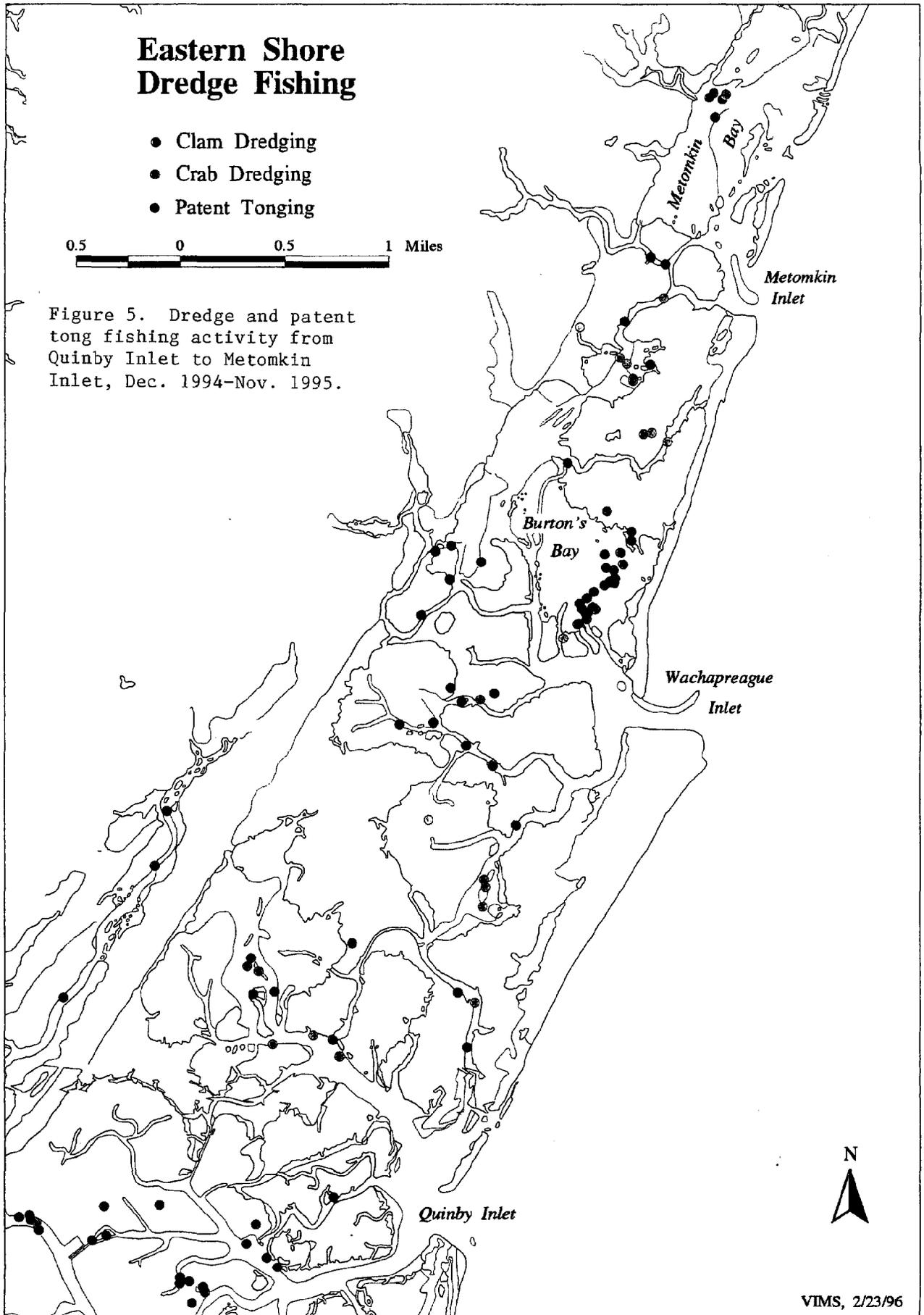
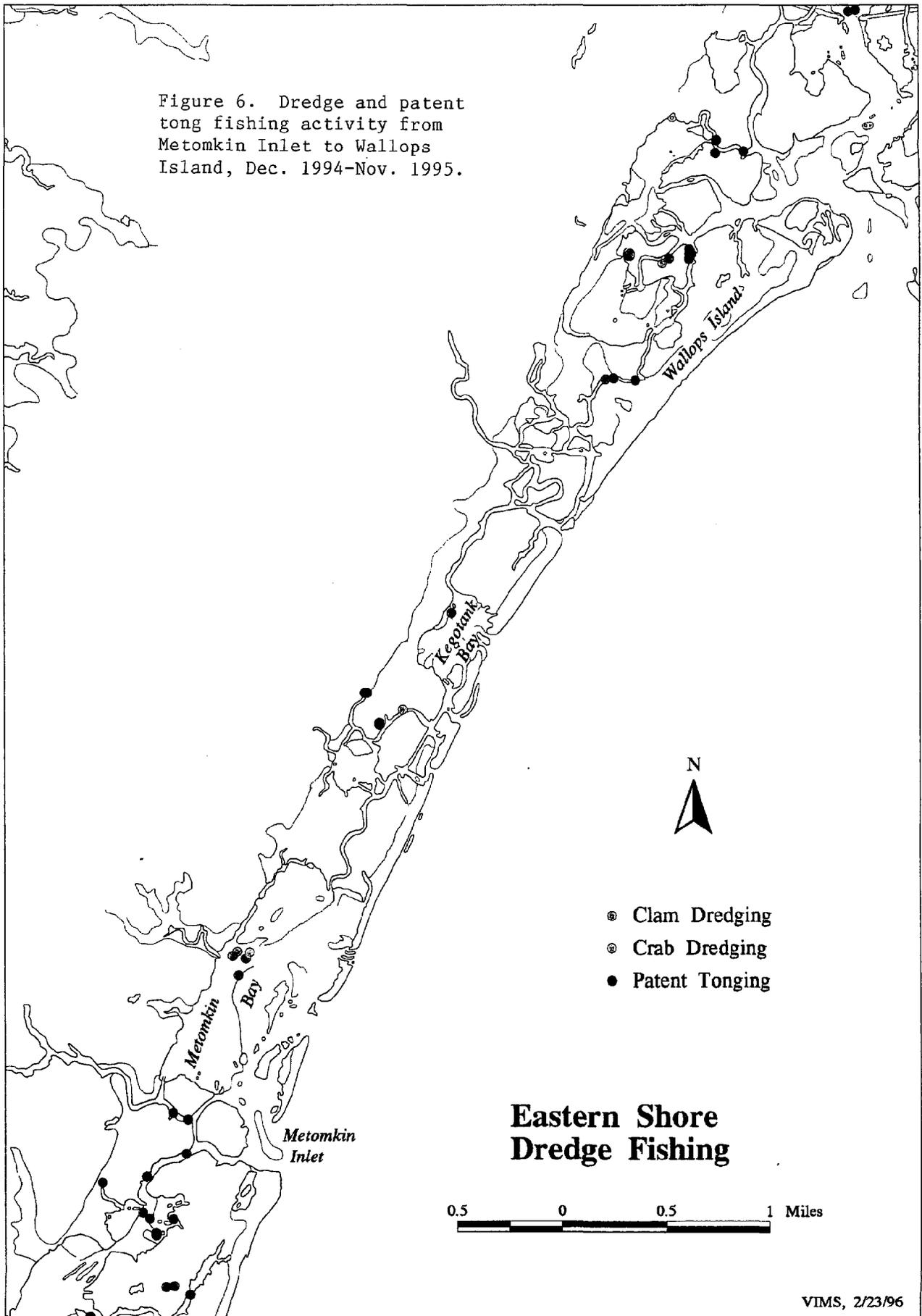


Figure 6. Dredge and patent  
tong fishing activity from  
Metomkin Inlet to Wallops  
Island, Dec. 1994–Nov. 1995.

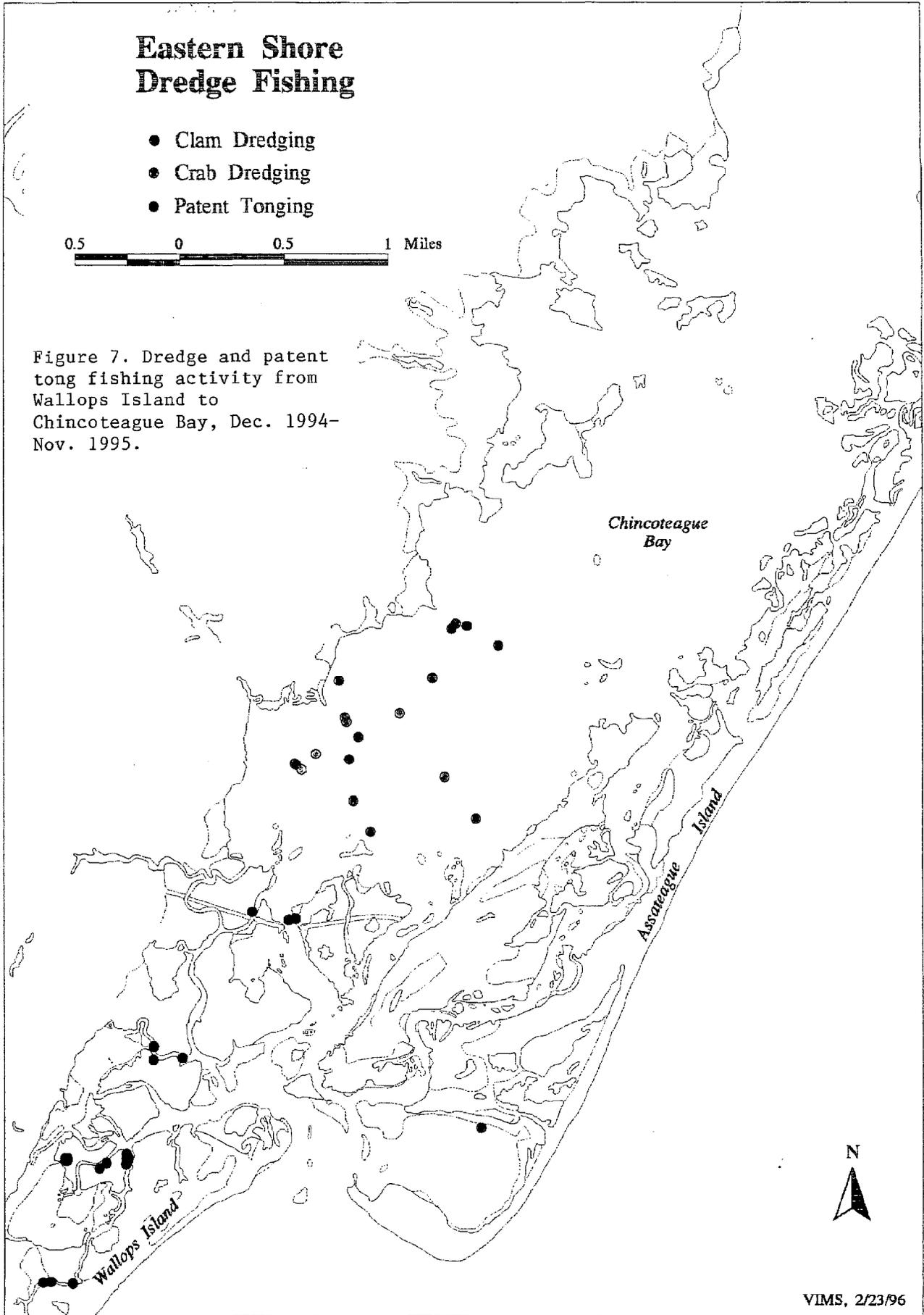


# Eastern Shore Dredge Fishing

- Clam Dredging
- Crab Dredging
- Patent TONGING

0.5 0 0.5 1 Miles

Figure 7. Dredge and patent tong fishing activity from Wallops Island to Chincoteague Bay, Dec. 1994–Nov. 1995.



Clam dredging - On the Seaside clam dredging is permitted on public and unassigned grounds from December 1 through March 31 and on private grounds year round. Clam dredge boats were observed throughout the year, but the number of boats was never high; monthly averages ranging from 8 boats/day in December 1994 to near 1 boat/day in March and September 1995 (Fig. 10) and the largest number of clam dredge boats observed on 1 day was 11 (Table 2). Our data reveal the greatest proportion of clam dredging activity on public grounds during November through February (Fig. 11). Clam dredging was distributed along the entire length of the Seaside (Fig. 2), but was clearly concentrated on a few shallow water habitats in Hog Island Bay (Figs. 3 & 4), Burton's Bay (Fig. 5) and Chincoteague Bay (Fig. 7).

Two types of dredges are presently used by clam dredgers on the Eastern Shore. The basic design is taken from the historically-used oyster dredge; it is generally 4 ft wide and has a forward scraping bar with 6 - 8 inch teeth. One type uses a mesh bag at the end to catch the clams and the other uses a heavy metal cage which allows the dredge to dig deeper into the bottom. Recently this design has become so exaggerated that in some cases the dredge acts as an anchor that allows the power boat propeller to stir and fluidize the bottom, thereby digging or "kicking" the clams out of the bottom. Using a boat's propeller to hydraulically fluidize the bottom is illegal if done with an anchor, but this regulation is now circumvented with the use of these heavy dredges. We did not obtain data on the number of boats using each type of dredge or on the relative amount of area dredged by each. Conversations with dredge fishermen indicate that dredges with bags are preferred in habitats with soft mud bottoms and dredges with cages are preferred in habitats with sand or clay bottoms.

#### *Impacts of dredge fishing*

Crab dredging - We sought to position an observer onboard a commercial crab dredge boat on several occasions during the entire season, December through March. Initially we received good cooperation from some fishermen and we collected data aboard three boats during December 1994 and January 1995. After that period, we had difficulty gaining access, particularly aboard other dredge boats. We were expressly denied access aboard any boats during spring high tides, when the shallow flats (presumably with good clam resources) were accessible. Table 3 summarizes our findings with regard to crab harvest, crab damage and by-catch from the dredge boats we were permitted aboard. During our observations all dredging was conducted in waters with greater than 4 ft depth. Crab landings during these observations ranged from 1 - 14 bushels and the percentage of damaged from 0 to 100%. Also, the number of clams caught varied considerably, from as few as 20 to 1200. On two occasions during which we were aboard the dredge boat *Samantha* was clearly targeting blood clams (*Noetia ponderosa*).

Figure 8. Crab dredging activity. Monthly average number of boats per day, Dec. 1994-Nov. 1995.

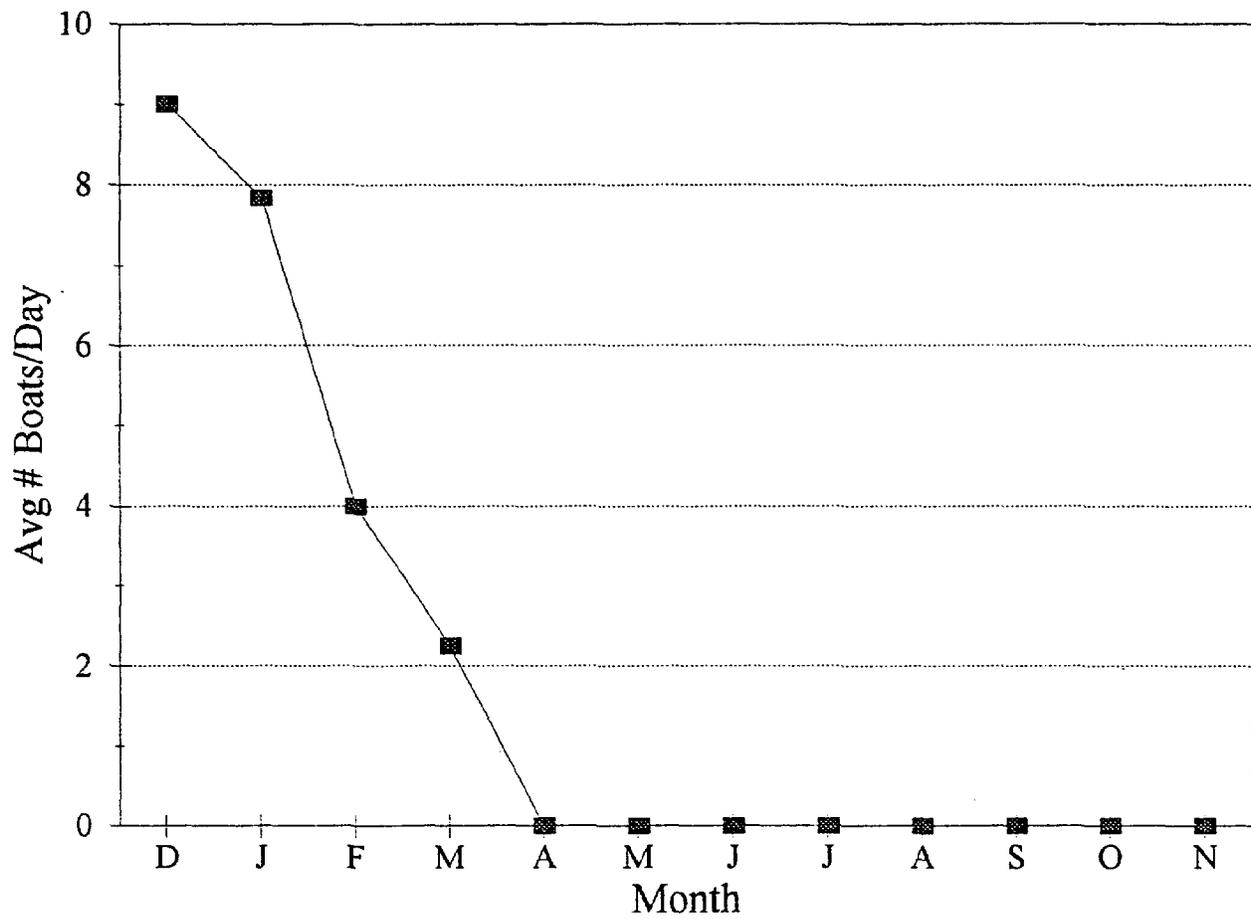


Figure 9. Crab dredging activity by lease status, Dec. 1994-Nov. 1995.

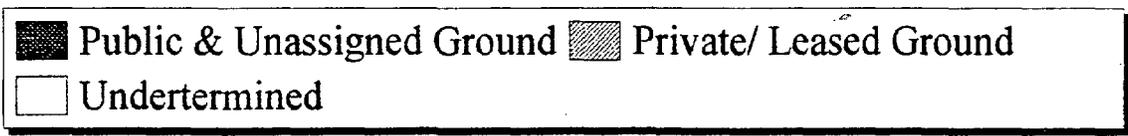
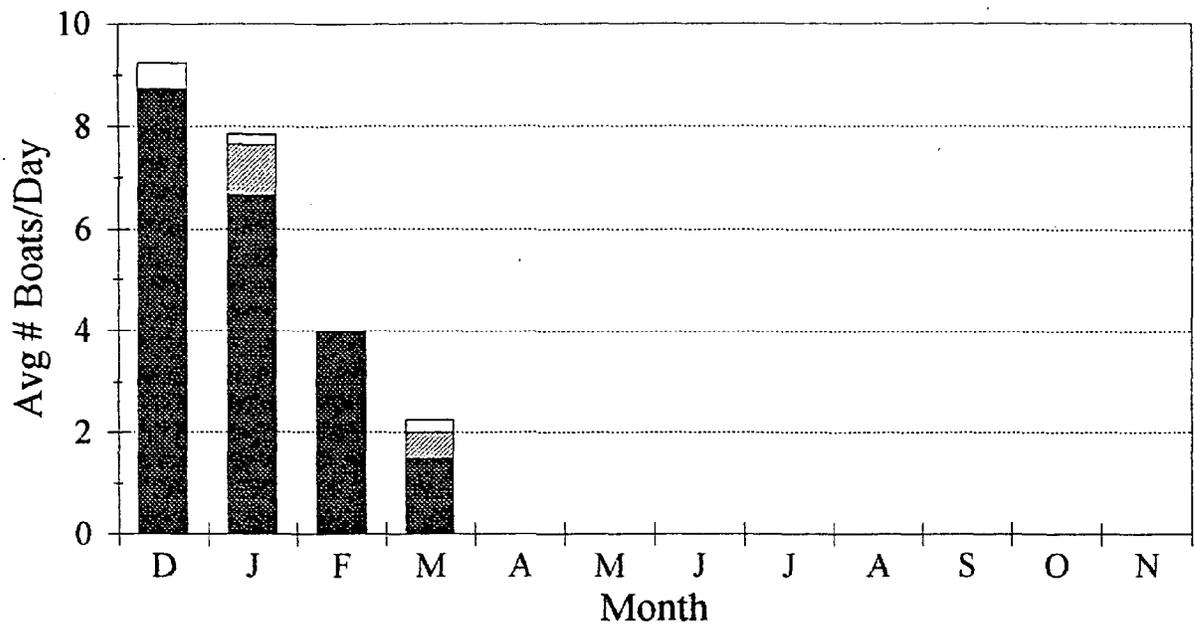


Figure 10. Clam dredging activity. Monthly average number of boats per day, Dec. 1994-Nov. 1995.

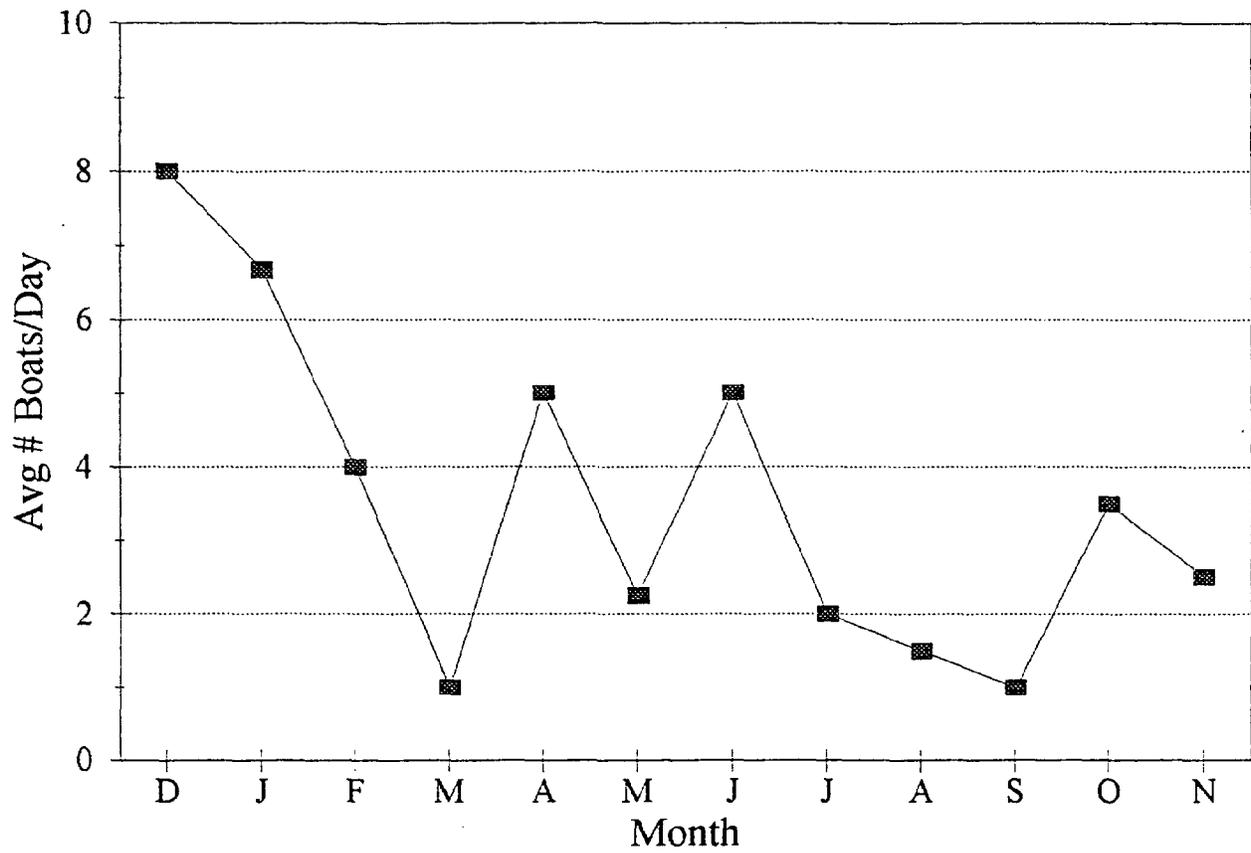
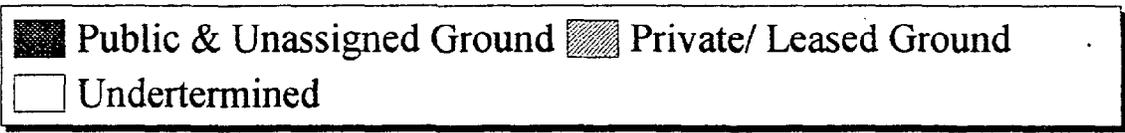
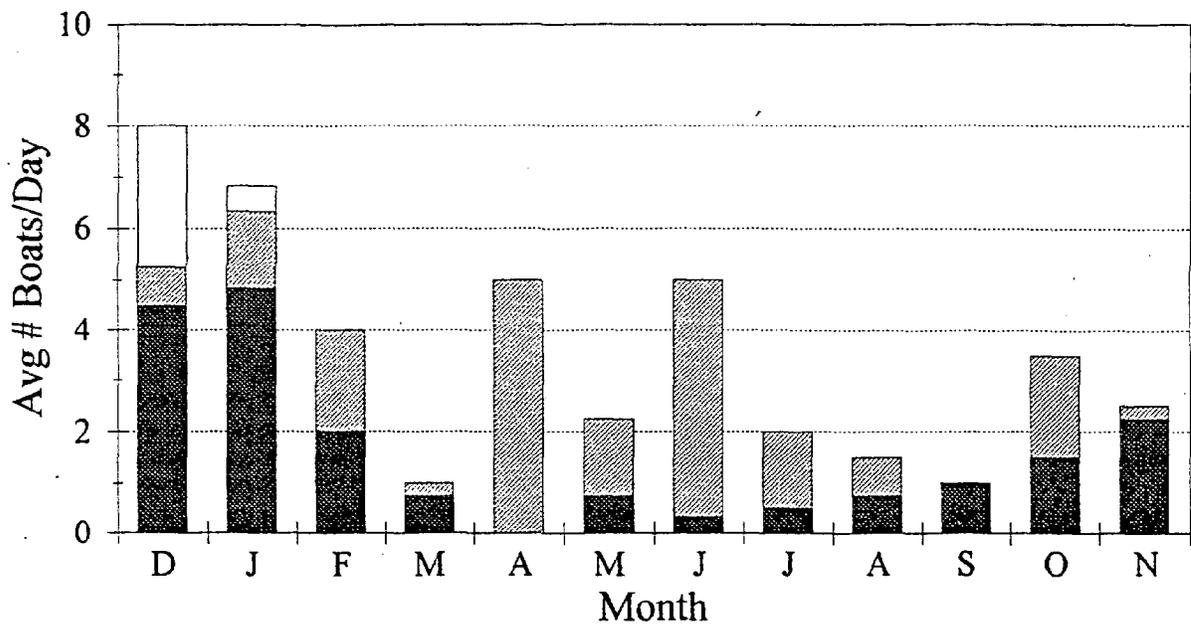


Figure 11. Clam dredging activity by lease status, Dec. 1994-Nov. 1995.



**Table 3. Crab landings and bycatch from observations onboard commercial dredge boats.**

Date	Boat	Area of Operation	Crabs Caught	Crabs Damage	Clams Caught	Clams Damage	Other Bycatch
12/20/94	<i>Ellen Marie</i>	Wachapreague Channel	11 bushels	<2%	150 indiv	3 indiv	45 flounder 6 windowpane rock crabs
12/21/94	<i>Samantha</i>	Machipongo River	10 bushels	none	20 indiv	none	3200 blood clams 50-100 rock crabs/tow
12/22/94	<i>Ellen Marie</i>	Hog Island Bay	1 bushel	20%	20 indiv	none	10 blood clams rock crabs
1/10/95	<i>Barbara J</i>	Chincoteague Bay	6 bushels	6 bushels	1200	1-2/tow	holothurians
1/25/95	<i>Samantha</i>	Machipongo River	14 bushels	none	115	none	3000 blood clams, 15- 20 rock crabs/ tow, 1 window- pane, 2 summer flounder

Clam dredging - During the course of the study we became aware of the potential for difference in damage to clams among dredge types. Though we did not conducted a replicated experiment to compare dredge effects a few *post hoc* comparisons can be made (Table 4). These data are confounded by several factors, including boat, dredge size and area of operation; however, they reveal a pattern consistent with that expressed to us by some watermen: The modified dredge with the cage resulted is significant damage to clams when used in a sandy habitat.

**Table 4. Clam landings and bycatch from observations onboard commercial dredge boats.**

Boat	Bottom Type	Dredge type	Dredge Width (ft)	Area of operation	Dredge Time (hr:min)	Clams Caught	Clams Damaged	Ratio Damage d/Caught	Bycatch
<i>Three Brothers</i>	Mud	Bag	4	Drum Hole	3:19	6025	117	0.019	200 blood clams, conch
<i>Billie Crystal</i>	Sand	Cage	2.7	South Bay	2:37	2245	286	0.127	4 conch
<i>Billie Crystal</i>	Mud	Cage	2.7	South Bay	1:08	230	6	0.026	2 conch

The number of clams in the experimental plots declined after dredging, but the observed pattern was not consistent with the time spent dredging or the numbers of clams caught by the dredger (see Table 1 and Fig. 12). The declines which we observed may have been related to the dredging activity or other undetermined factors. Infaunal biomass from the suction sampling showed declines in 3 of the 4 plots after dredging (Table 5 and Figs. 13-16), but the decline was statistically significant in only one case. The one plot which had increased infaunal abundances was subjected to the least amount of dredging (see Tables 1 & 5). Again, because all plots were inadvertently dredged, we are unable to confirm that this change is related to the dredging itself. (See Appendix II for a complete listing of the infaunal abundances and biomass by species).

**Table 5. Average biomass of benthic infauna other than *M. mercenaria* before and after dredging in each plot in Spider Crab Bay. Values are means and (SD). [\* indicate significant differences at  $p \leq 0.05$ .]**

Plot	Total Infaunal biomass (g wet wt/m <sup>2</sup> )	
	Before Dredging	After Dredging
A	42.31 (18.45)	34.29 (21.95)
B	38.75 (26.03)	2.18 (1.46)*
C	25.44 (14.17)	74.84 (17.37)*
D	23.87 (17.51)	4.18 (3.29)

Figure 12. Clam densities determined by hydraulic escalator before and after dredging. (Dredging time per plot given in Table 1)

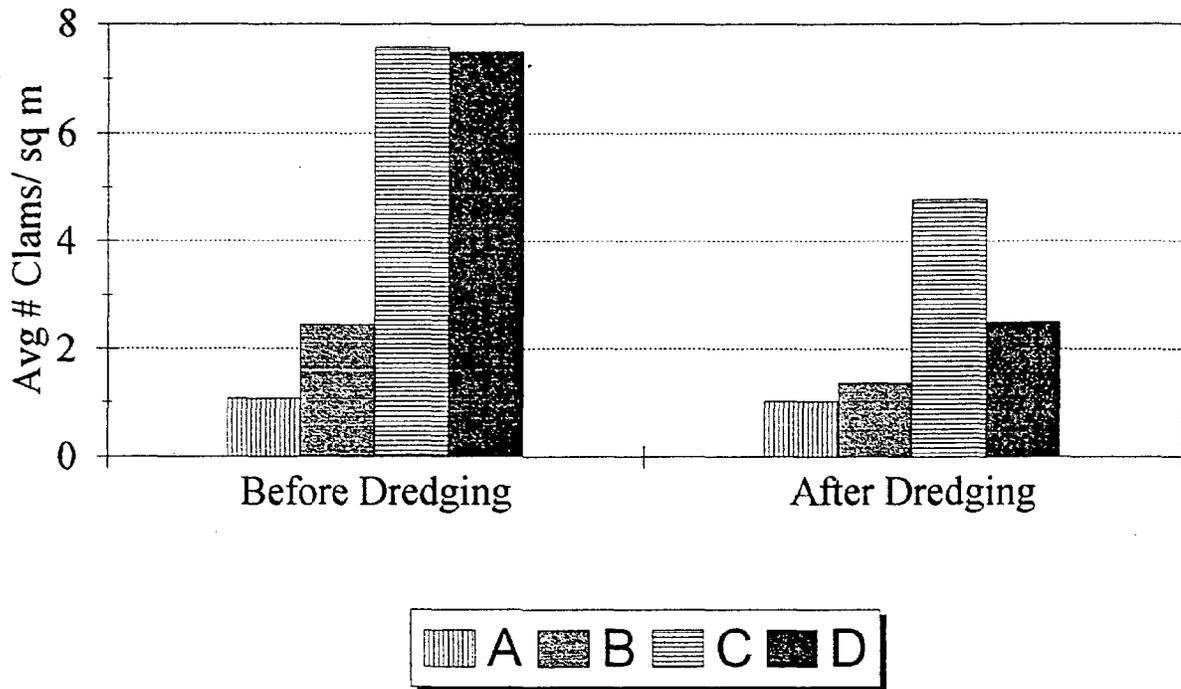


Figure 13. Infaunal biomass, other than *M. mercenaria*, before and after dredging for Plot A

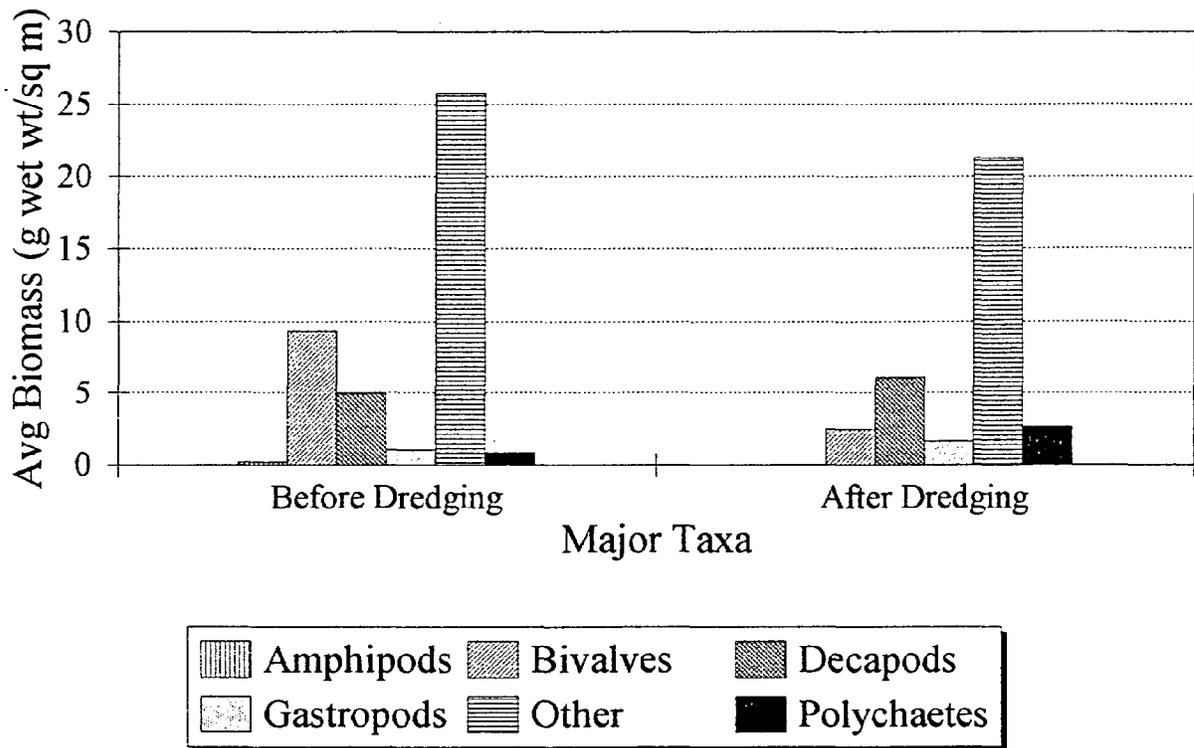


Figure 14. Infaunal biomass, other than *M. mercenaria*, before and after dredging for Plot B

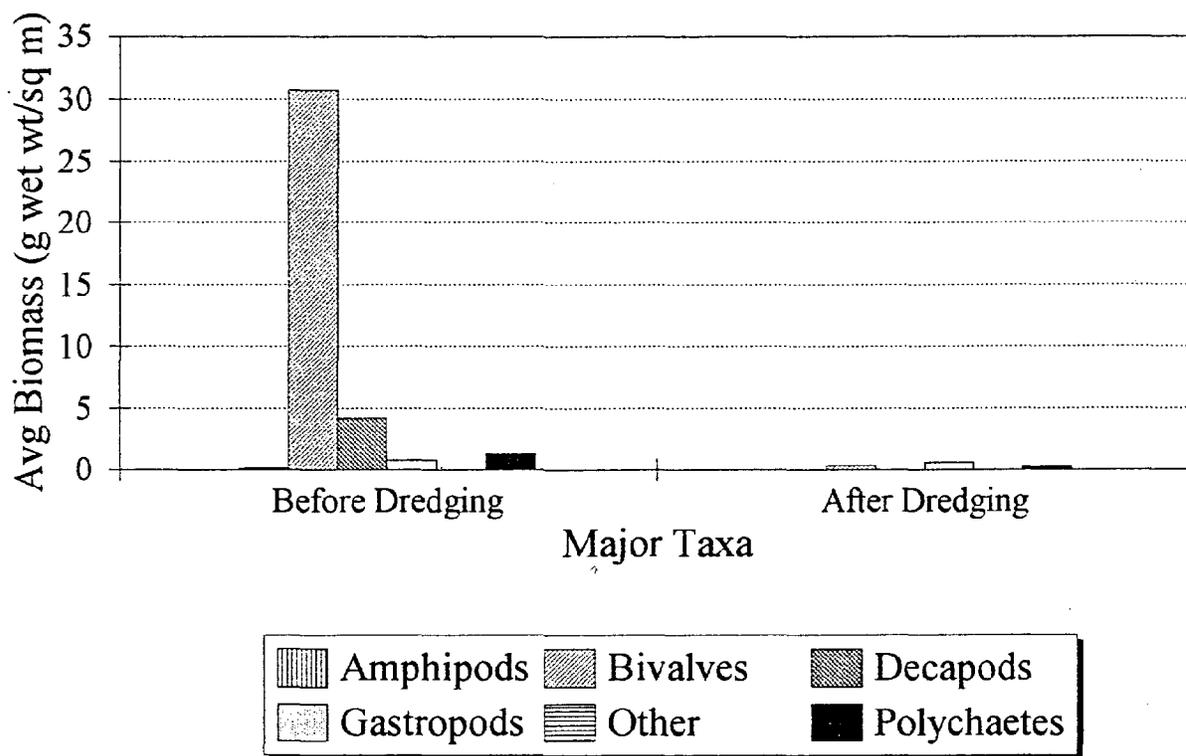


Figure 15. Infaunal biomass, other than *M. mercenaria*, before and after dredging for Plot C

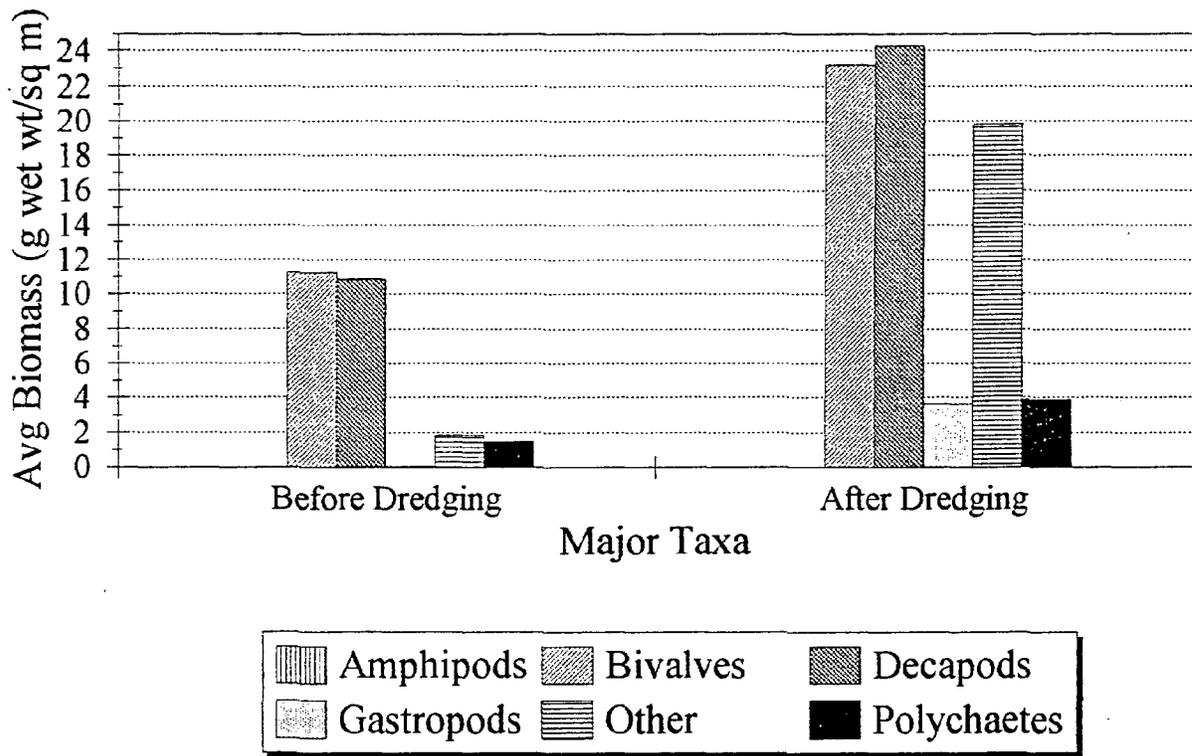
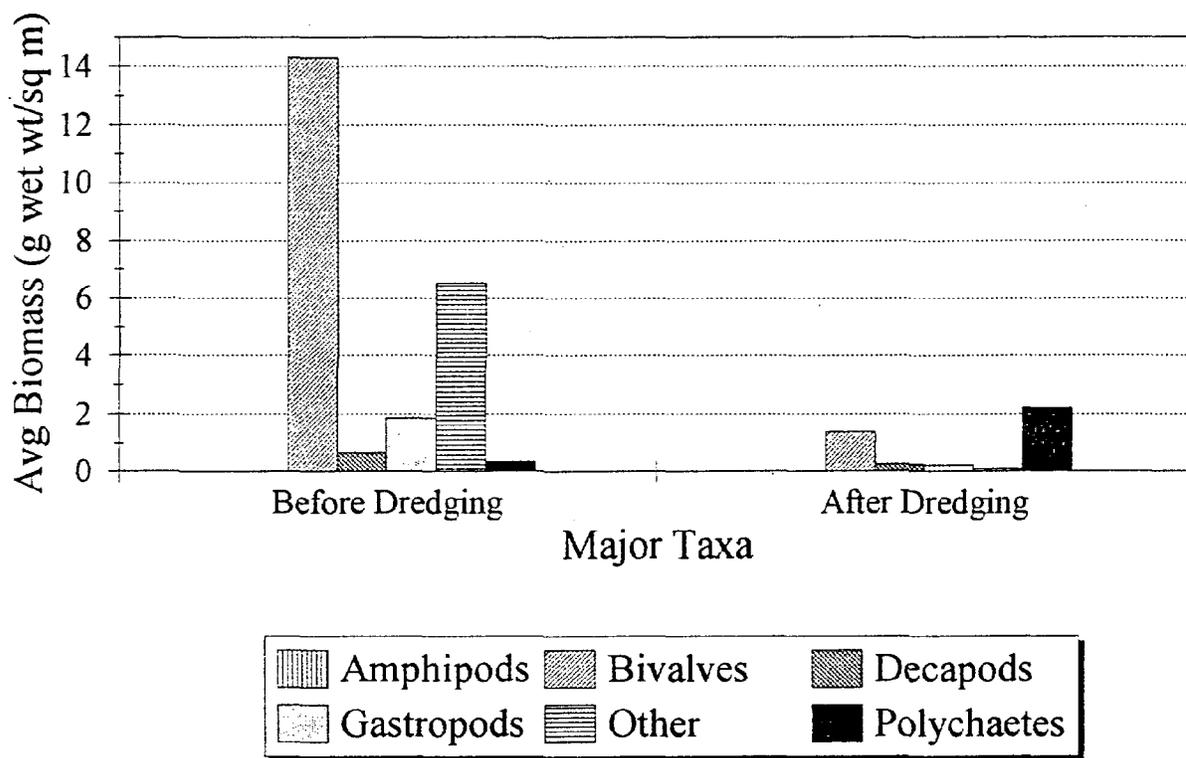


Figure 16. Infaunal biomass, other than *M. mercenaria*, before and after dredging for Plot D



## Discussion

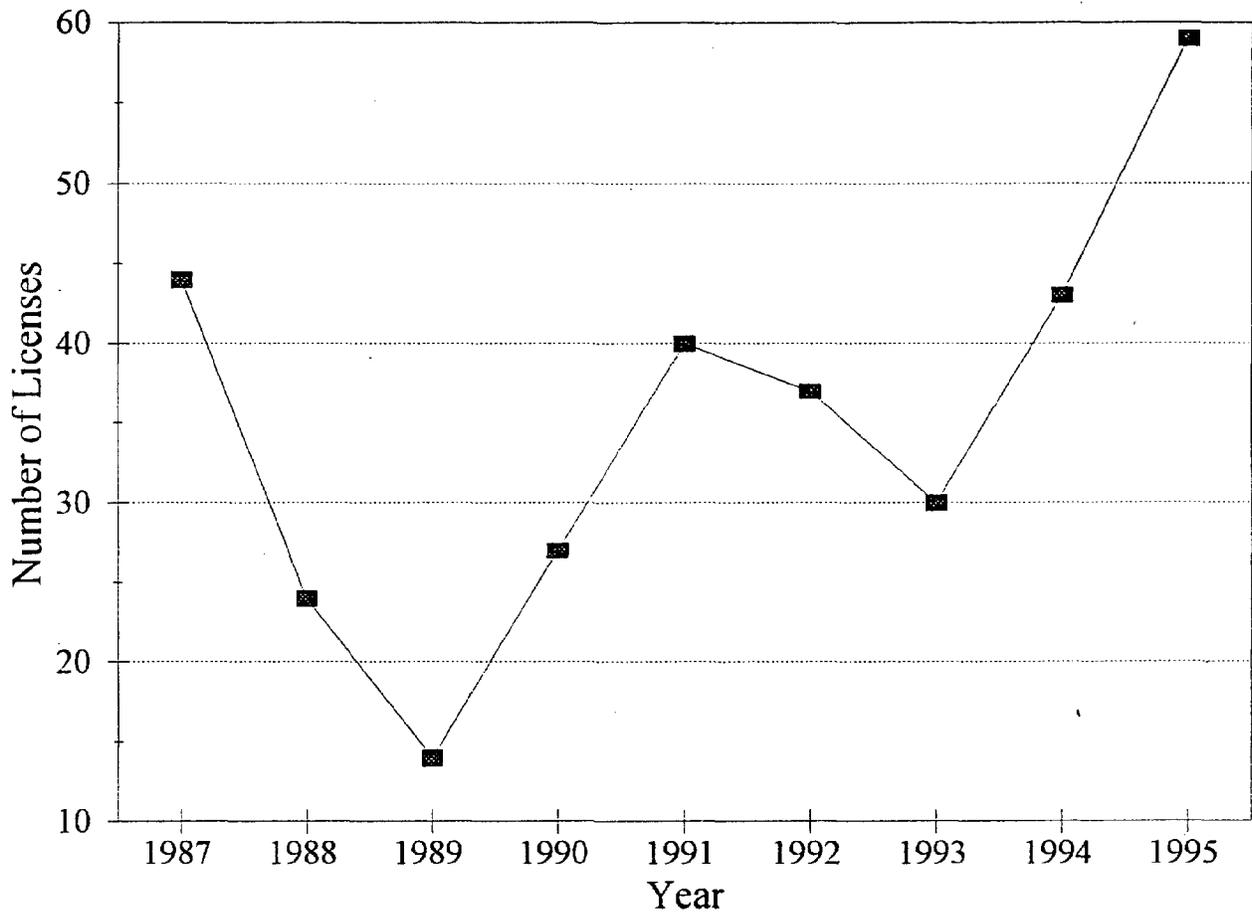
Our findings indicate an extensive dredge fishery for crabs and clams on the Seaside of the Eastern Shore. These are the first data of their kind for the region, and we have little basis for comparing the level of this fishing effort to other times or regions. Comparable historical data on dredge fishing efforts on the Seaside are not available. By comparison to the Chesapeake Bay, the availability of bottom area at greater than 4 ft depth for crab dredging is quite limited. Without a systematic survey of crab resources and the development of stock-recruit relationships, we are unable to comment on whether this level of effort is excessive. For a nominal fee crab dredgers may purchase a clam dredge license which grants unlimited by-catch opportunity for clams. Our data and experience (of being excluded from boats on high spring tides) indicate that the "crab" dredge fishery is in fact a diverse fishery which targets blue crabs (*Callinectes sapidus*), hard clams (*Mercenaria mercenaria*) and blood clams (*Noetia ponderosa*) depending upon availability and tides. The unlimited by-catch which is permitted under crab dredging regulations on the Seaside favors this practice of targeting multiple species.

Clam dredging on public grounds in Virginia occurs only on the Seaside and a license is required to dredge clams from public grounds during the season from December 1 through March 31. Each license is associated with one operator/boat. Over the past 9 years the numbers of licenses issued has varied from a low of 14 in 1989 to 59 in 1995 (Figure 17). Throughout our aerial survey, we rarely observed more than 10% of the licensed boats dredging on any one day. A sharp increase in licenses issued in the past 3 years is evident in these data, but the reason for this increase is unknown.

Clam dredging on private grounds requires a separate permit for each lease which is dredged. Thus, a single operator/boat may be associated with several permits. During the period of this study there were 34 operators who held permits to dredge 116 leases on the Seaside (held by 60 people). (See Appendix III for a complete listing of operators, leases and boats associated with clam dredge permits for the period of this study.) Historical data are lacking, but anecdotal evidence suggests that there are fewer clam dredgers and dredge boats operating on the Seaside now than within the past few decades. However, since many operators hold permits for dredging for more than one lease, it is not evident that less ground is being dredged, merely that fewer boats are apparently involved in that dredging. Moreover, the involvement of fewer boats may be a temporary aberration. Many of the individuals formerly involved in the clam dredge fishery, including most of the operators listed in Appendix III, are presently conch potting. If this fishery fails to continue to support them, many are likely to return to clam dredging.

The impacts of dredging on clam stocks cannot be determined from a short-term study such as this. Effects on recruitment and growth rate as well the losses from harvest and damage would need to be determined. We observed high rates of harvest aboard some boats (over 6000 clams harvested in little over 3 hrs, see Table 4) and we have reports from watermen of catches ranging from 8,000 to 10,000 clams per day, but we do not have comparable data on rates using

Figure 17. Clam dredge licenses for public ground, 1987-1995



patent tongs. There appears to be an interaction between dredge type and sediment type which affects the extent of damage to clams. Our data and reports from watermen suggest that use of the metal cage dredge on firm bottom increases the harvest efficiency, but results in greater damage to clams.

Quantitative sampling revealed some reductions in benthic invertebrates other than hard clams associated with a single dredging event; however, there was some inconsistency in our results and we lack adequate controls. We have not established the longer-term impacts of repeated dredging on benthic resources.

Aerial observations made throughout the study revealed dramatic increases in turbidity in the vicinity of clam dredging activity. Resuspension of large amounts of sediment, presumably from both the dredge and boat's propeller, resulted in telltale signs of dredging, even after boats had left the site. It has been reported to us that clam aquaculturists are particularly concerned with this resuspension, which they associate with reduced growth and, in some cases, burial of cultured clams. In this study we did not collect any data to support or refute this contention.

## Conclusions and Recommendations

The unlimited by-catch allowable under regulation of the crab dredge fishery on the Seaside has resulted in a fishery which targets multiple species. This has the effect of extending the crab fishery beyond the time when it would ordinarily cease for economic reasons. In addition, it permits a dredge fishery on blood clams and could be used to target conch (*Busycon carica* and *Busycoptus canniculatum*). This regulation seems incongruous with effective management of these stocks and we believe that it should be carefully scrutinized.

A relatively large number of individuals are involved in the clam dredge fishery on, at least, a part-time basis. Our findings indicate, however, that the average number of boats operating on a daily basis equals only about 10% of the licenses for public ground or as many as 25% of the permits for leased grounds. This study documented only limited damage to clam stocks and benthic communities associated with this fishery, and it suggests habitat-specific effects for the different dredge types. Justified concerns persist among many watermen and aquaculturists regarding overfishing and habitat degradation resulting from clam dredging practices. Further effort should be made to evaluate the short- and long-term impacts of this practice on turbidity, bottom topography, clam resources and benthic community dynamics.

Modifications to the standard oyster dredge--the lengthening of the teeth and the replacement of the mesh bag with a heavy metal cage--have been made to increase the effectiveness of the dredge in areas with coarse sediment and cohesive clays. The result has been that dredging in this manner is often effectively "kicking" clams; that is, using the propeller to wash clams out of the bottom. Our data indicate that damage to clams caught in this manner may be significant, but the results are inconsistent. Anecdotal evidence suggests that clams harvested in this manner have shorter shelf lives than those taken by other means. VMRC Regulation #450-01-0013 [*Pertaining to the taking of clams on the seaside of the Eastern Shore*] should be clarified, and the status of this harvest practice using the modified dredge should be specifically addressed by the Commission.

The practice of acquiring or using leased bottom primarily for the purpose of dredging hard clams is inconsistent with §28.2-603 of the Code of Virginia which authorizes leasing of state-owned bottom for the "purpose of planting and propogating shellfish." As recently indicated in a report prepared for the Virginia General Assembly (House Document 16, 1996) by VMRC, VIMS and the shellfish aquaculture industry, the lack of available bottom for leasing is a major impediment to the continued expansion of the shellfish culture industry.

A few individuals hold most of the permits to dredge private leases. The total acreage permitted for dredging at present is 10,080 acres; however, 7 individuals hold the dredge permits for 4,796 acres (47.6%) of this ground. The indirect effects of this activity extend beyond the bounds of the permitted dredge sites. Inadequate staking of grounds prior to dredging leads to errors in the sites being dredged. We mapped dredge boats working on public ground and non-

permitted private grounds in the vicinity of legitimately permitted sites. This practice appears to result in entire areas of a bay being subject to dredging, not merely the permitted lease. For example, note the region of Burton's Bay (Fig. 5) near the Wachapreague Inlet; dredging was observed on public ground and several private leases, although only one lease in the area is permitted for clam dredging.

Concern has been expressed by clam aquaculturists, regarding both the straying of dredges from permitted leases and the increased turbidity associated with dredging. A consequence of this concern has been that aquaculturists often feel compelled to hold larger leases than would otherwise be necessary, to provide a buffer between their operations and dredging activity. This has a negative impact on the availability of leased bottom for the expansion of aquaculture.

Finally, within the past few years new leases have been issued for the primary purpose of dredging clams from the site. These leases are granted without a survey of existing clam stocks to determine if a public resources exist. In effect, the lessee buys exclusive rights to the wild stocks of clams at the site. In a similar situation involving oysters, private leases would not be granted.

In summary, clam dredging on private grounds, as it is currently practiced on the Seaside of the Eastern Shore, appears inconsistent with (i) the statute authorizing leasing, (ii) regulations related to harvest practices (kicking and dredge types), (iii) the policy related to the availability of public resource and (iv) recommendations made in the Commission report House Document 15, 1996. Careful reconsideration of this practice by the Virginia Marine Resources Commission is clearly warranted and strongly recommended.

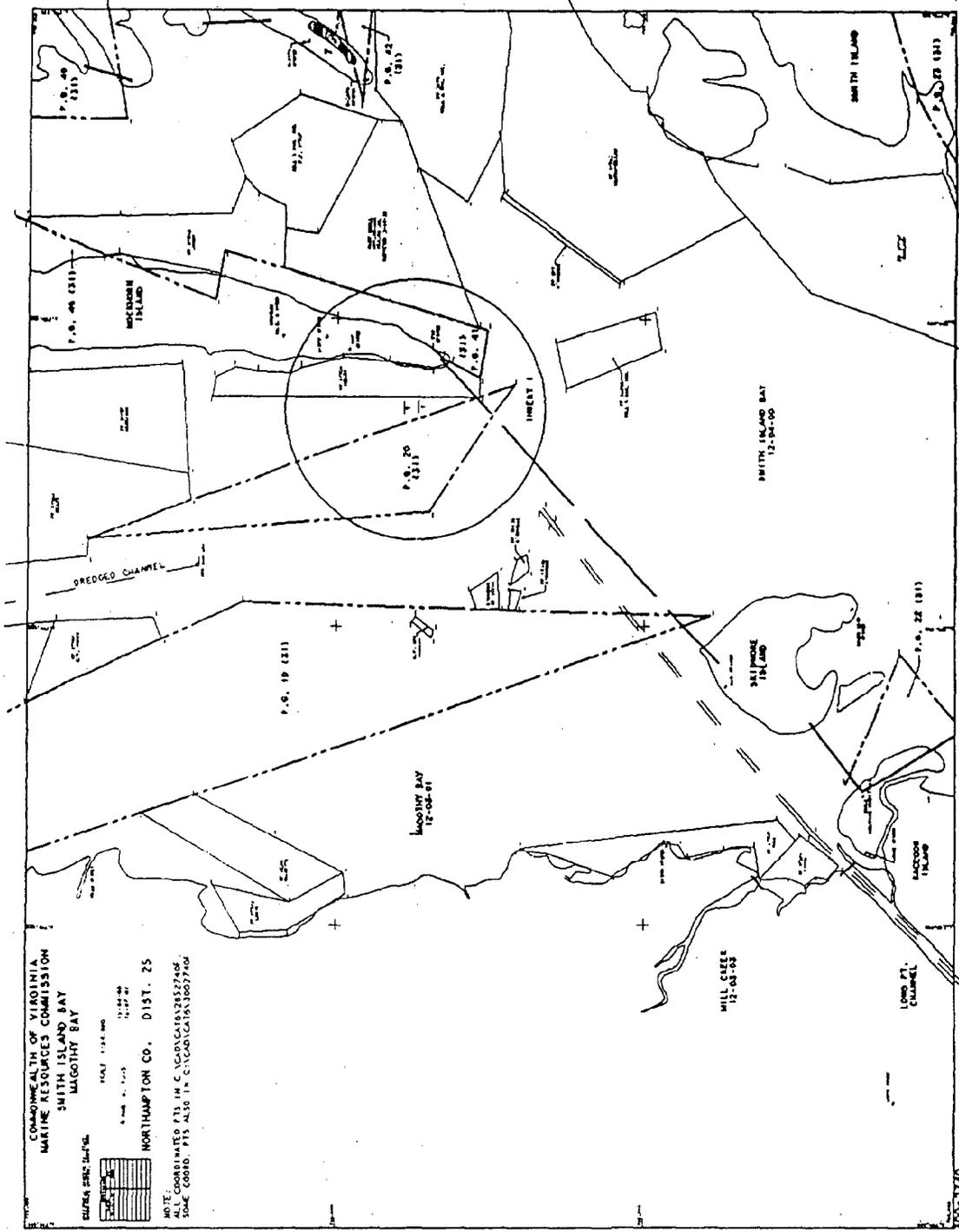
Appendix I. Locations of all commercial fishing boats observed during the study period, December 1994 - November 1995. Shoreline map is from VMRC Surveying and Engineering Division. The locations of private leases, public and unassigned bottom are indicated. Area maps contain one or more inserts which are shown in close up on succeeding pages.

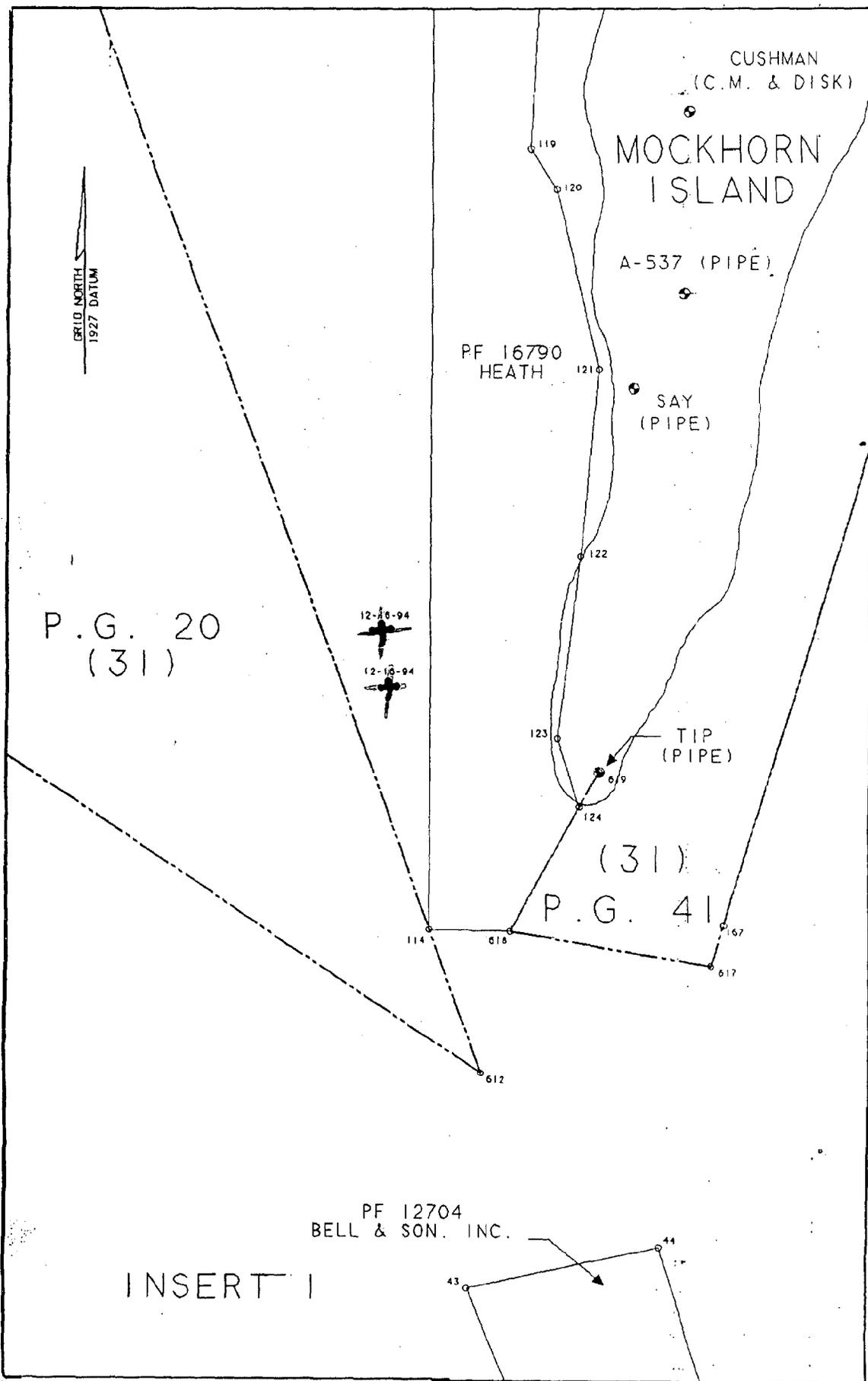
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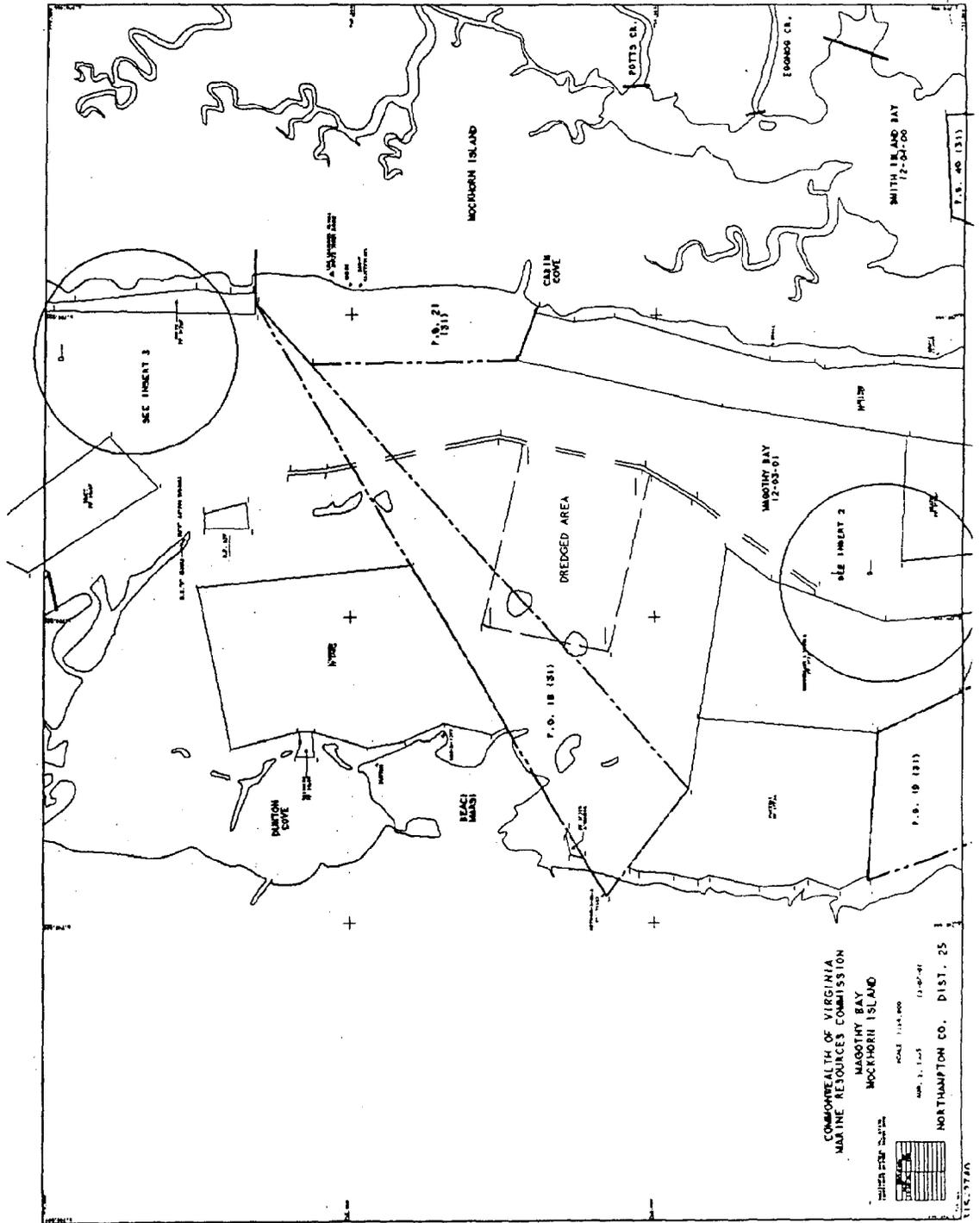
\* - Clam Dredge

■ - Crab Dredge

◆ - Patent Tong







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DREDGE AREA

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1927 DATUM

901  
907

ROBBERECHT & MORRIS  
PF 16793

1-31-95

HEATH  
PF 16829

1-25-95

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SMITH  
PF 16783

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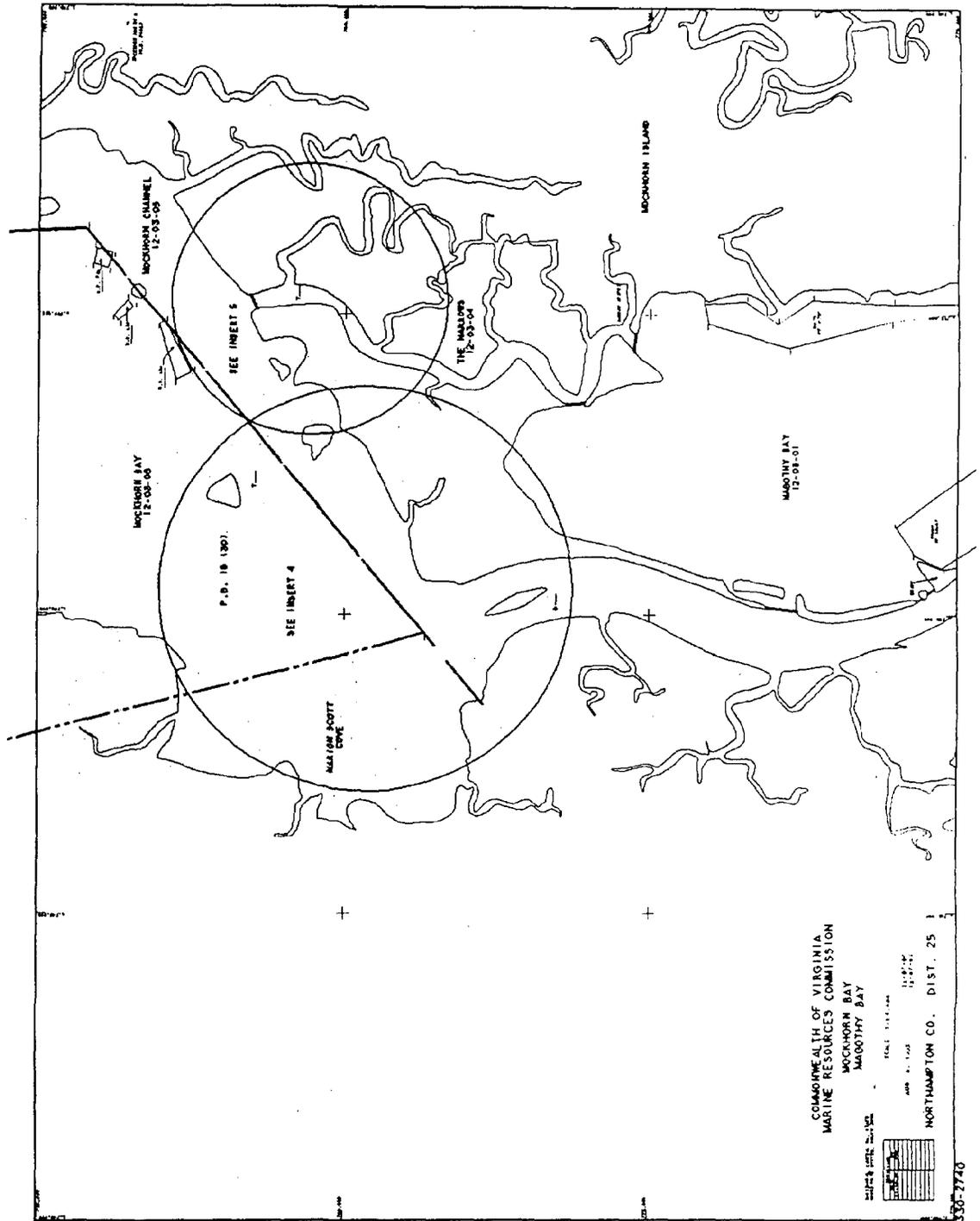
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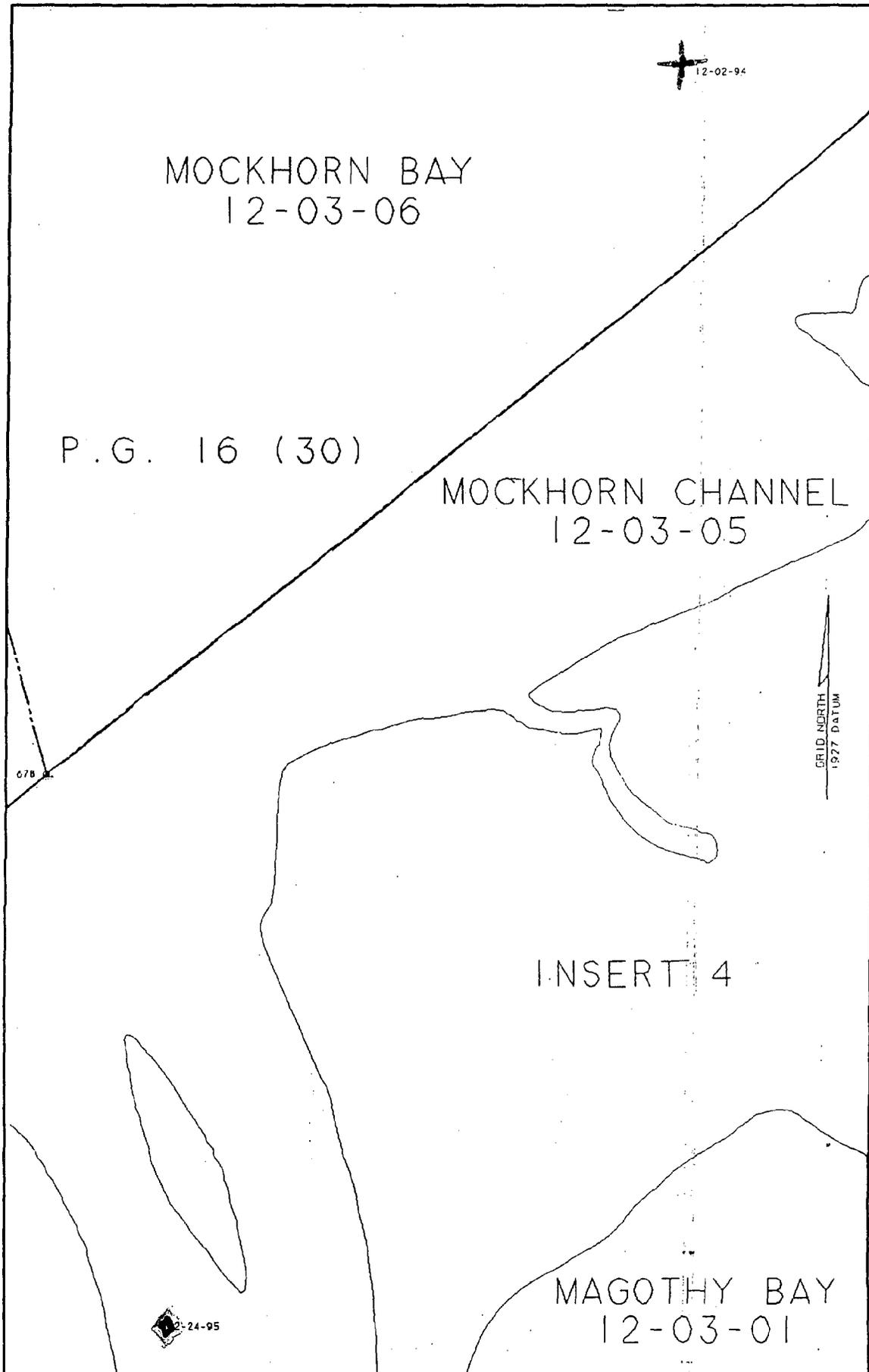
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USE MOCKHORN (DISK) \*  
NORTH TOWER RANGE

CABIN

MAC-3  
(1977/DISK)





MOCKHORN BAY  
12-03-06

P.G. 16 (30)

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S.P. 281  
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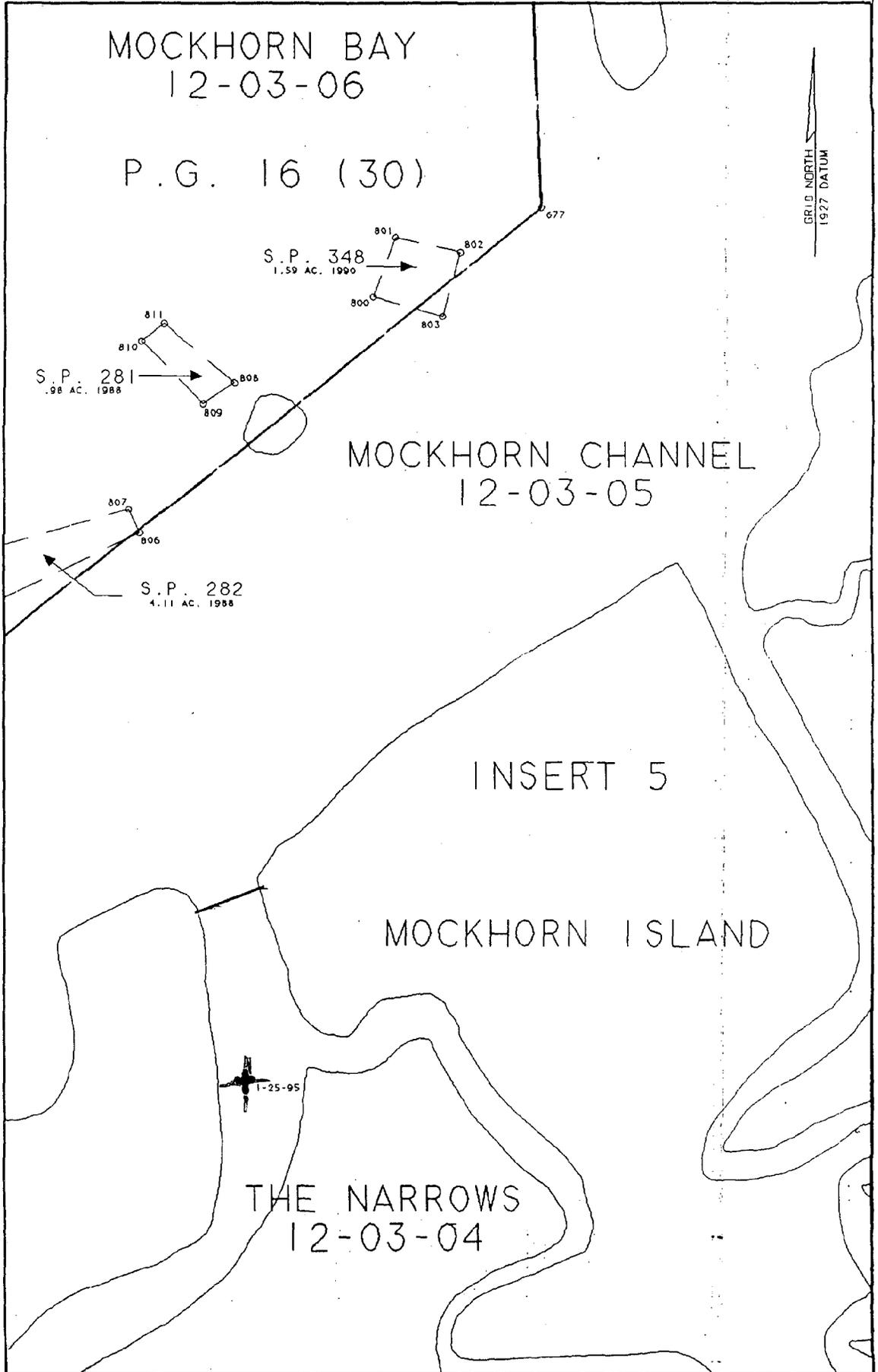
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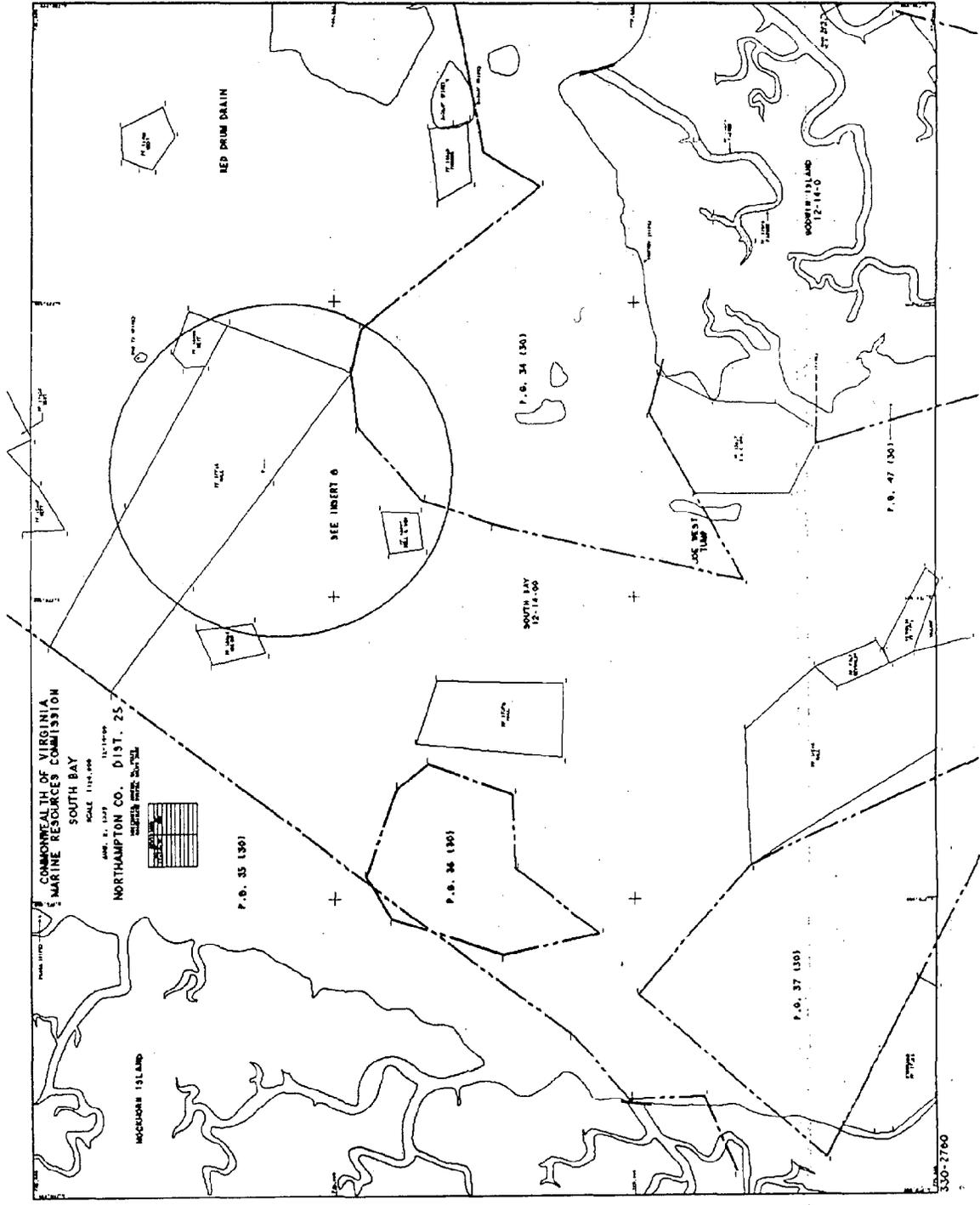
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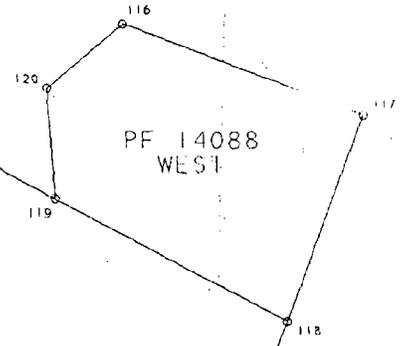
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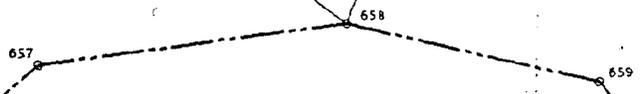


PF 16624  
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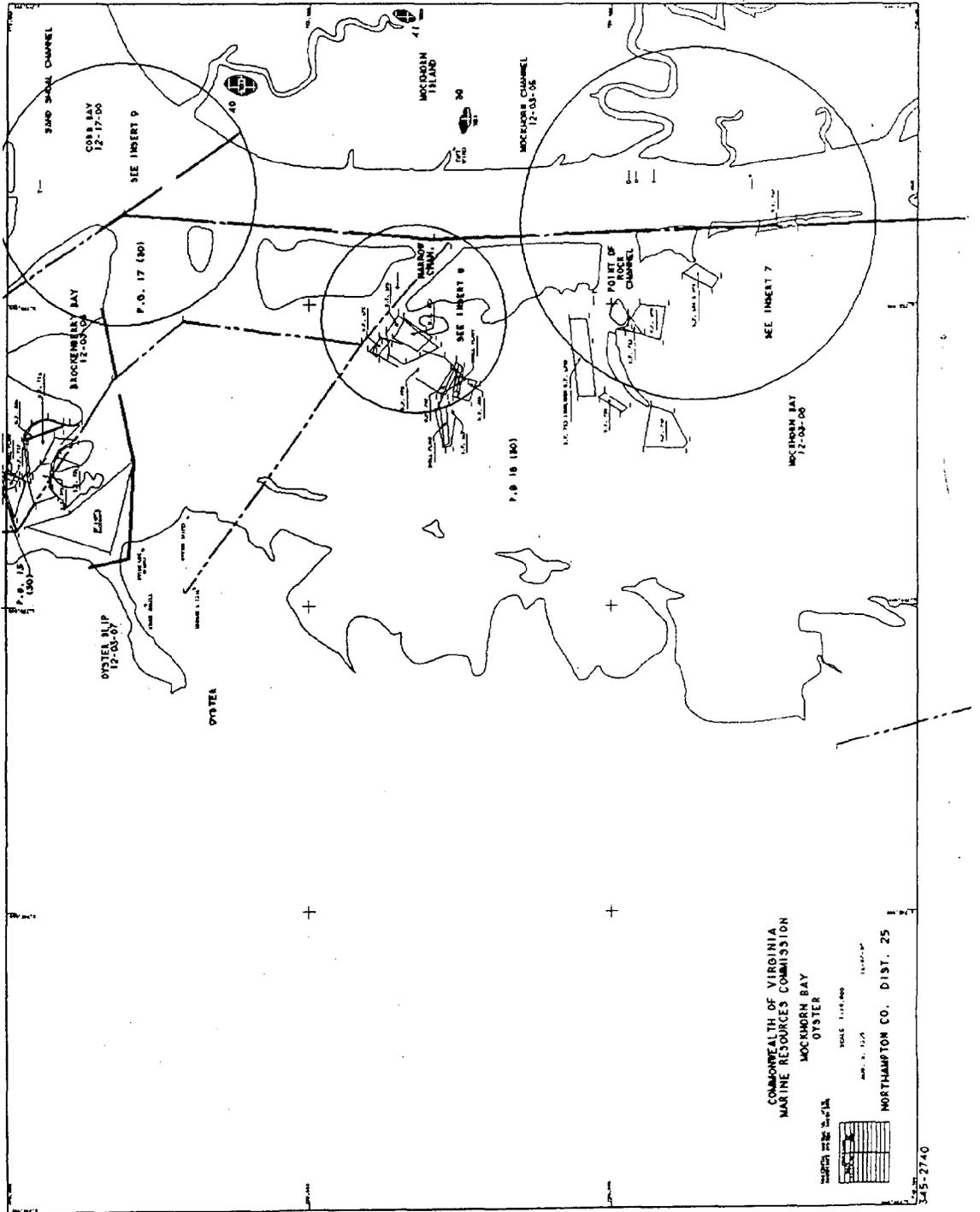
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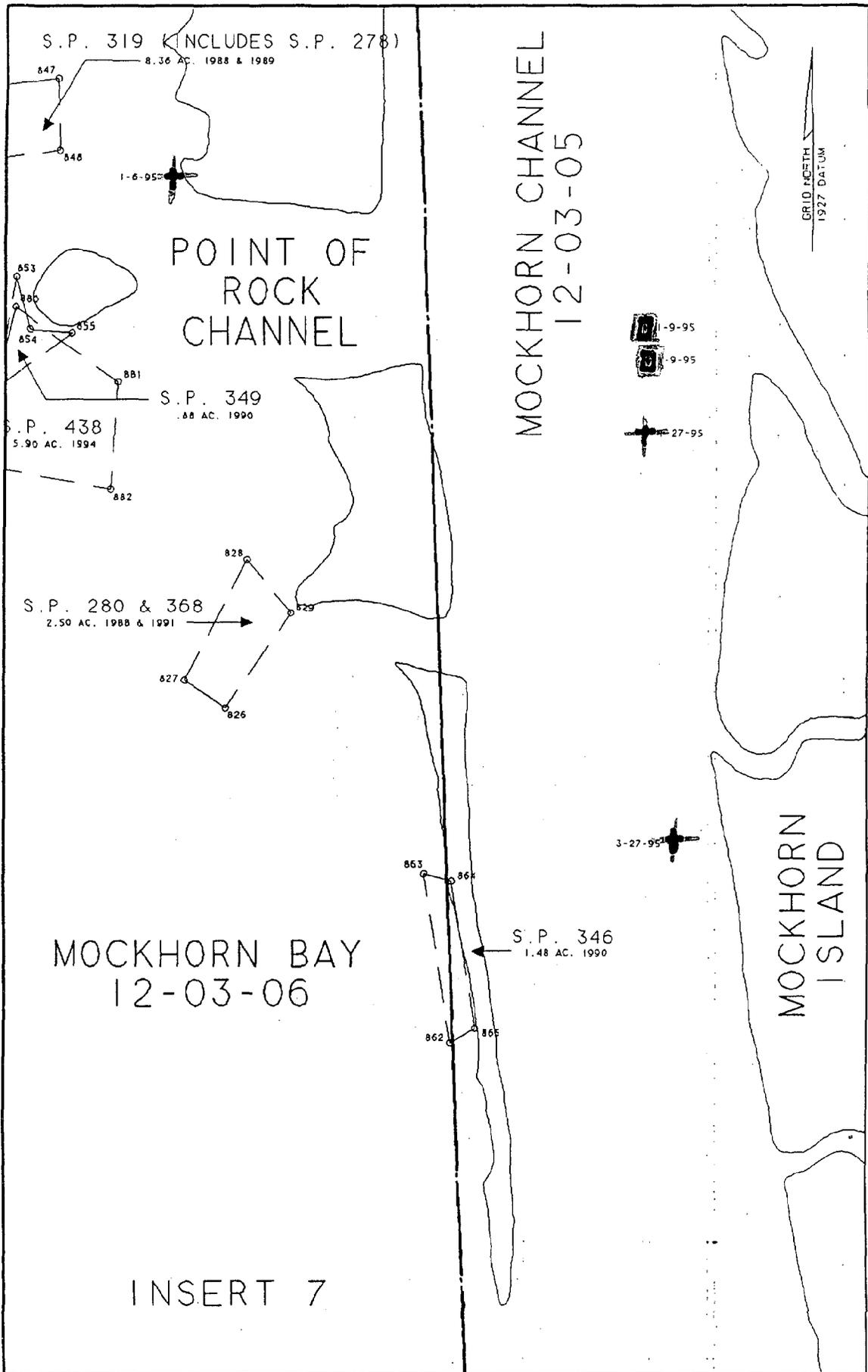
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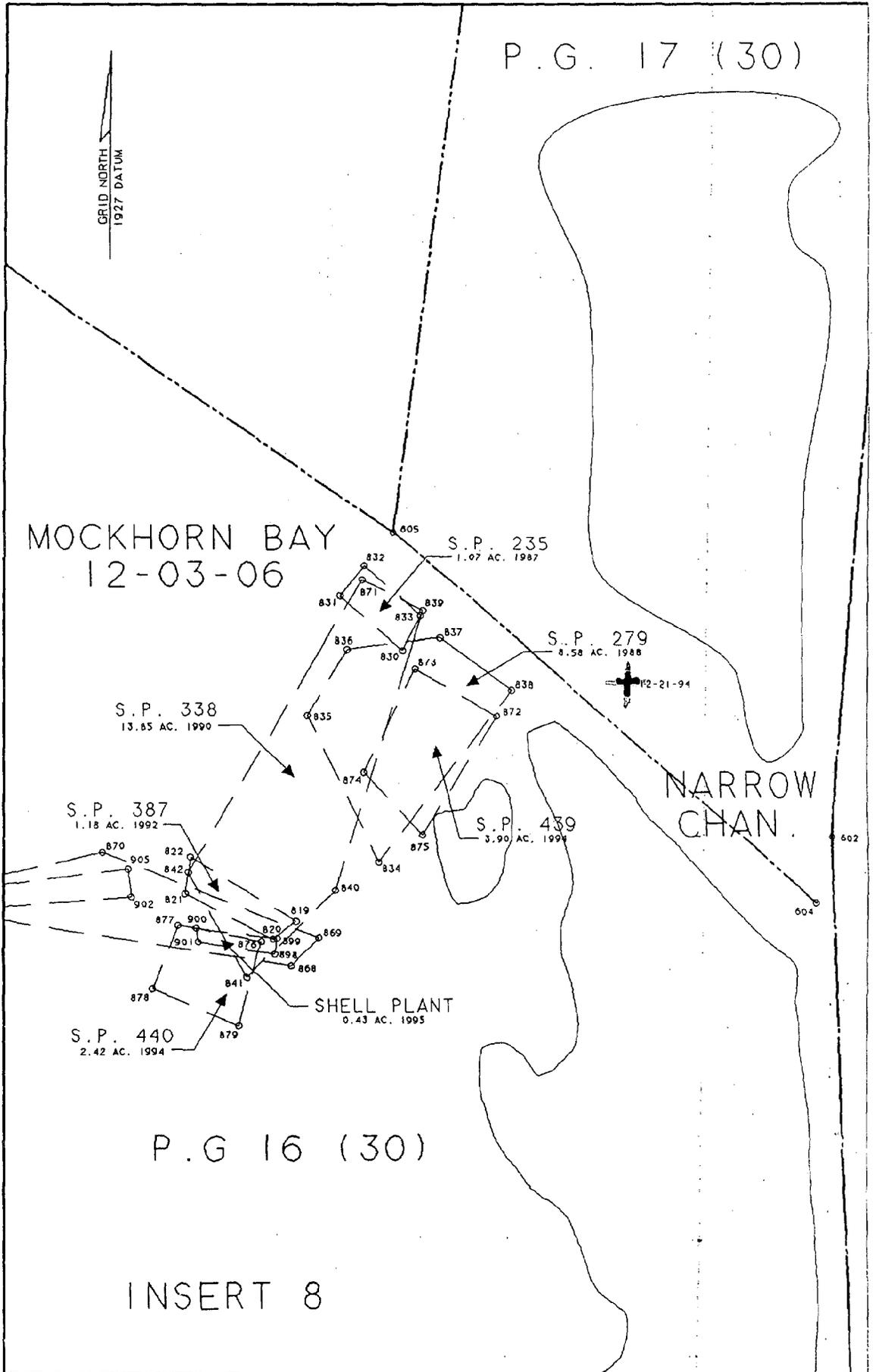


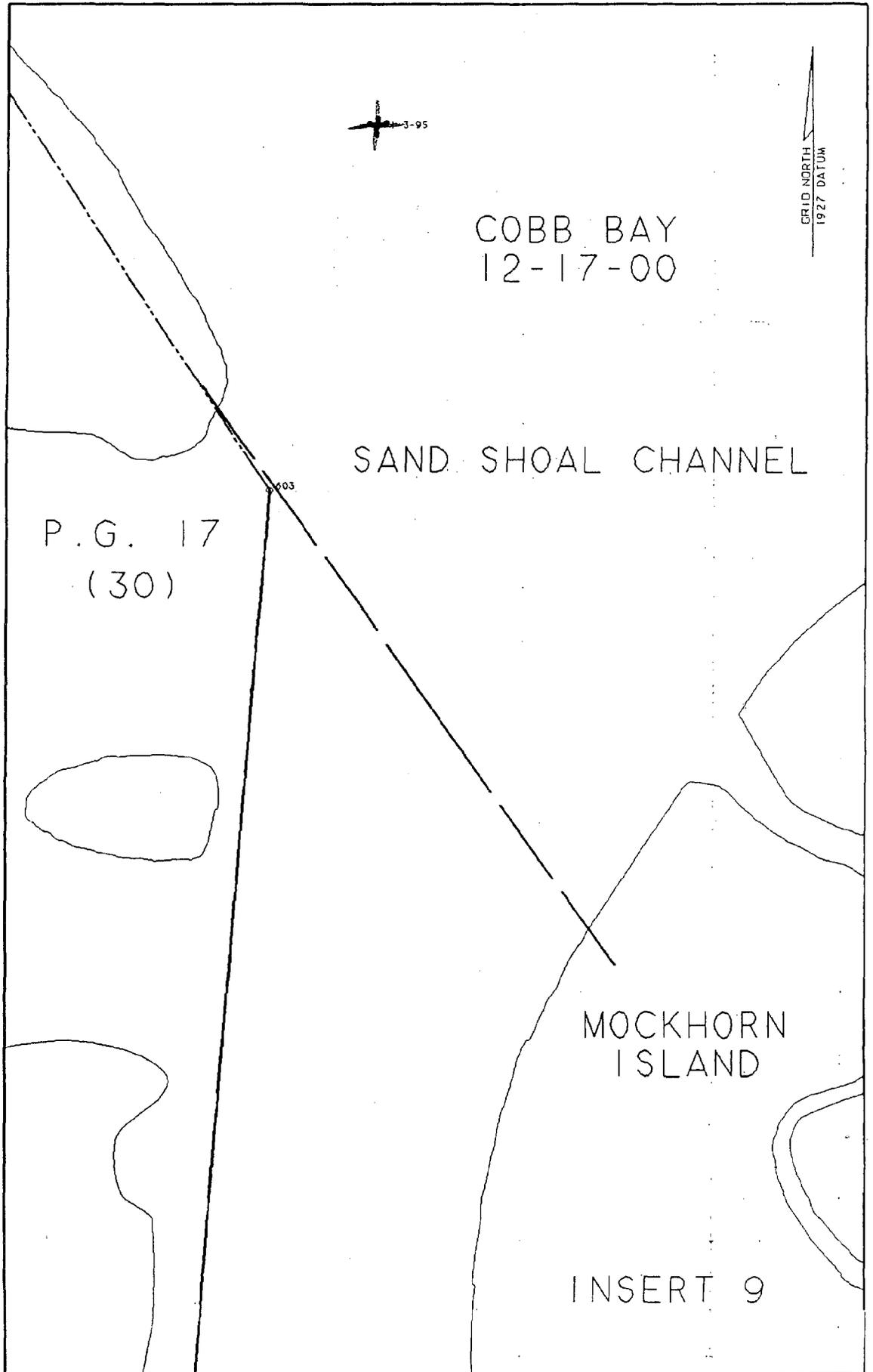
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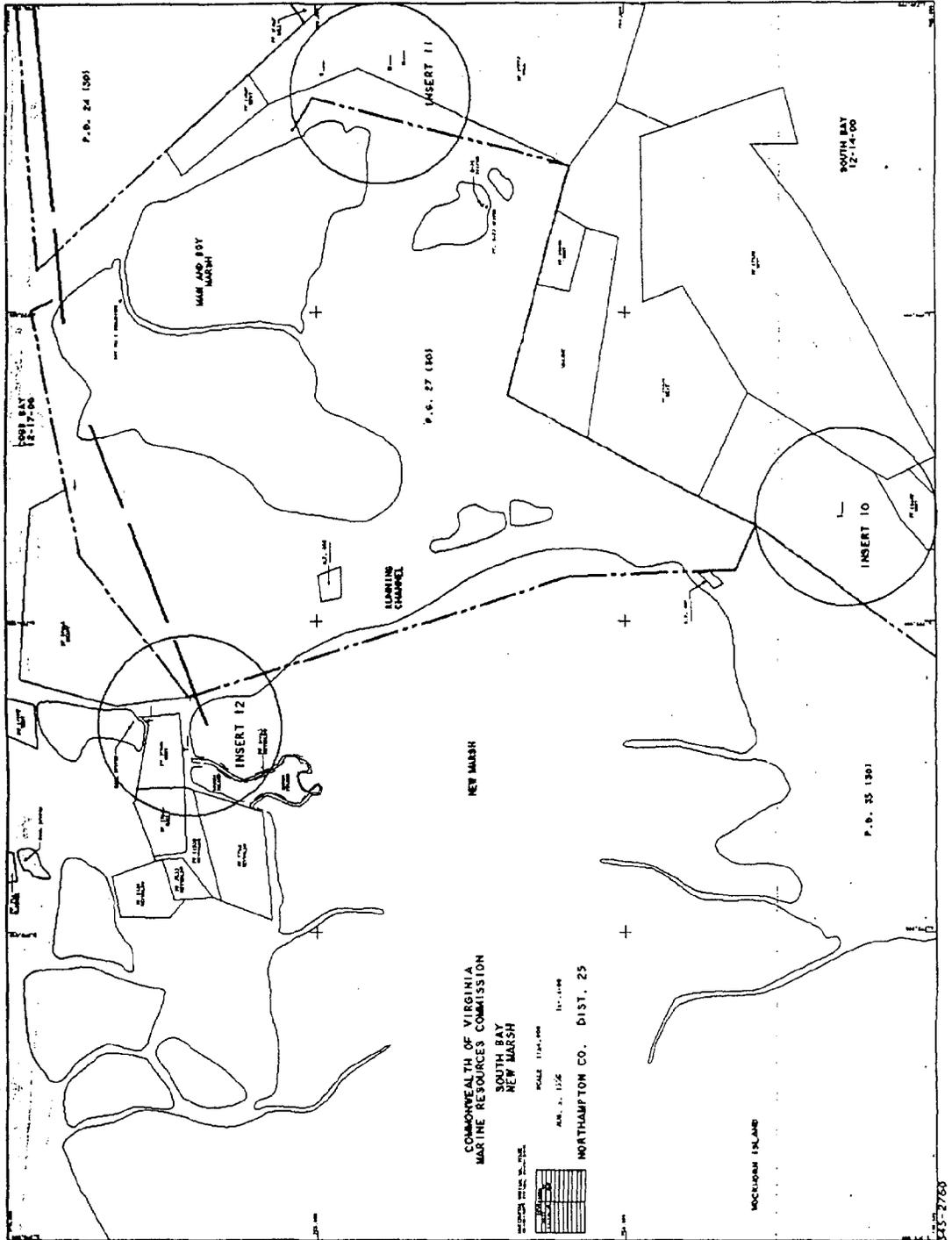
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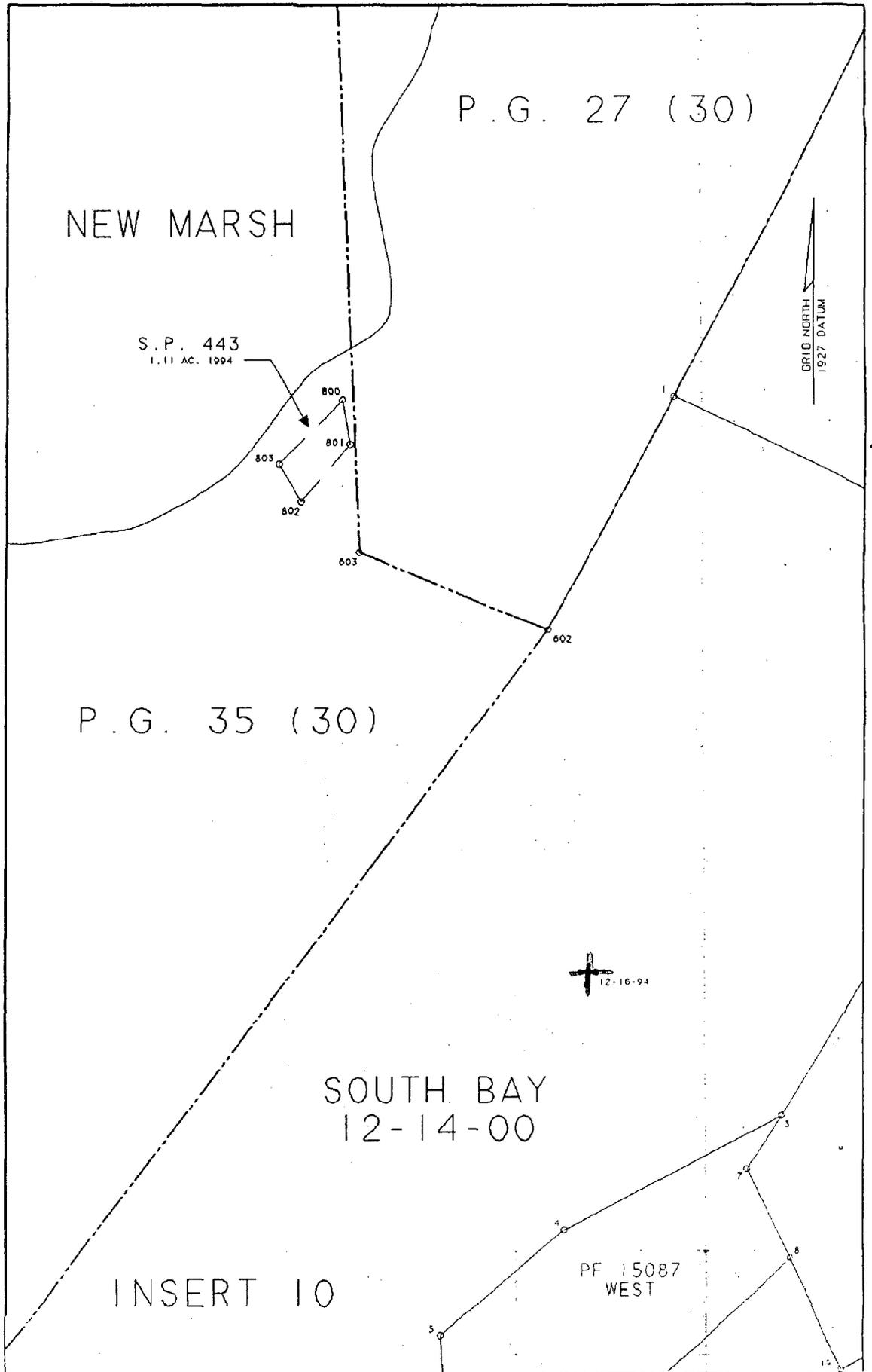












NEW MARSH

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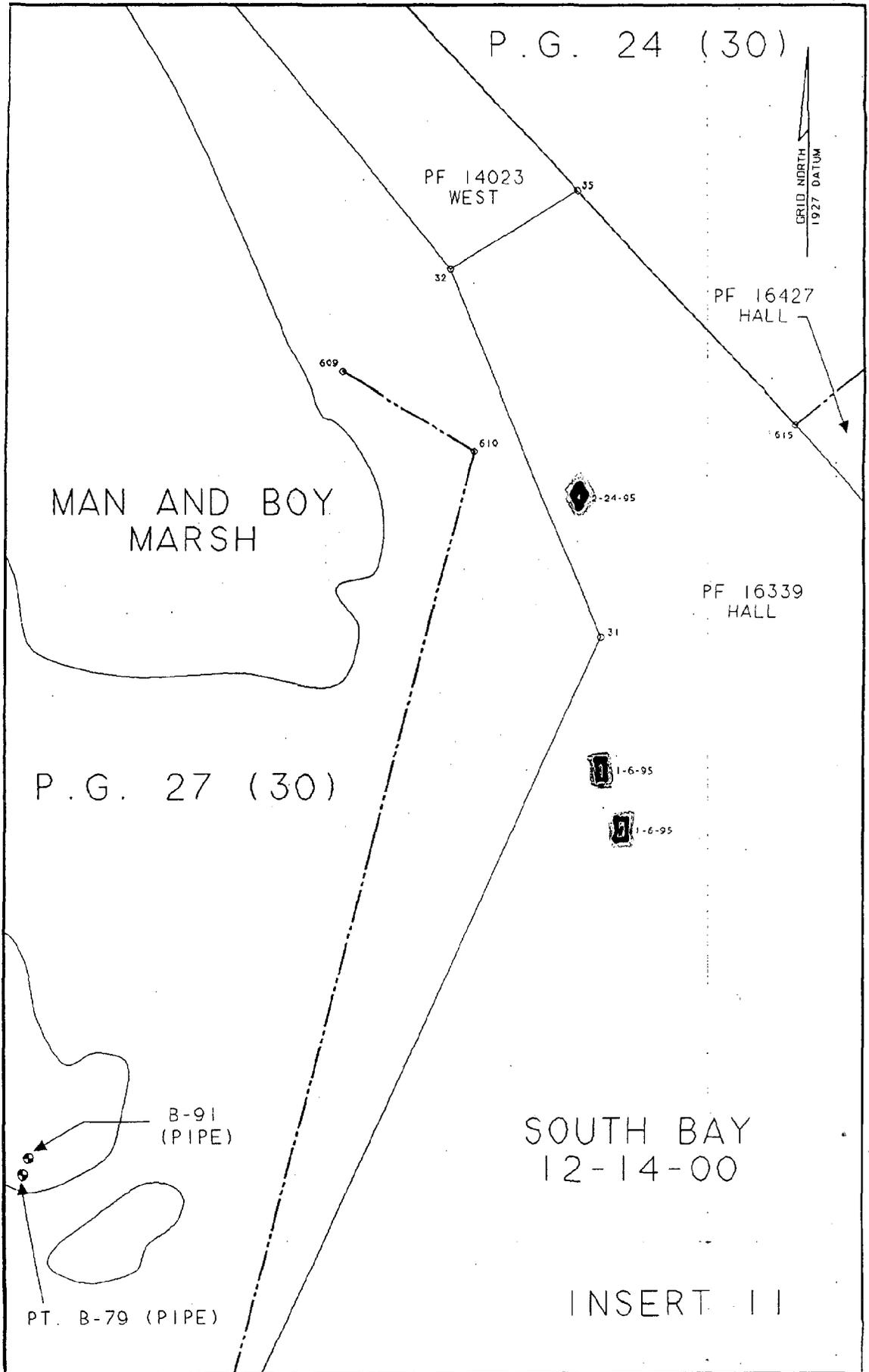
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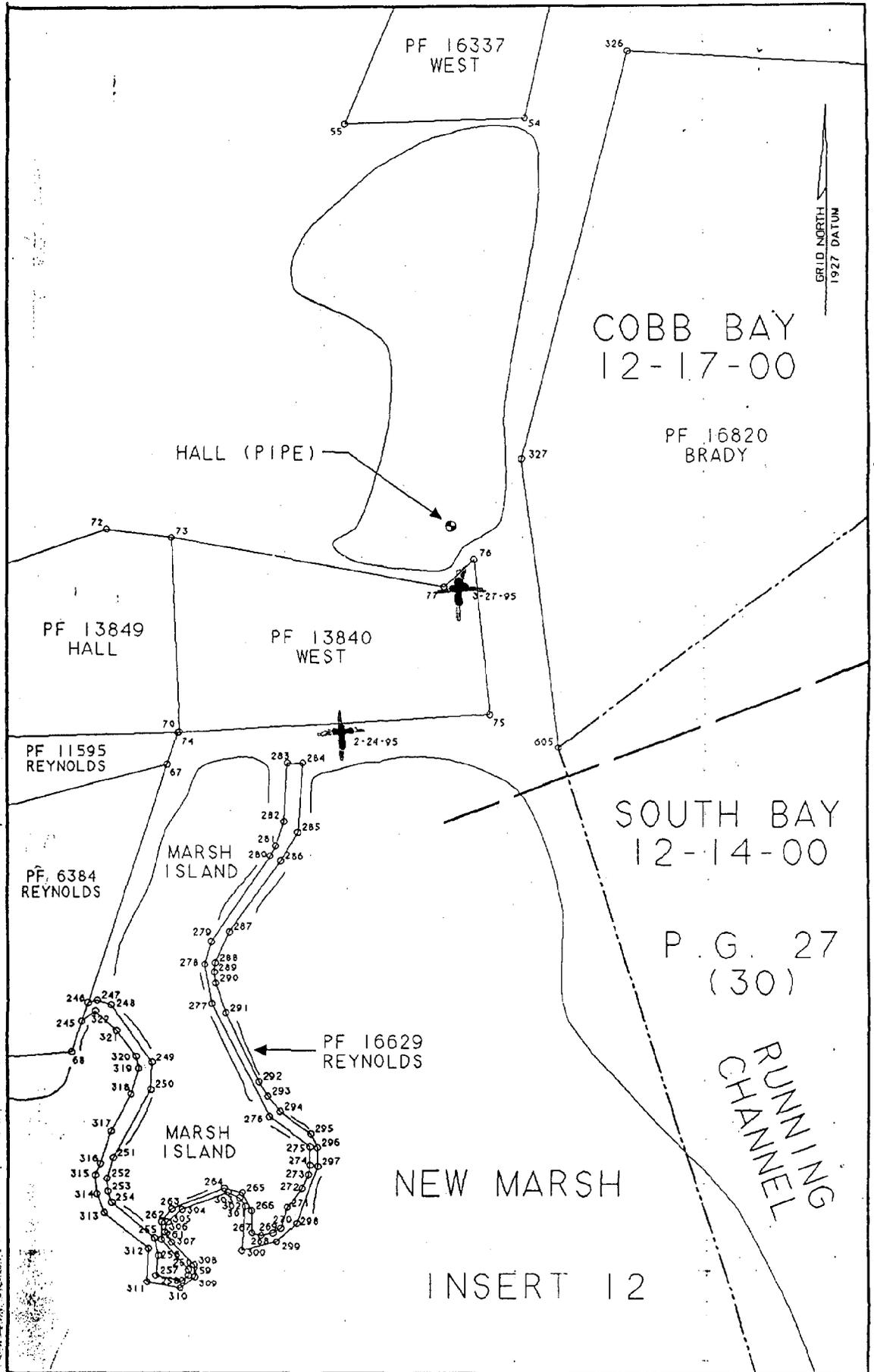
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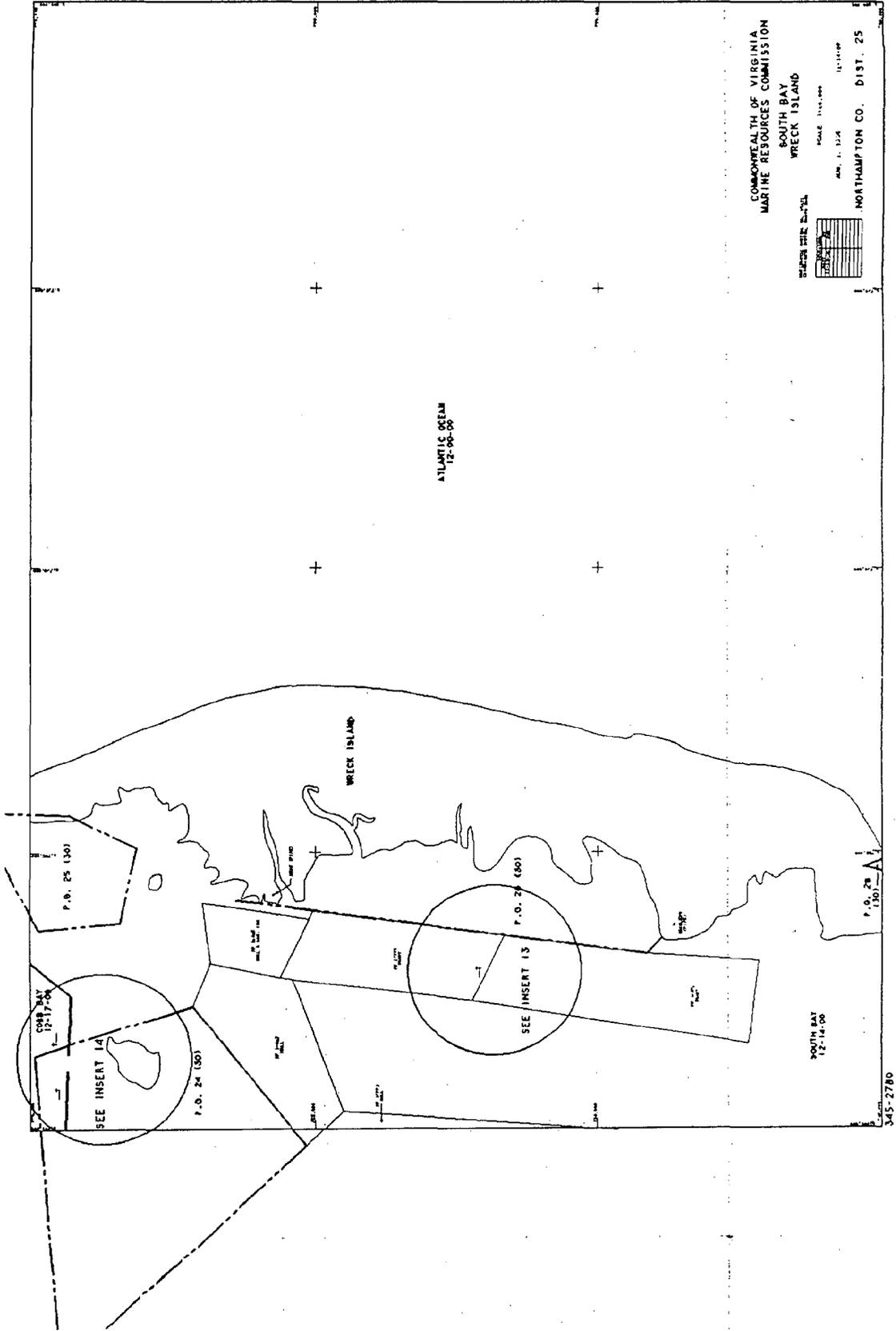
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COMMONWEALTH OF VIRGINIA  
 MARINE RESOURCES COMMISSION  
 SOUTH BAY  
 WRECK ISLAND



NORTHAMPTON CO. DIST. 25

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12-14-00

PF 16338  
BRADY

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1927 DATUM

46



43

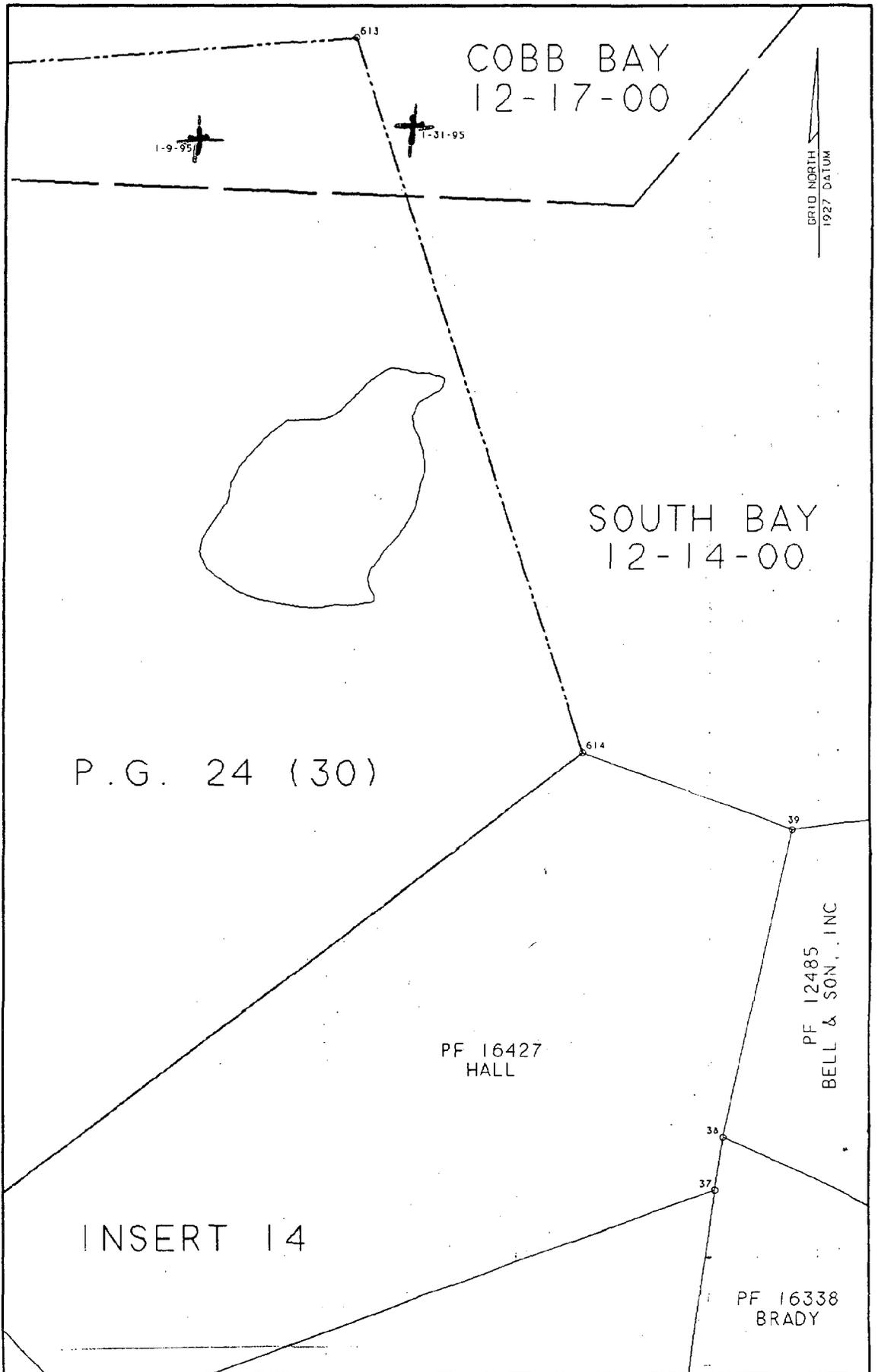
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ISLAND

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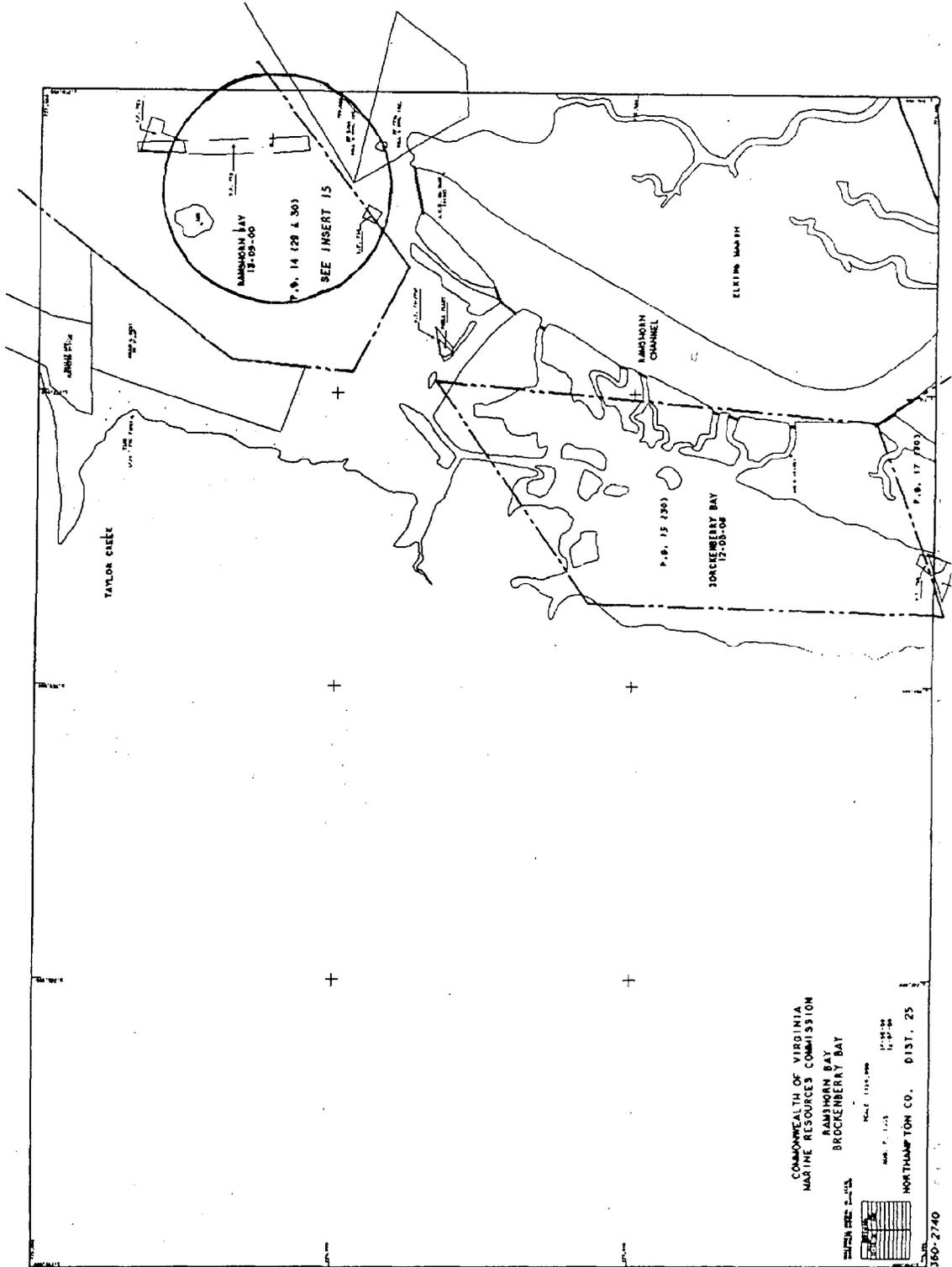
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PF 12485  
BELL & SON, INC

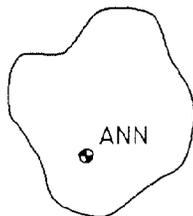
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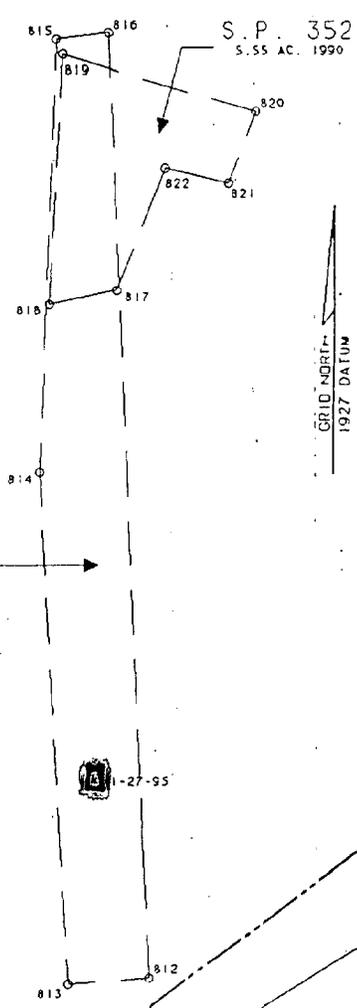
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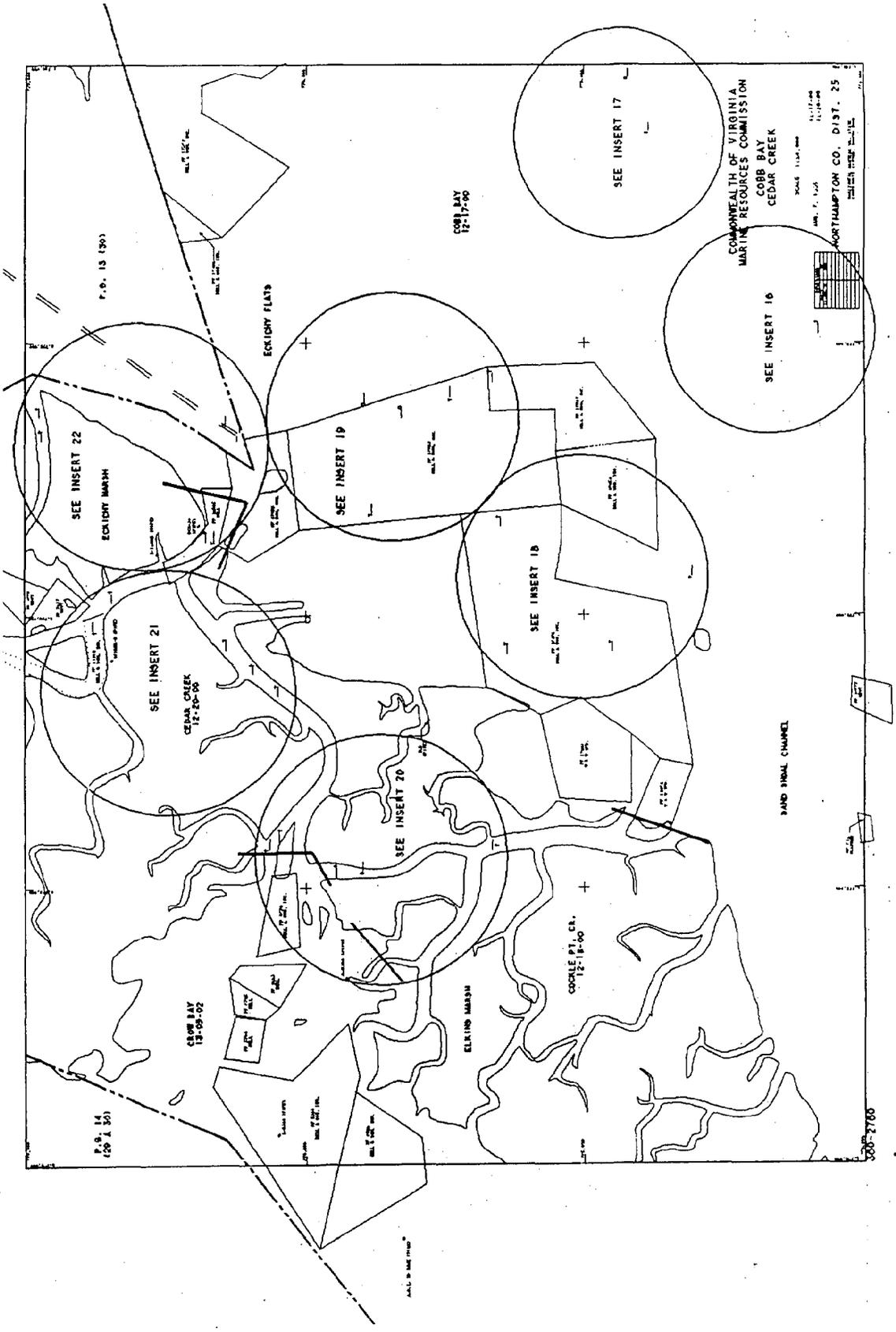
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PF 6382  
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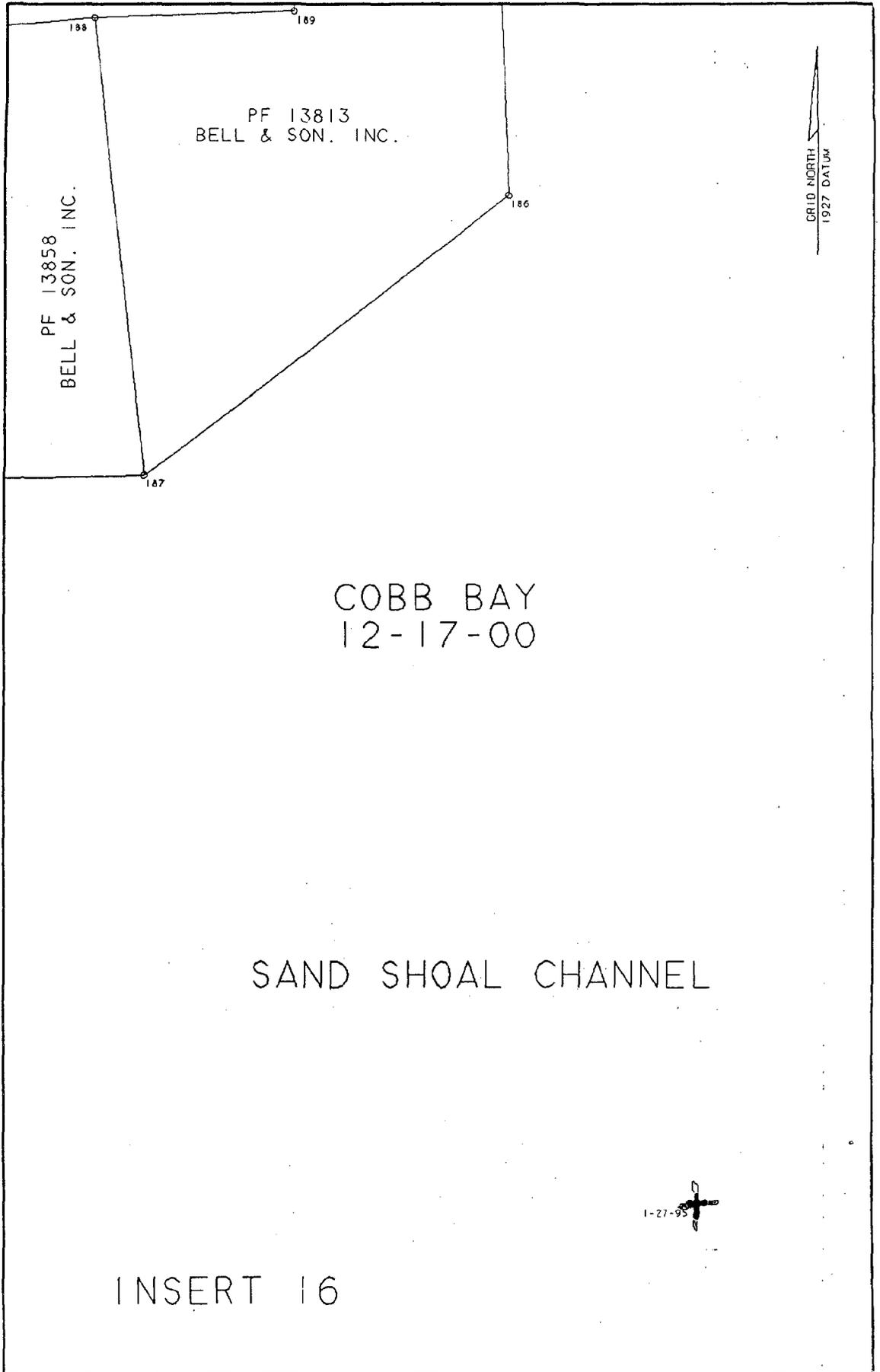
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COMMONWEALTH OF VIRGINIA  
 MARINE RESOURCES COMMISSION  
 COBB BAY  
 CEDAR CREEK

SCALE 1:25,000  
 APR. 2, 1958  
 NORTHAMPTON CO., DIST. 25  
 SHEET 16 OF 21

500-2780



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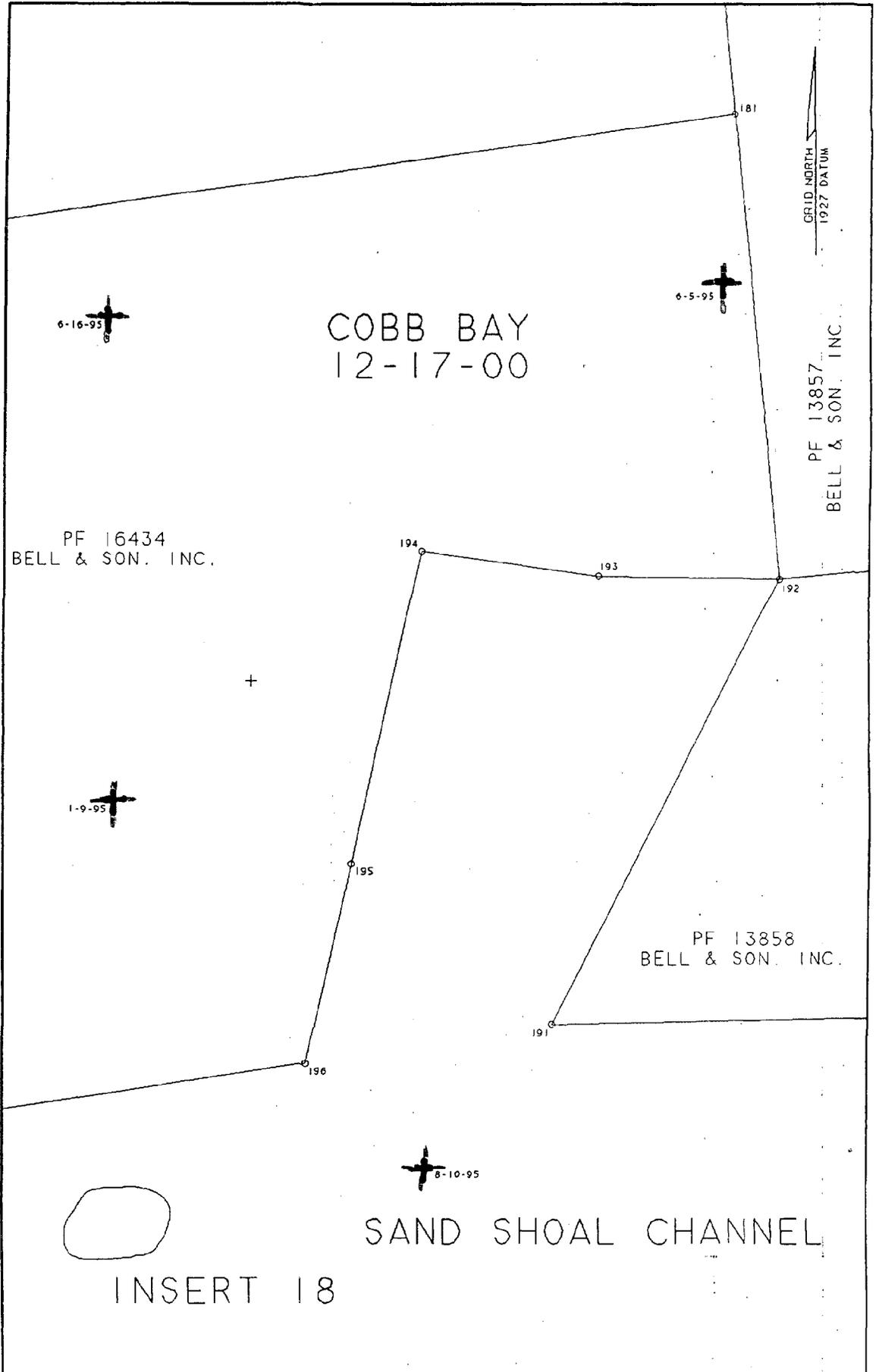
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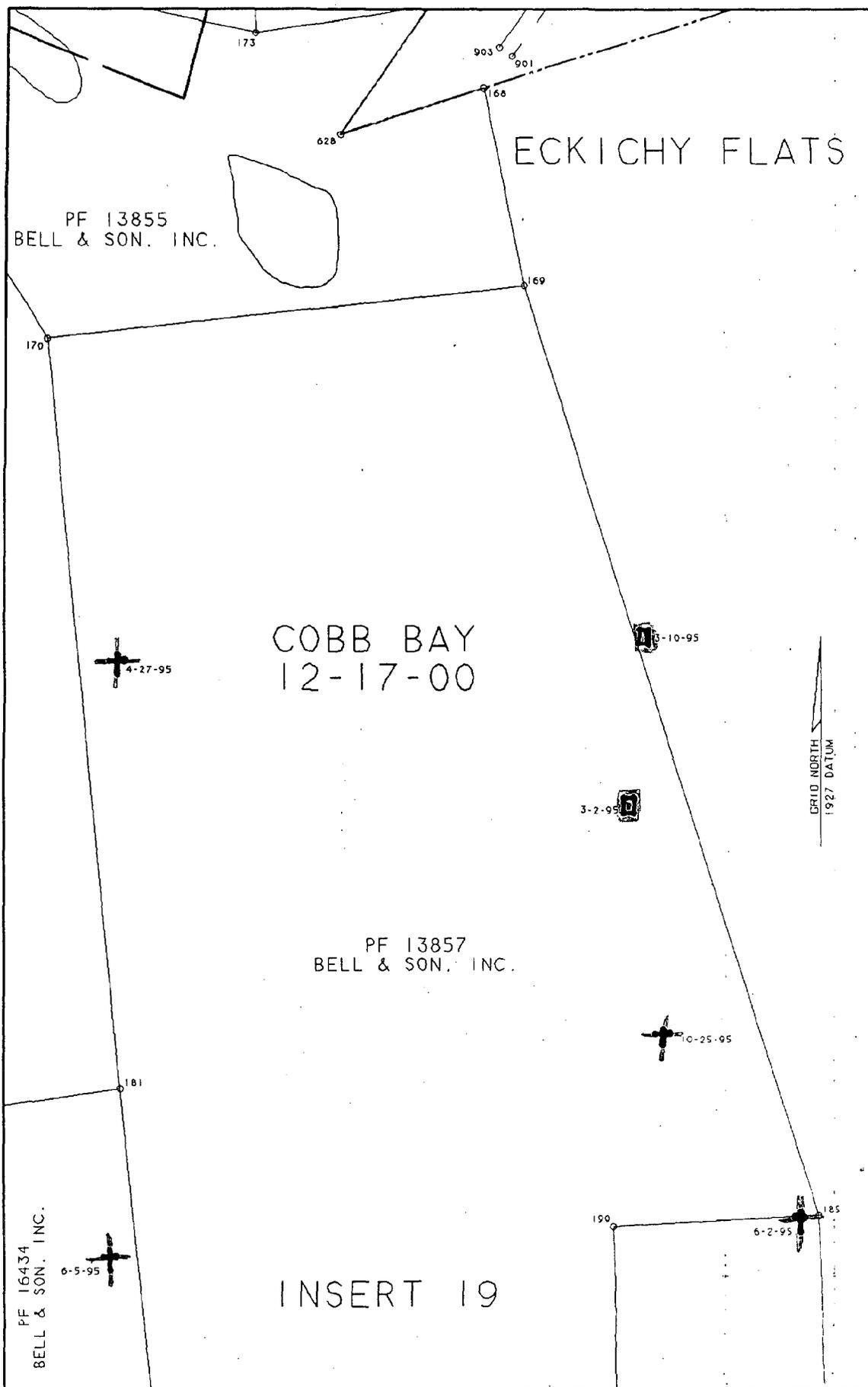
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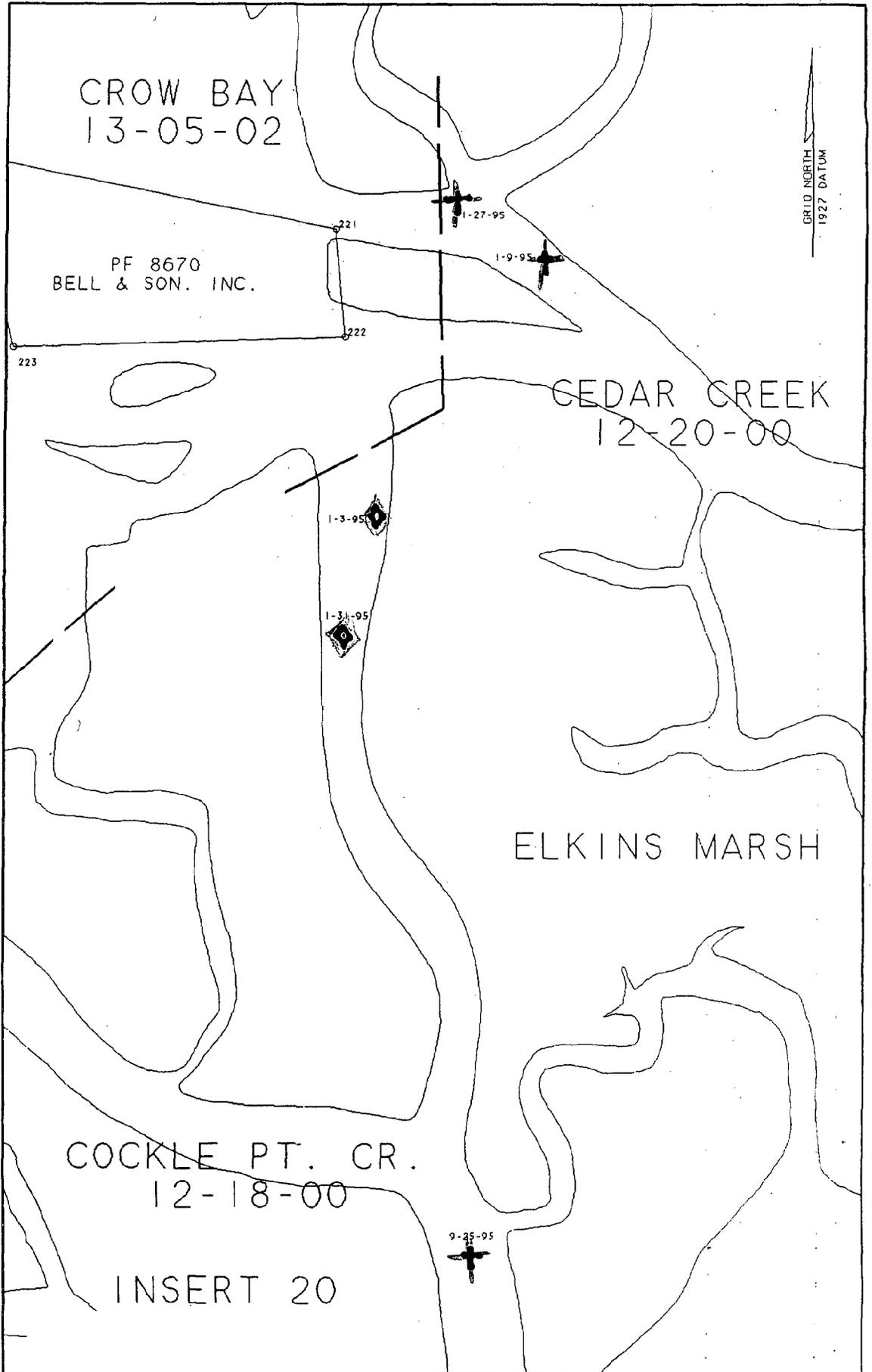
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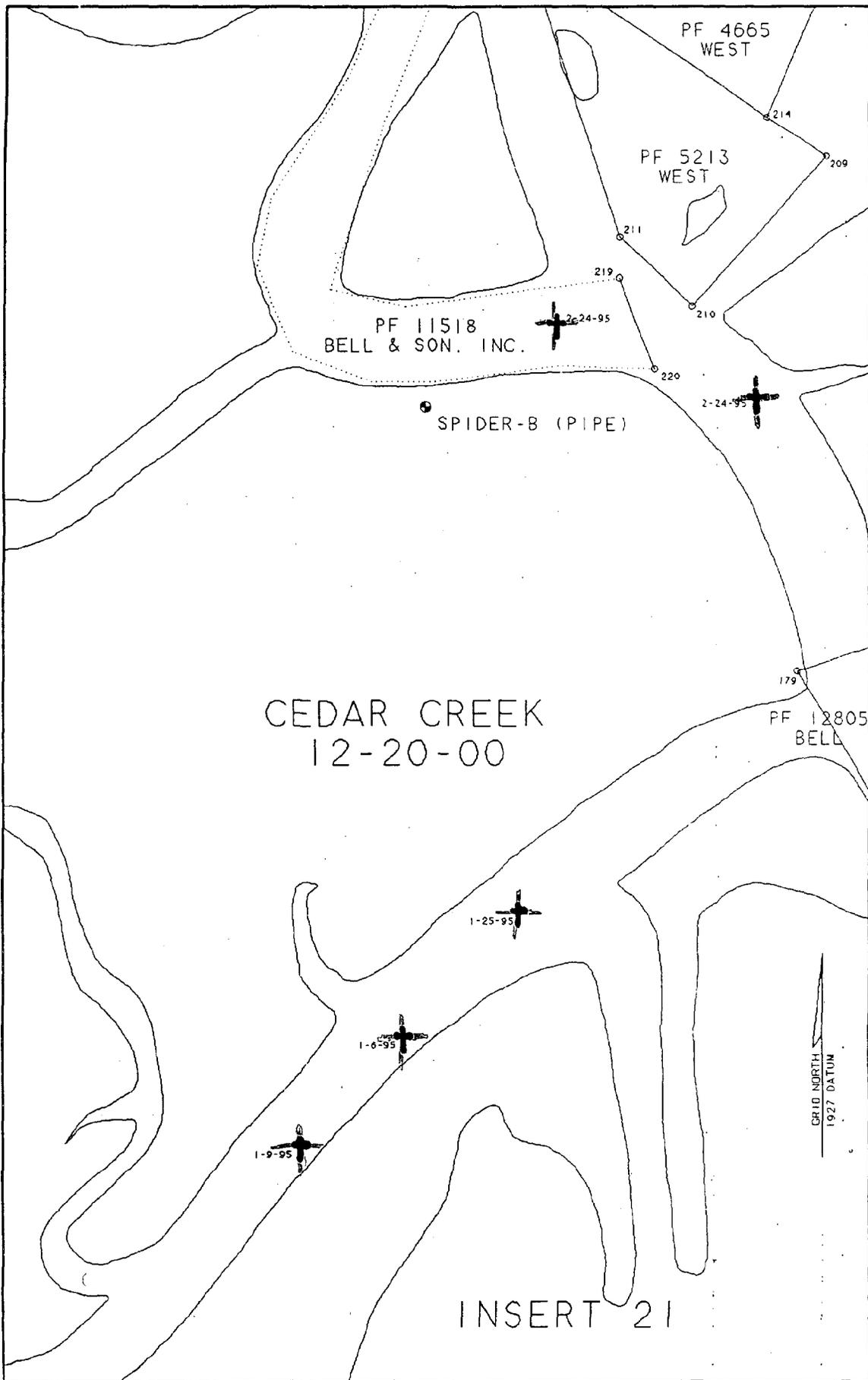
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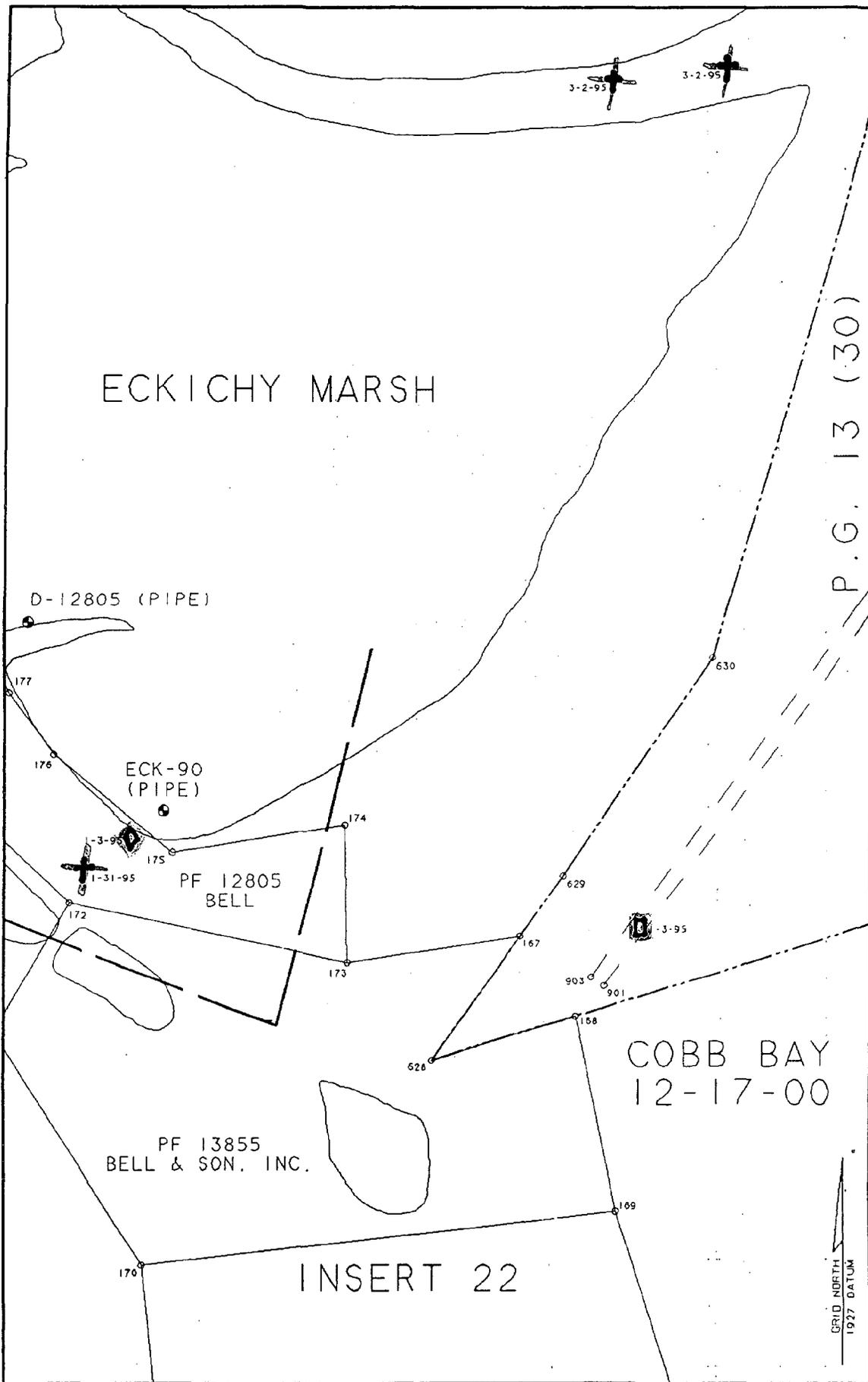
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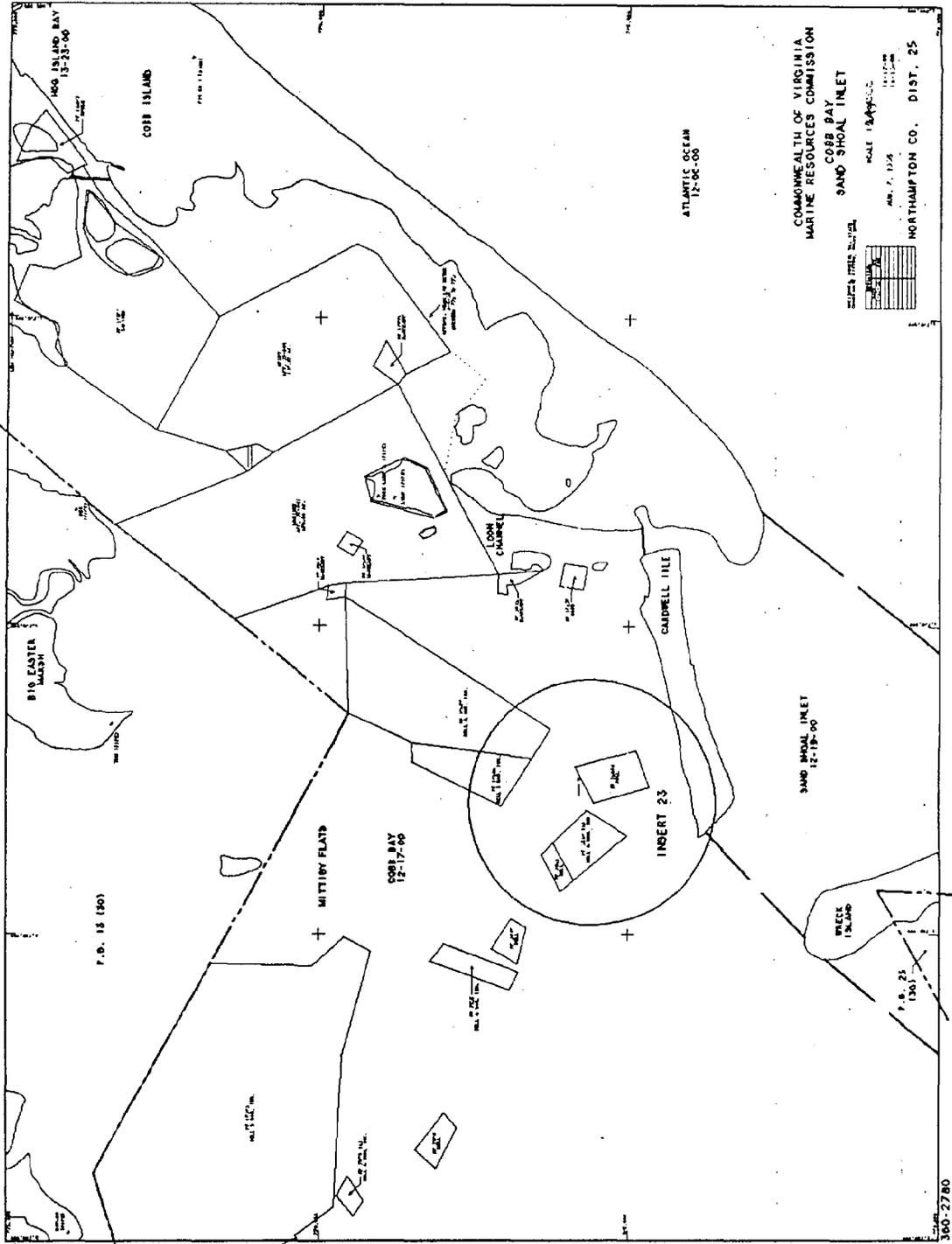








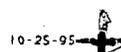
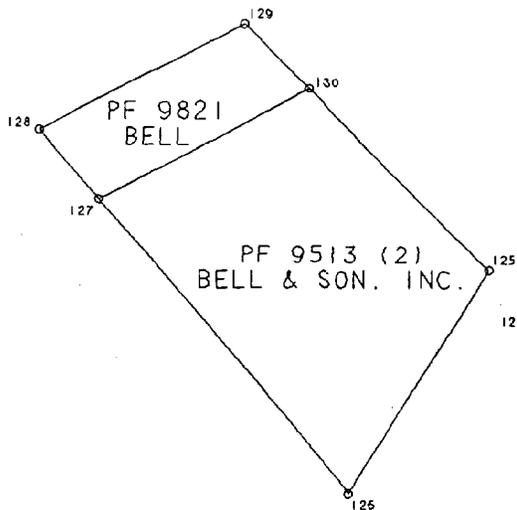




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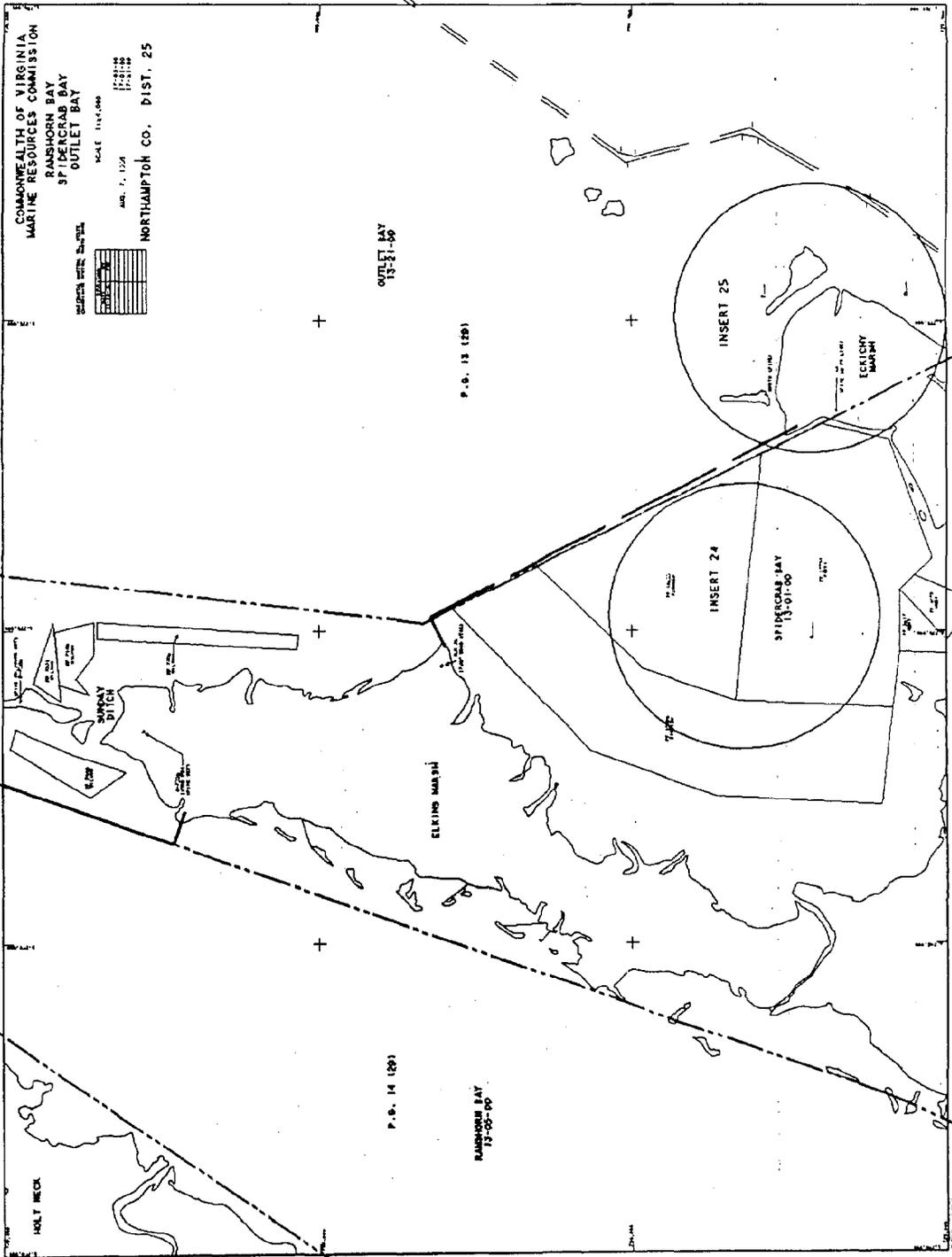


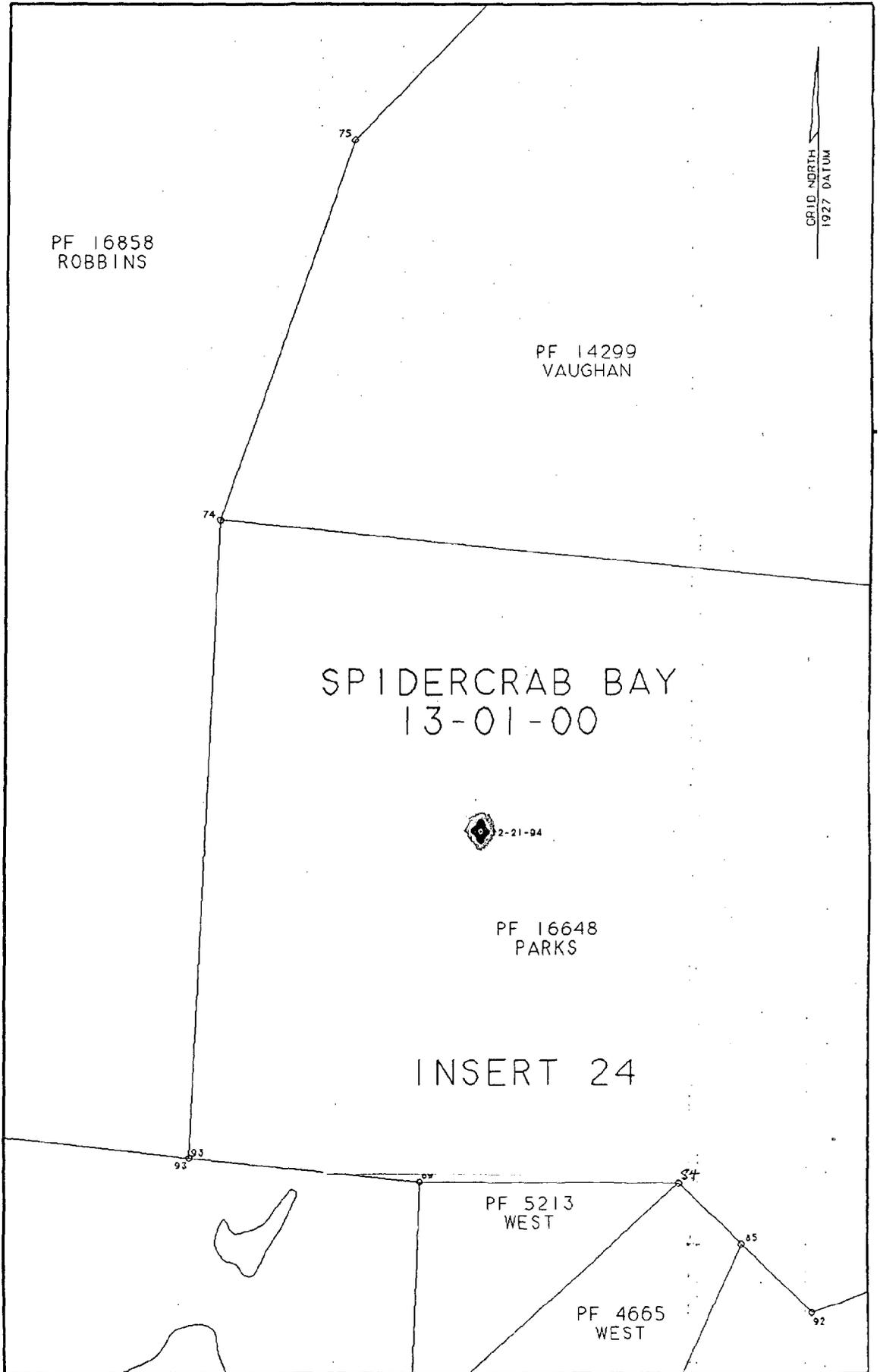
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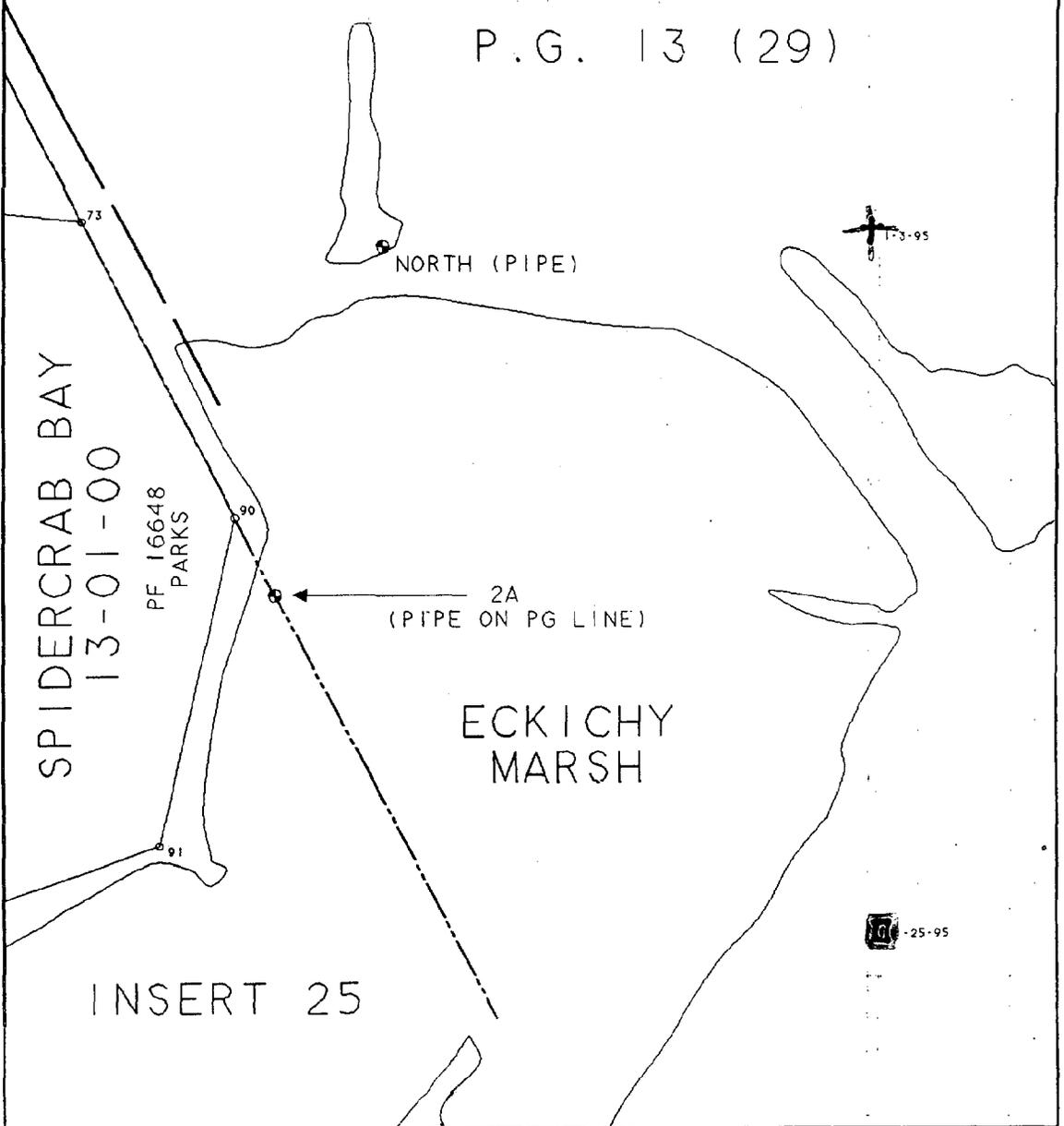




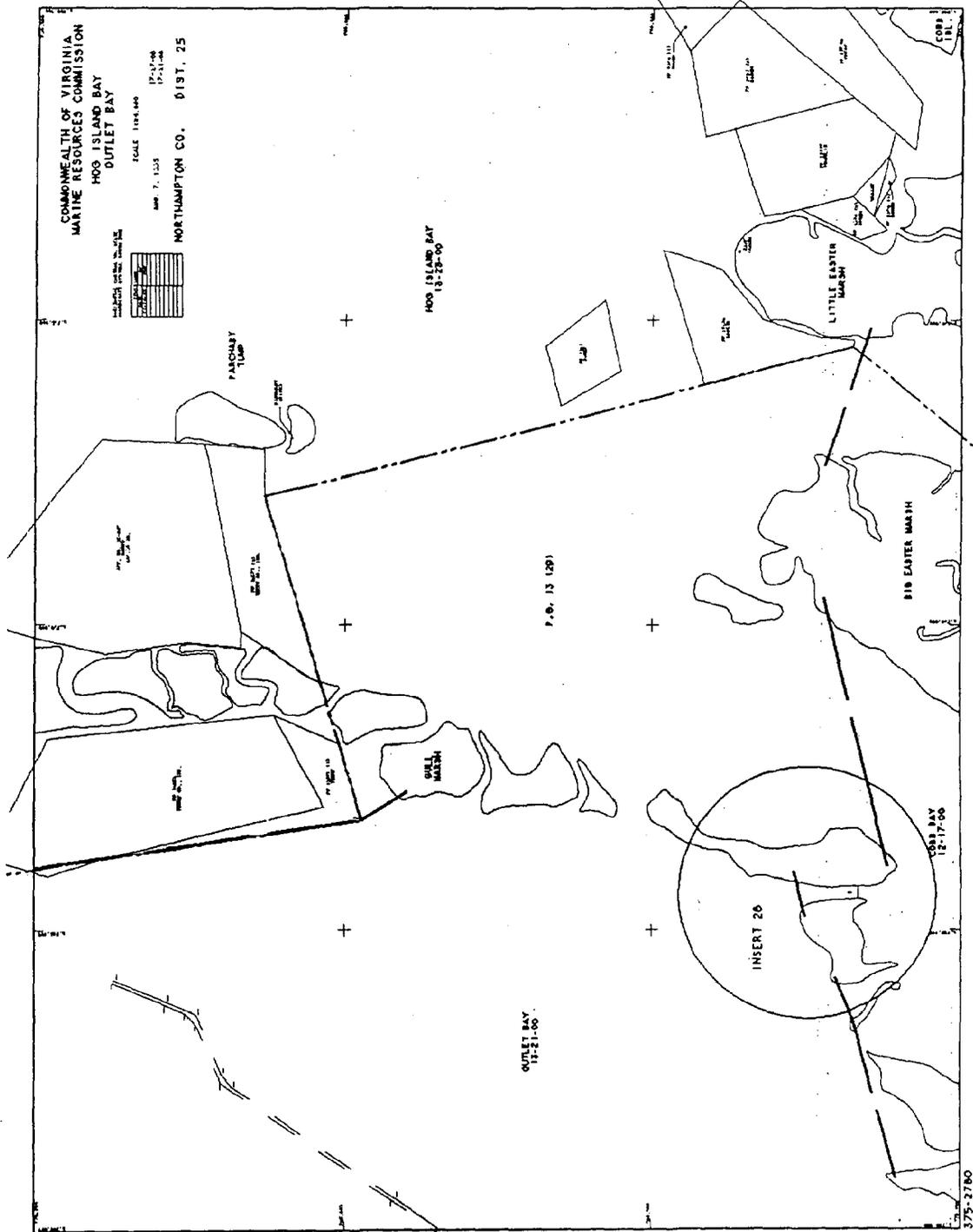
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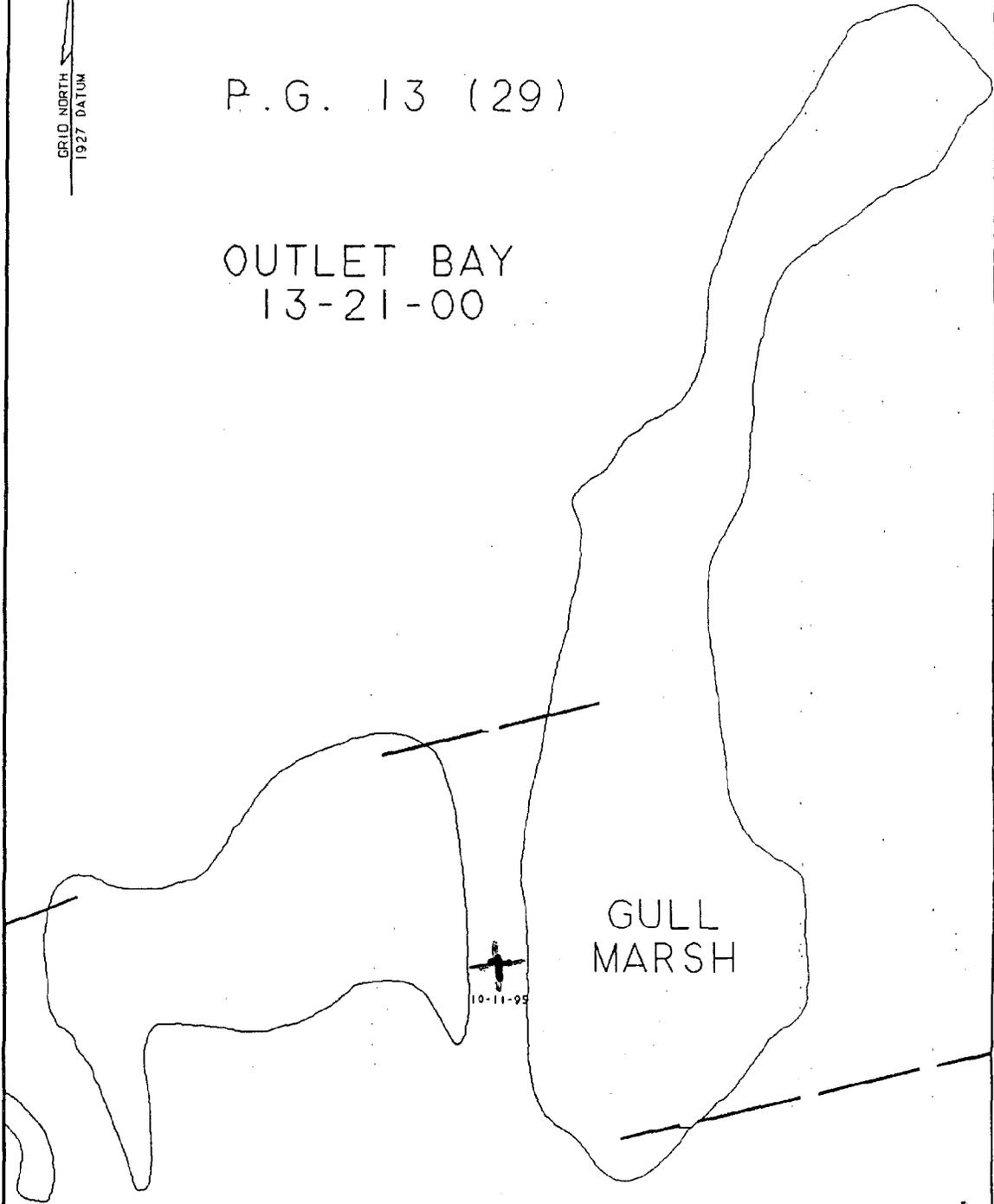
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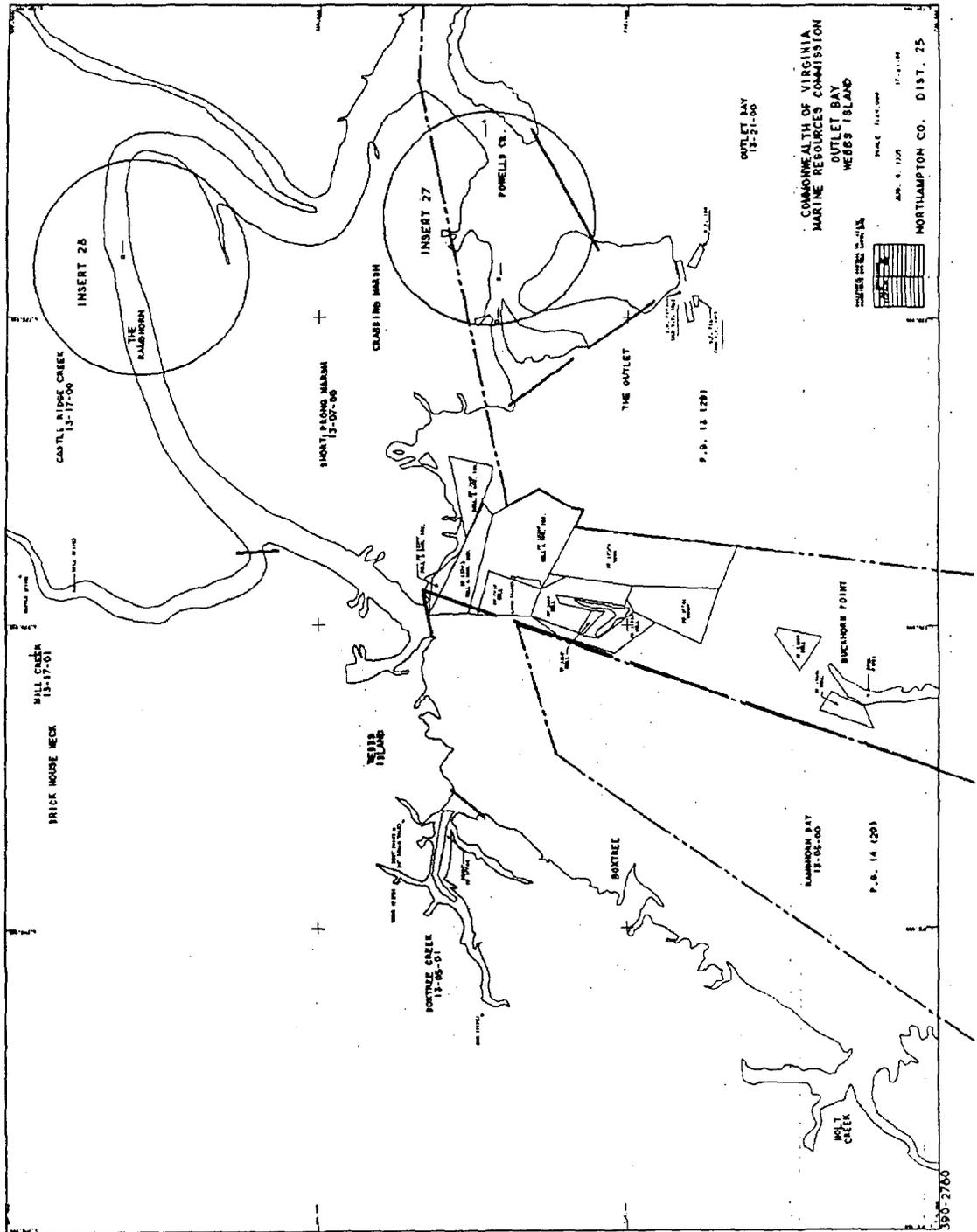


GULL  
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SHORT PRONG MARSH  
13-07-00

GRID NORTH  
1927 DATUM

CRABBING MARSH

11-30-95

3-27-95

2-24-95

POWELLS CR.

P.G. 13 (29)

OUTLET BAY  
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INSERT 27

CASTLE RIDGE CREEK  
13-17-00

GRID NORTH  
1927 DATUM

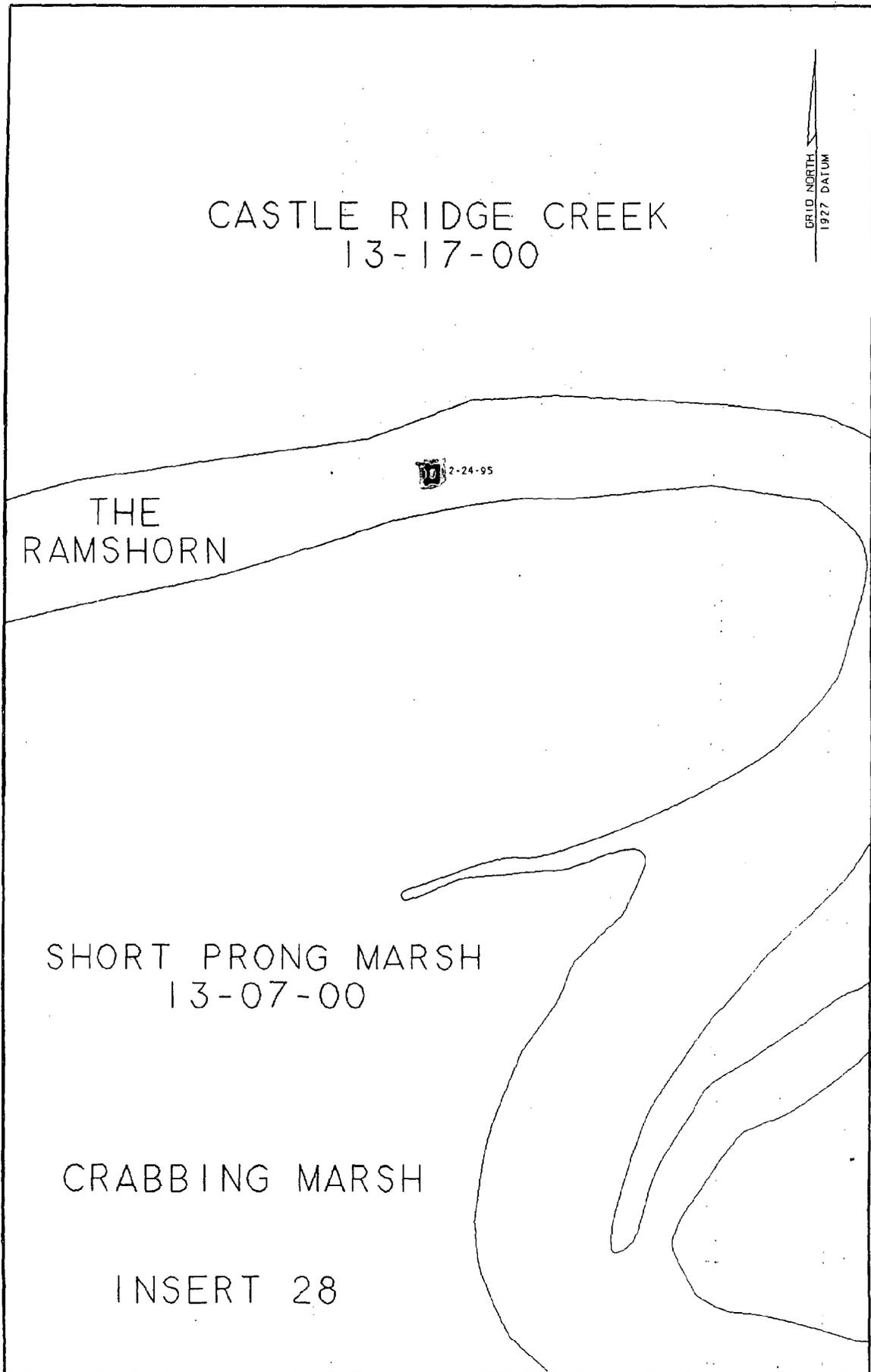
THE  
RAMSHORN

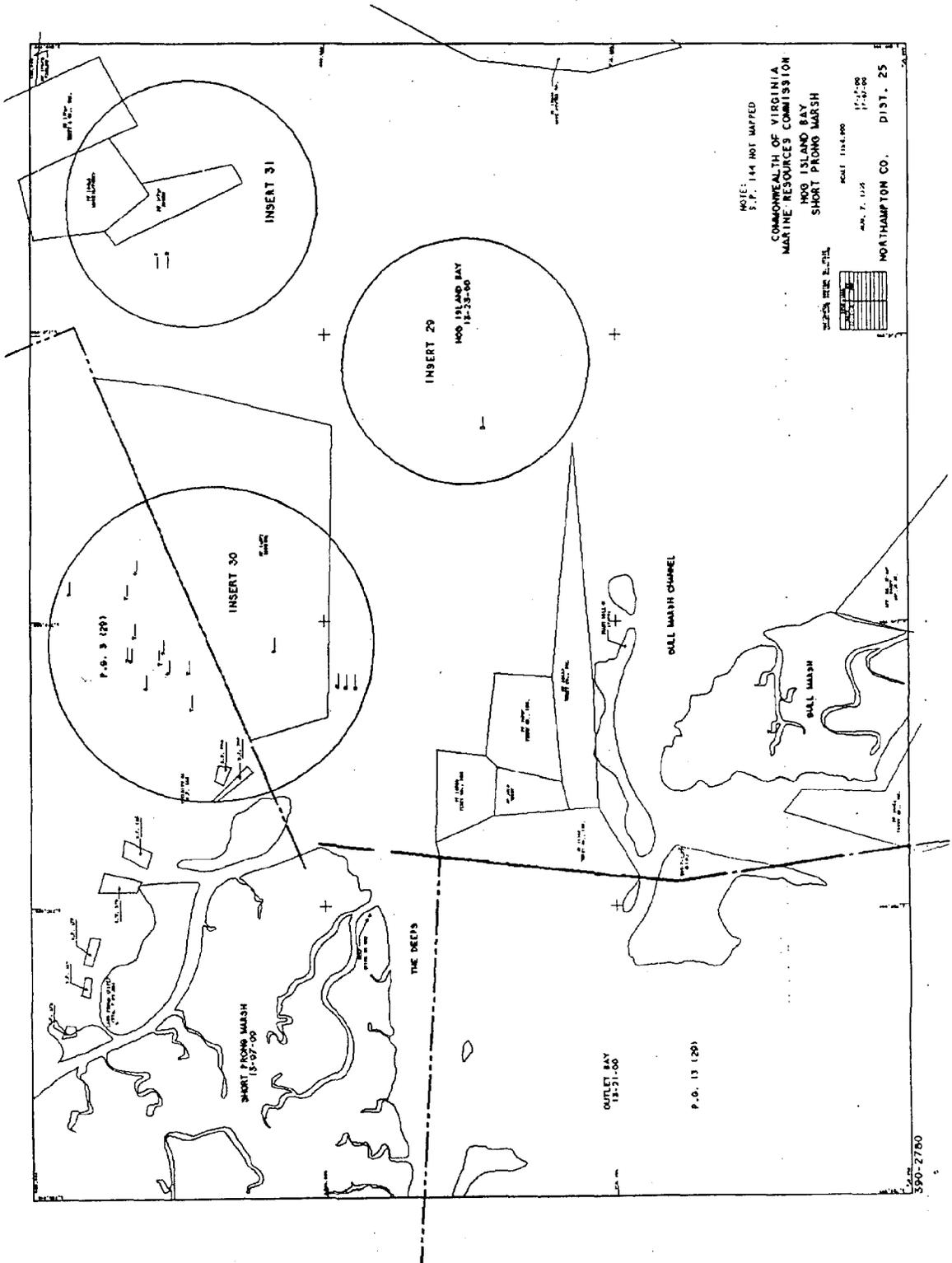
10 2-24-95

SHORT PRONG MARSH  
13-07-00

CRABBING MARSH

INSERT 28





NOTE: 144 NOT MAFFED  
 S.F. 144 NOT MAFFED

COMMONWEALTH OF VIRGINIA  
 MARINE RESOURCES COMMISSION  
 HOG ISLAND BAY  
 SHORT PRONG MARSH

SCALE 1:100,000  
 11-27-00  
 11-27-00

NORTHAMPTON CO. DIST. 25


390-2780

GRID NORTH  
1927 DATUM



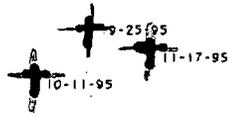
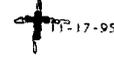
HOG ISLAND BAY  
13-23-00

PF 10899  
TERRY CO., INC.

INSERT 29

P.G. 3 (29)

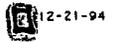
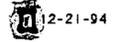
CRILO NORTH  
1927 DATUM



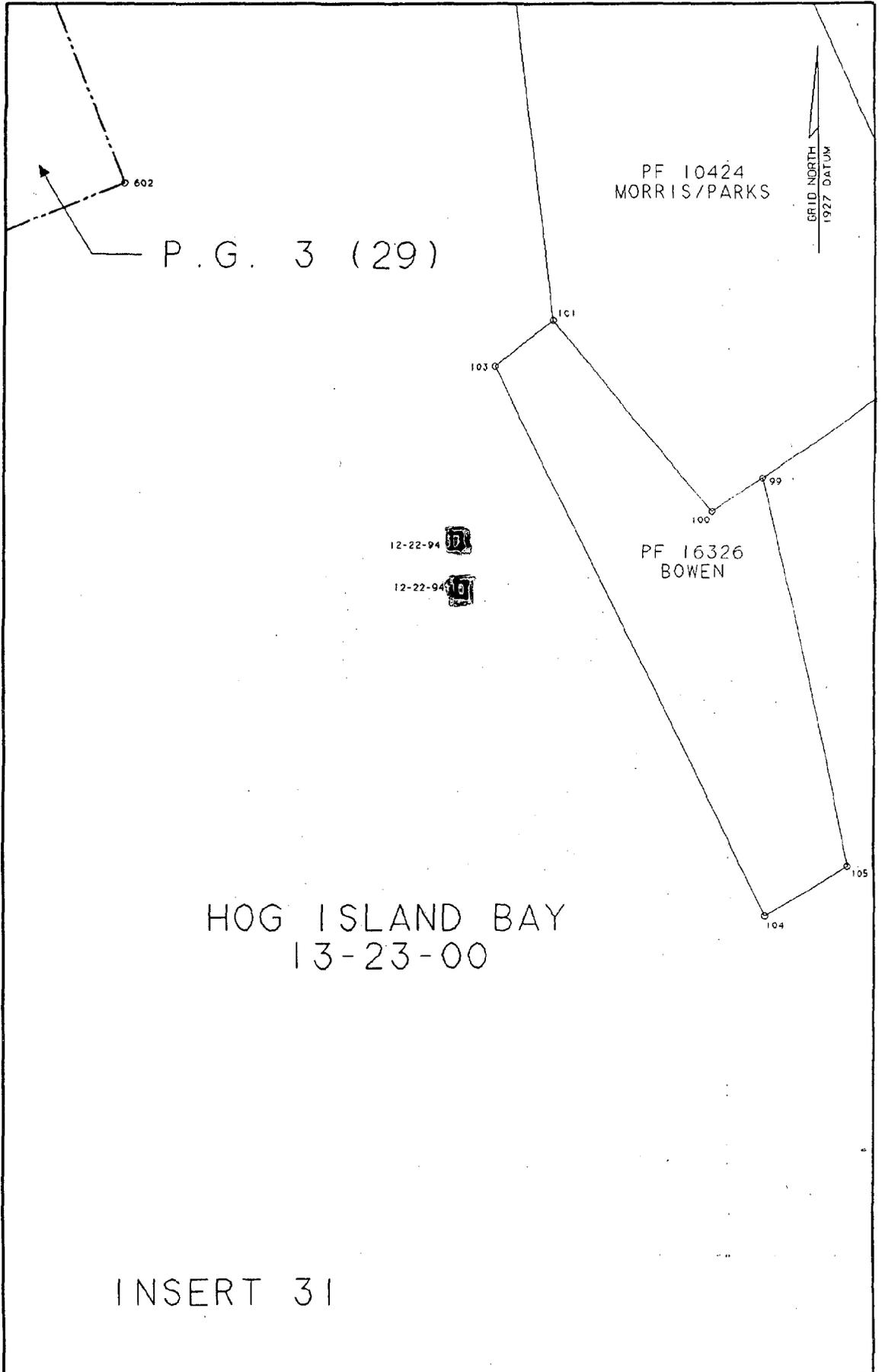
HOG ISLAND BAY  
13-23-00

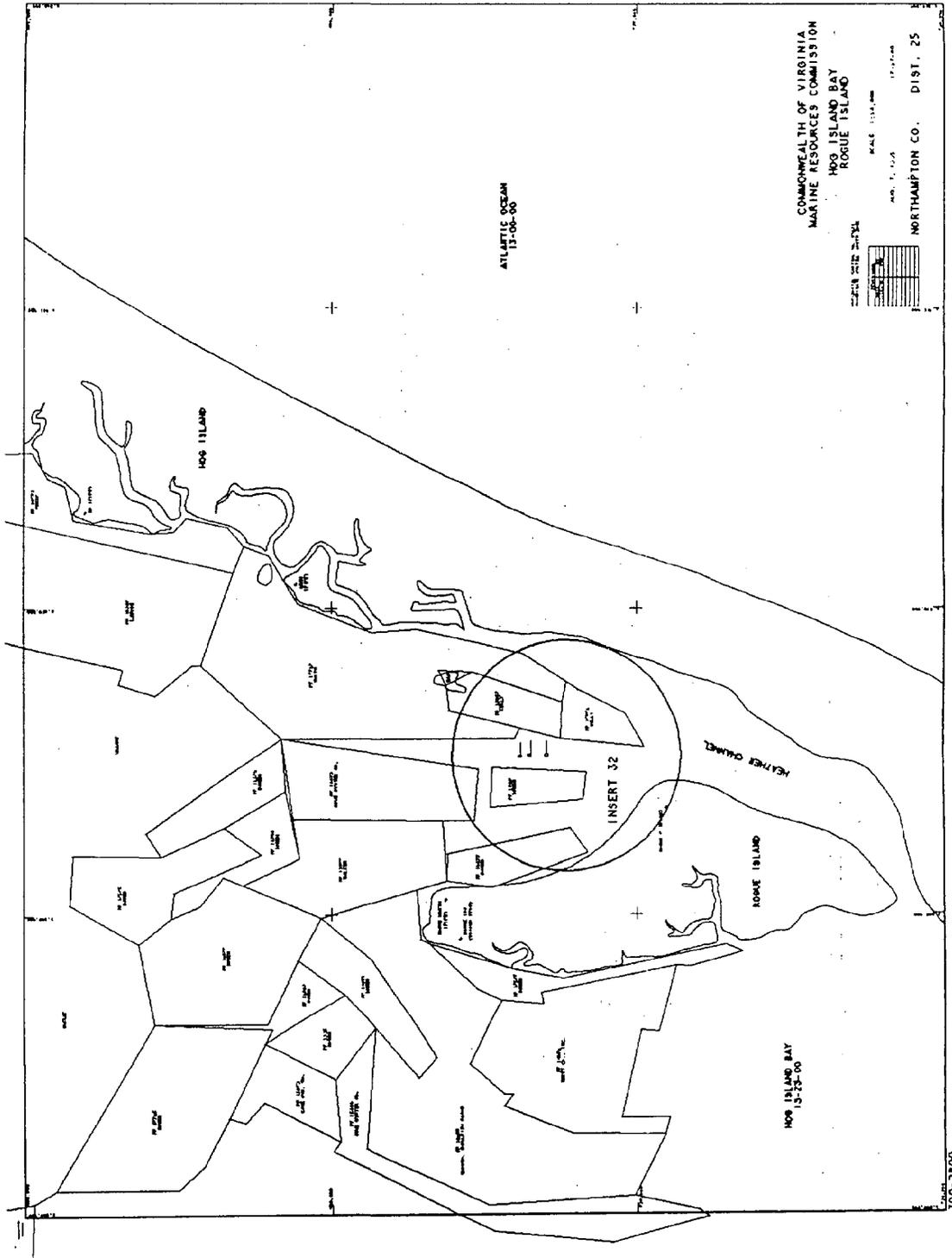


PF 12537  
ROBBINS



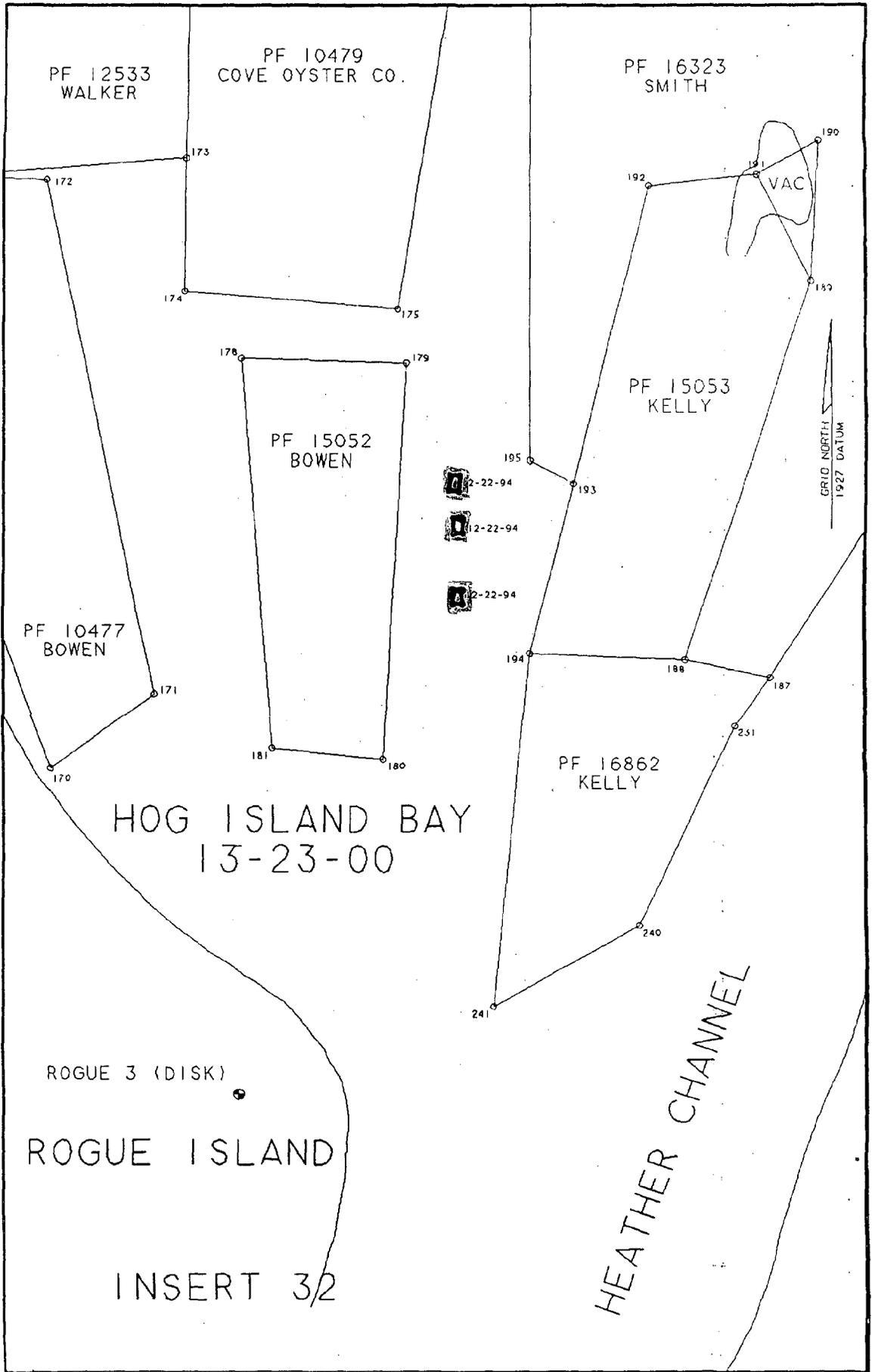
INSERT 30

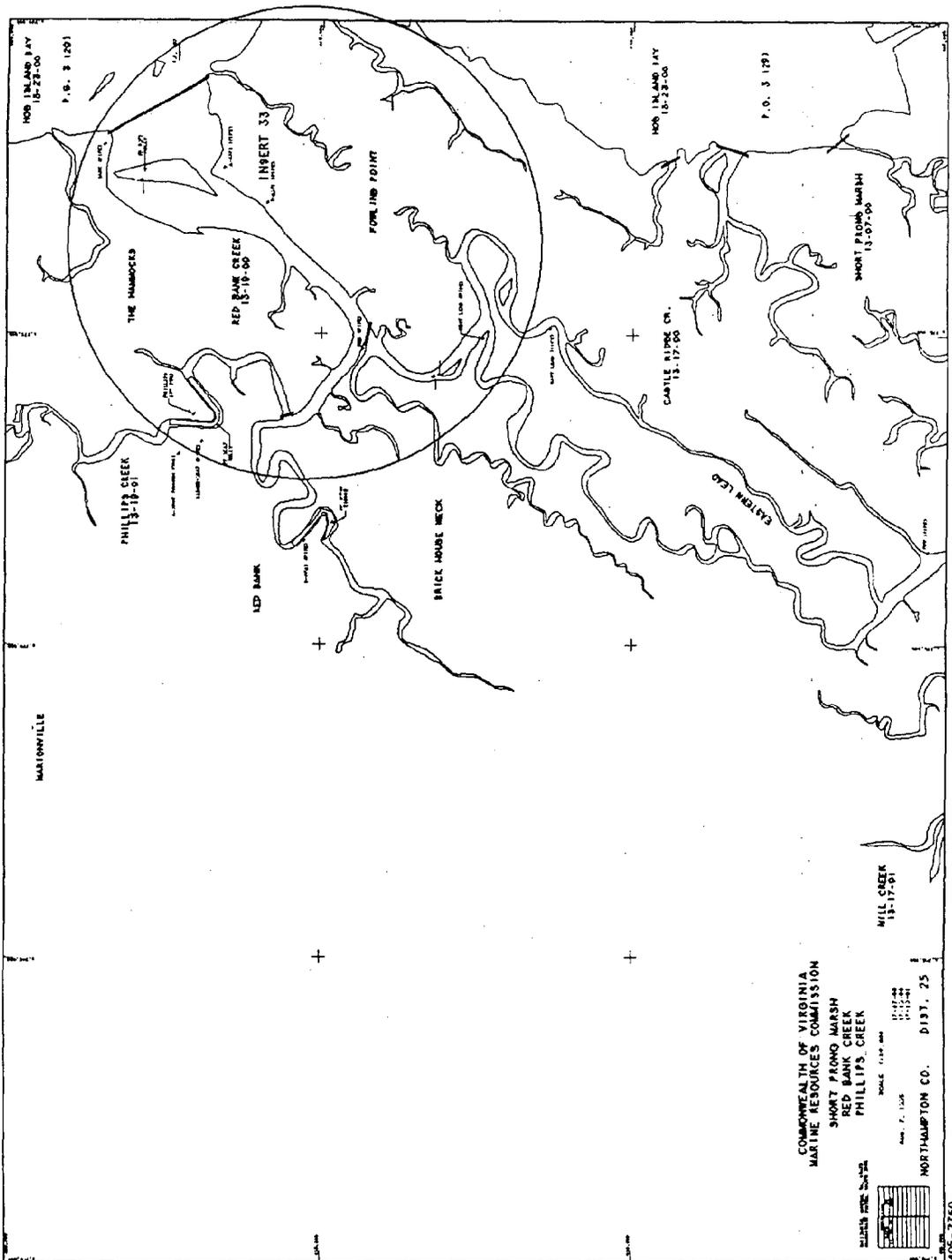


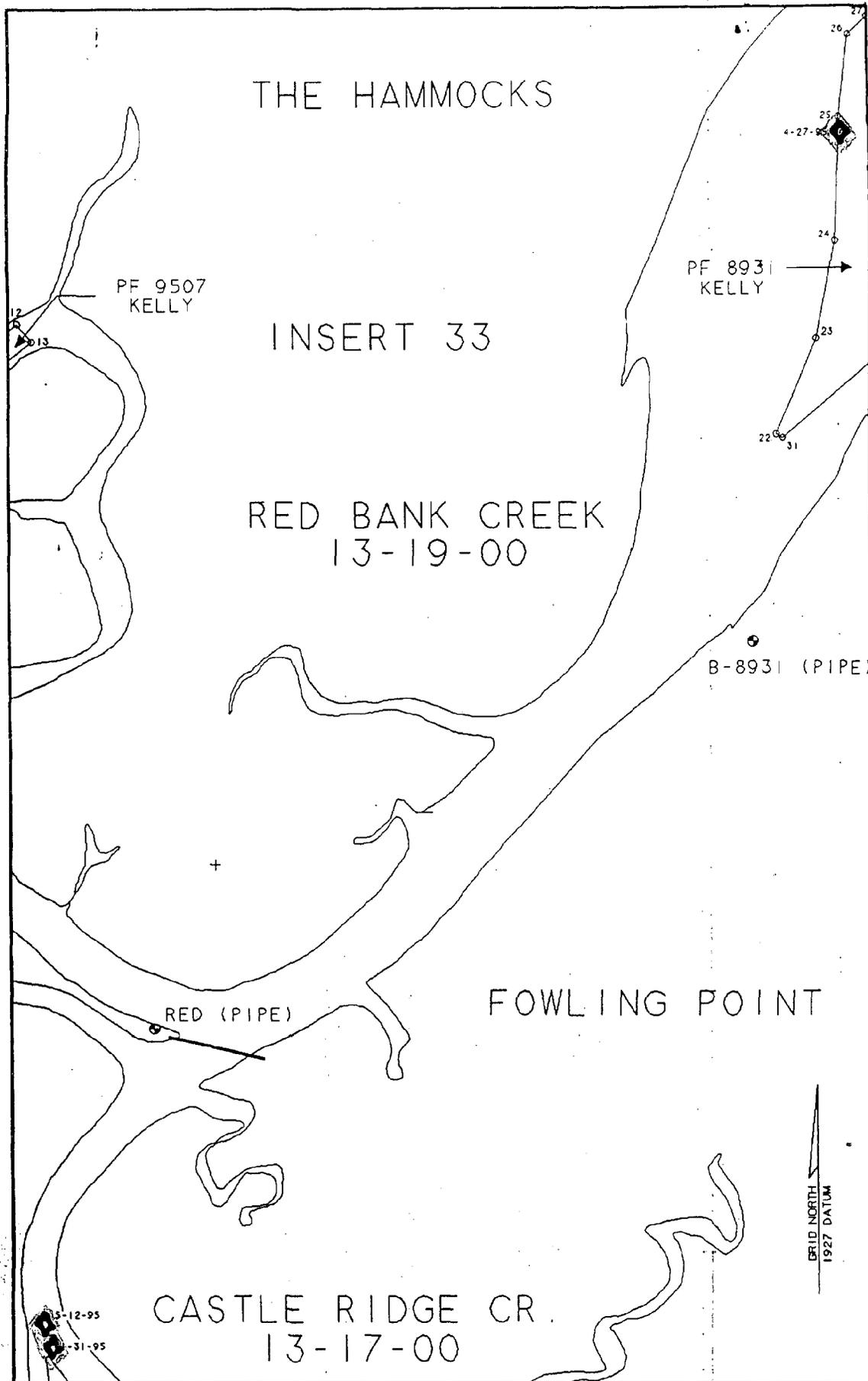


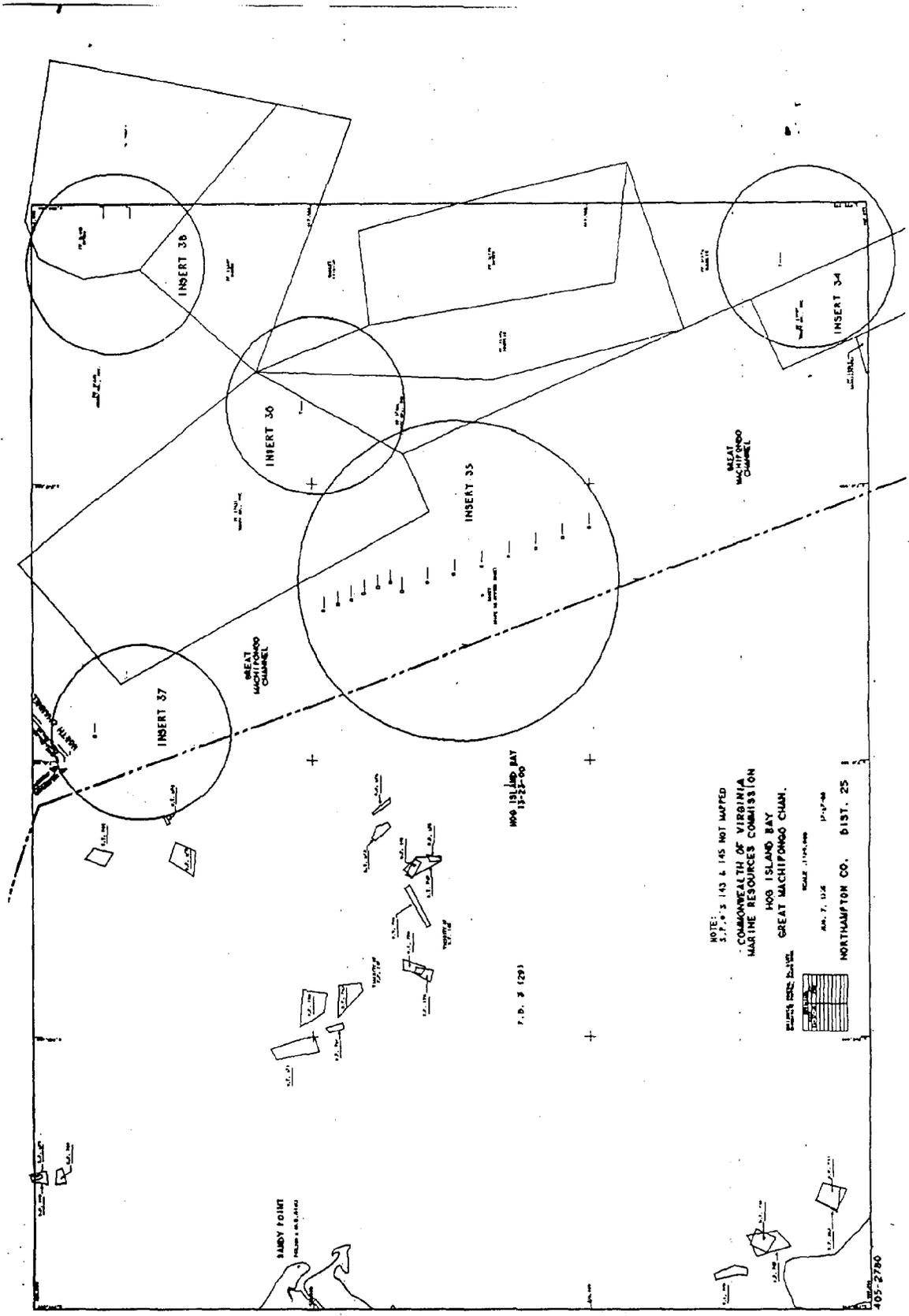
COMMONWEALTH OF VIRGINIA  
 MARINE RESOURCES COMMISSION  
 HOG ISLAND BAY  
 ROGUE ISLAND  
 NORTHAMPTON CO. DIST. 25

390-2800





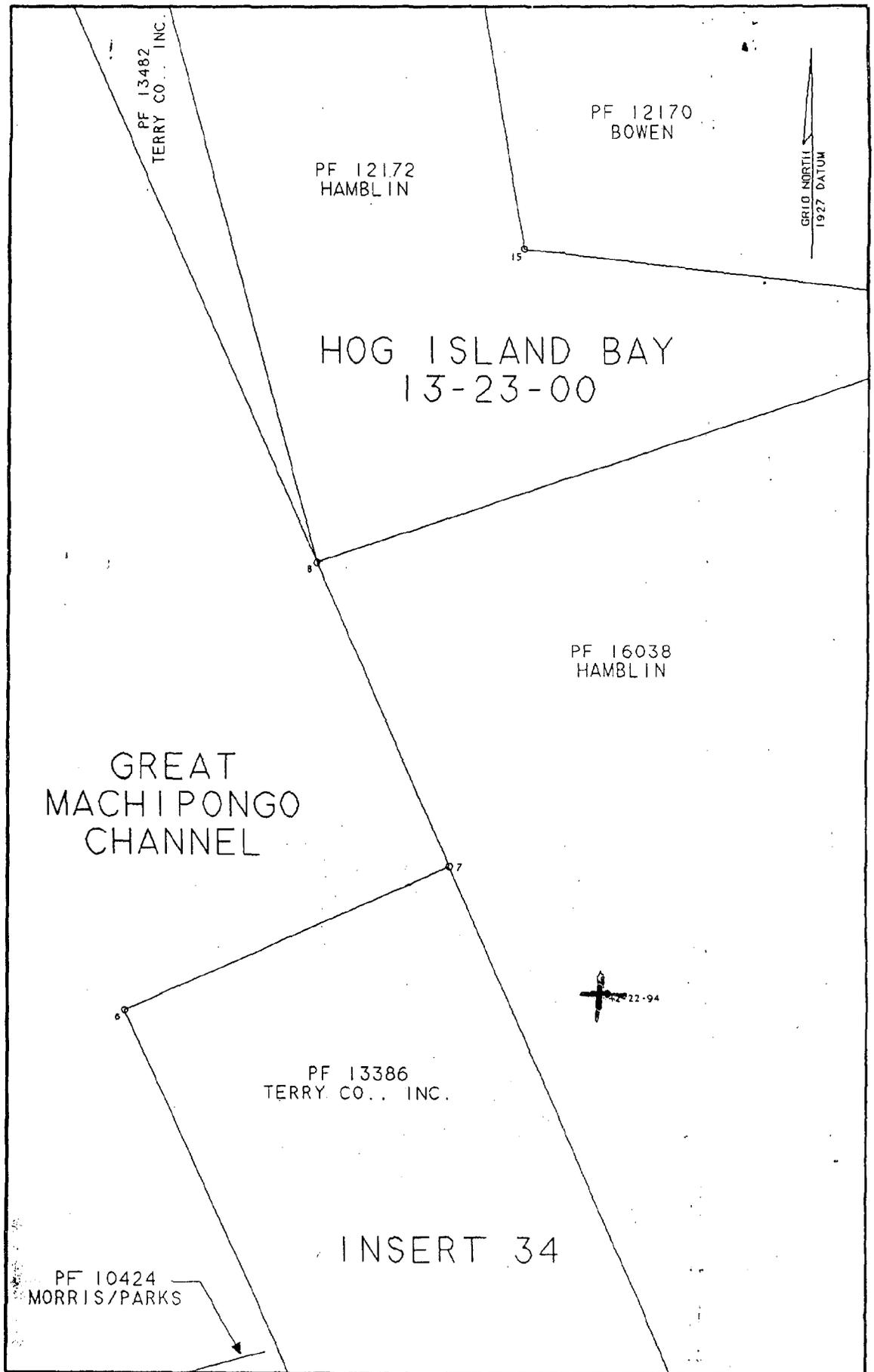




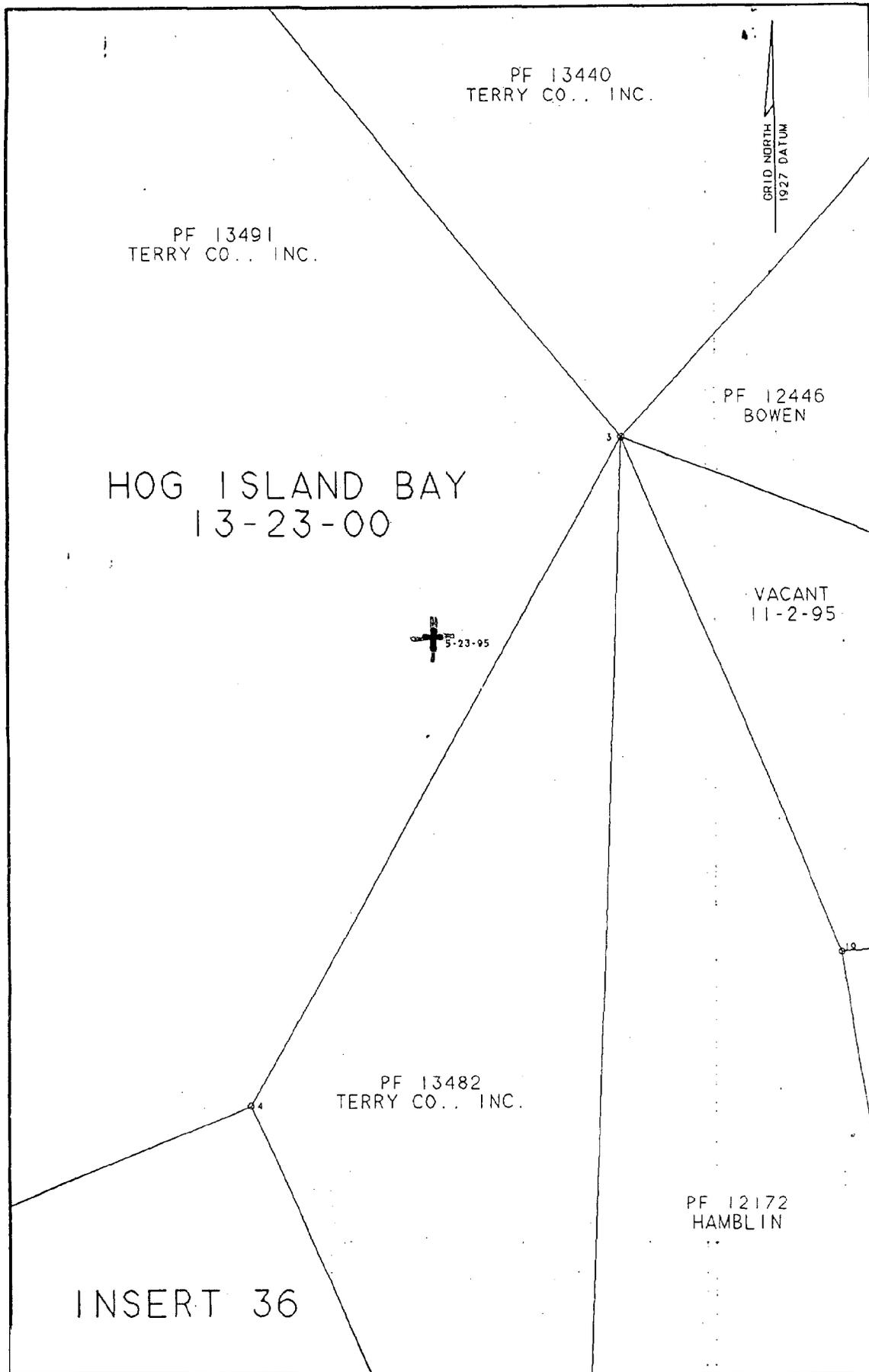
NOTE: 3, 143 & 145 NOT SURVEYED  
 2, 7, 9 & 142 NOT SURVEYED  
 COMMONWEALTH OF VIRGINIA  
 MARINE RESOURCES COMMISSION  
 HOB ISLAND BAY  
 GREAT WACHIFONGO CHAN.  
 SCALE: 1" = 100' 0"  
 DATE: 7, 1958  
 NORTHAMPTON CO. DIST. 25

DATE	1958
BY	U.S. NAVY
NO.	1400
CLASS.	SECRET

405-2780







PF 13440  
TERRY CO., INC.

PF 13491  
TERRY CO., INC.

PF 12446  
BOWEN

HOG ISLAND BAY  
13-23-00

VACANT  
11-2-95

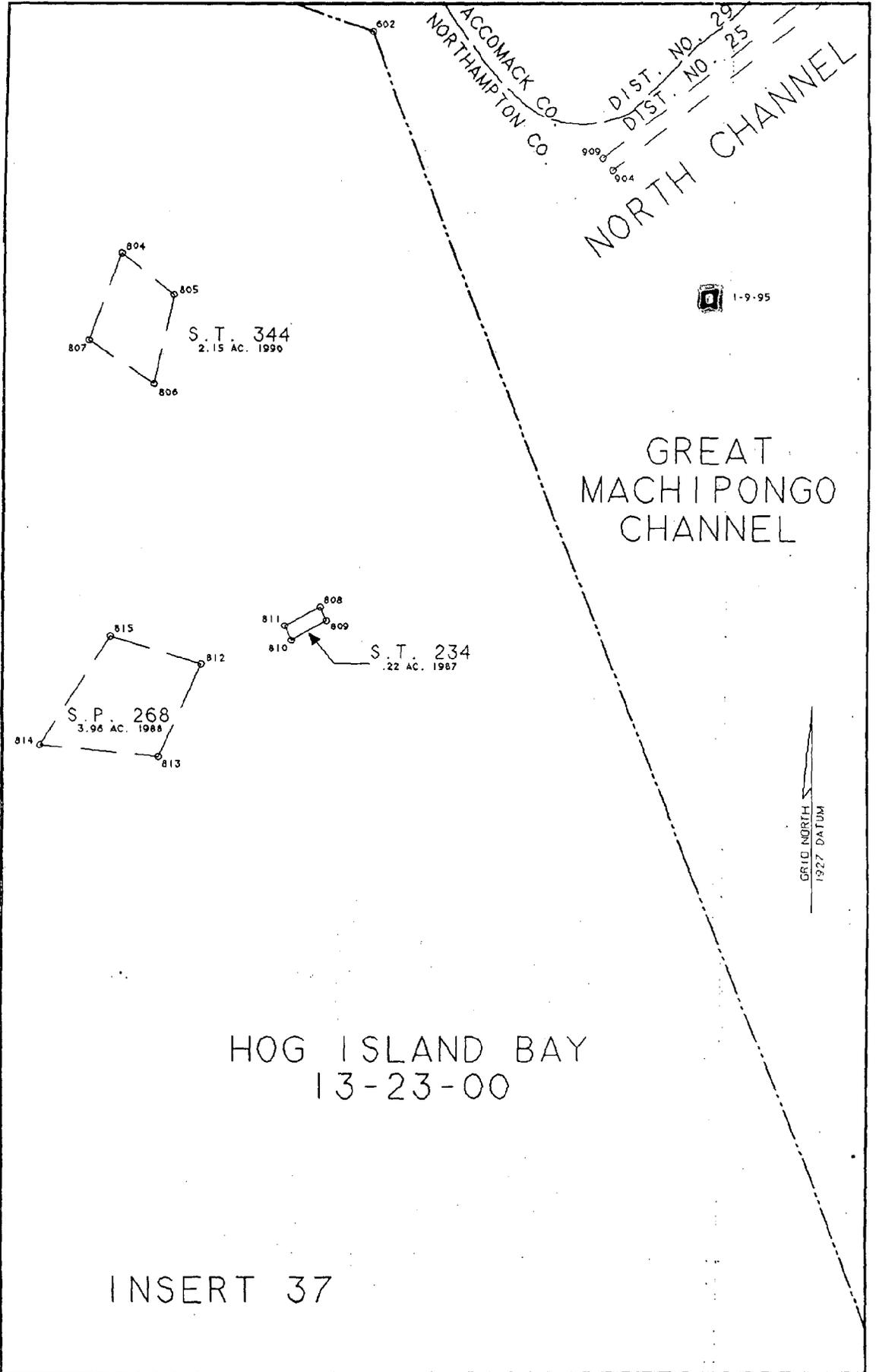
5-23-95

PF 13482  
TERRY CO., INC.

PF 12172  
HAMBLIN

INSERT 36

GRID NORTH  
1927 DATUM



ACCOMACK CO.  
 NORTHAMPTON CO.  
 DIST. NO. 29  
 DIST. NO. 25  
 NORTH CHANNEL

804  
 805  
 807  
 806  
 S.T. 344  
 2.15 AC. 1990

1-9-95

GREAT  
 MACHIPONGO  
 CHANNEL

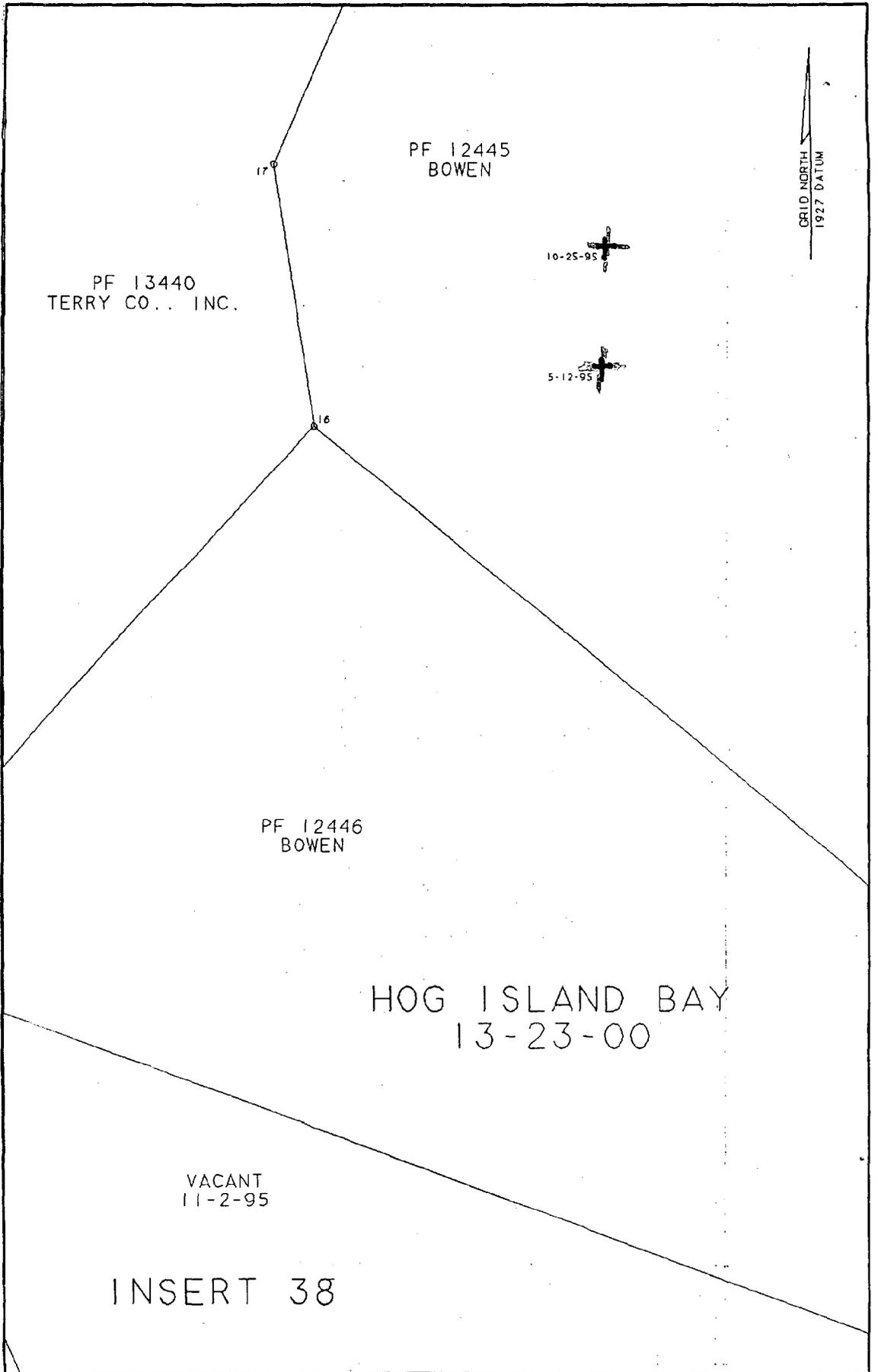
815  
 812  
 814  
 813  
 S.P. 268  
 3.96 AC. 1986

808  
 809  
 810  
 811  
 S.T. 234  
 .22 AC. 1987

GR10 NORTH  
 1927 DATUM

HOG ISLAND BAY  
 13-23-00

INSERT 37



PF 13440  
TERRY CO., INC.

PF 12445  
BOWEN

PF 12446  
BOWEN

HOG ISLAND BAY  
13-23-00

VACANT  
11-2-95

INSERT 38

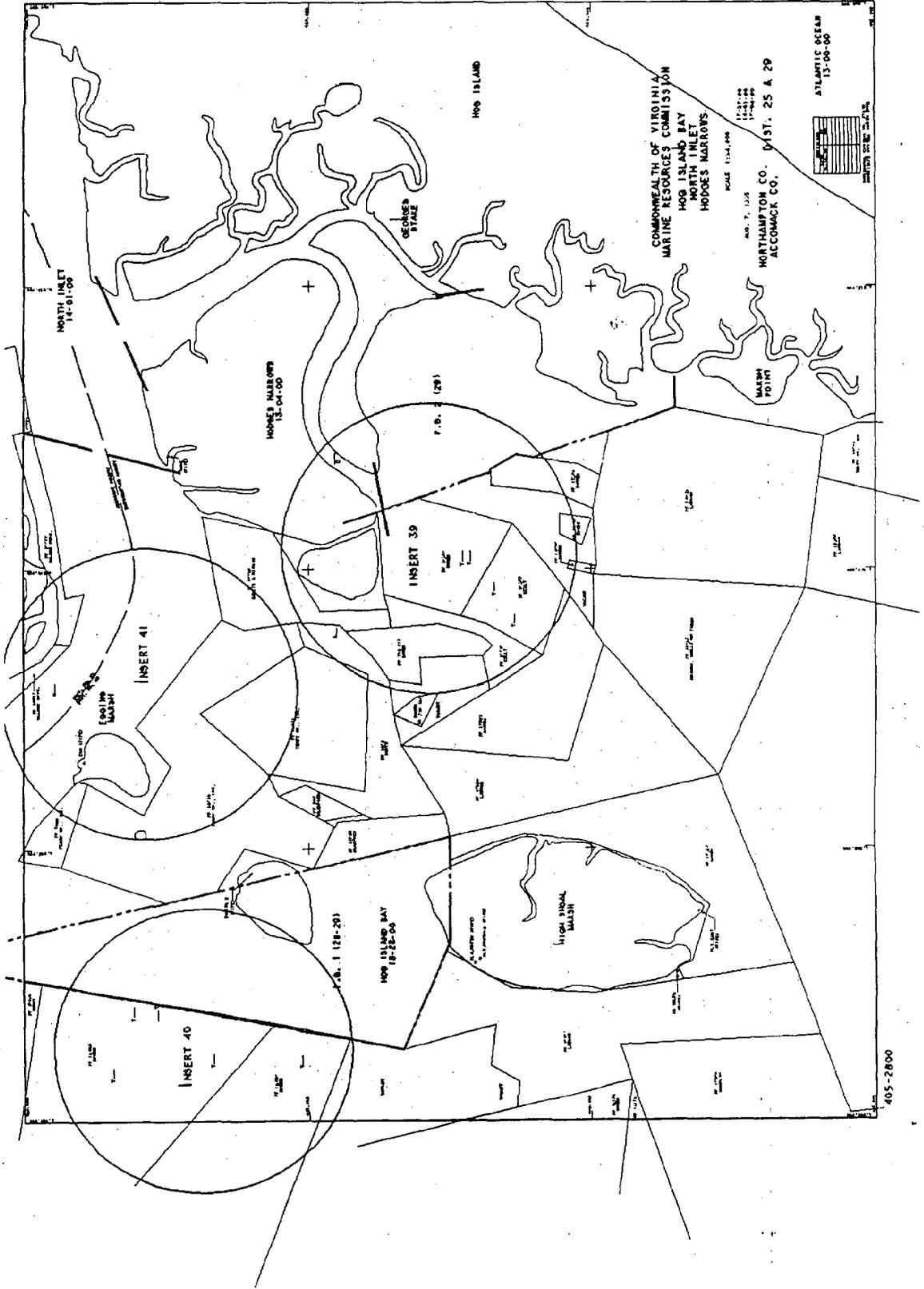
GRID NORTH  
1927 DATUM

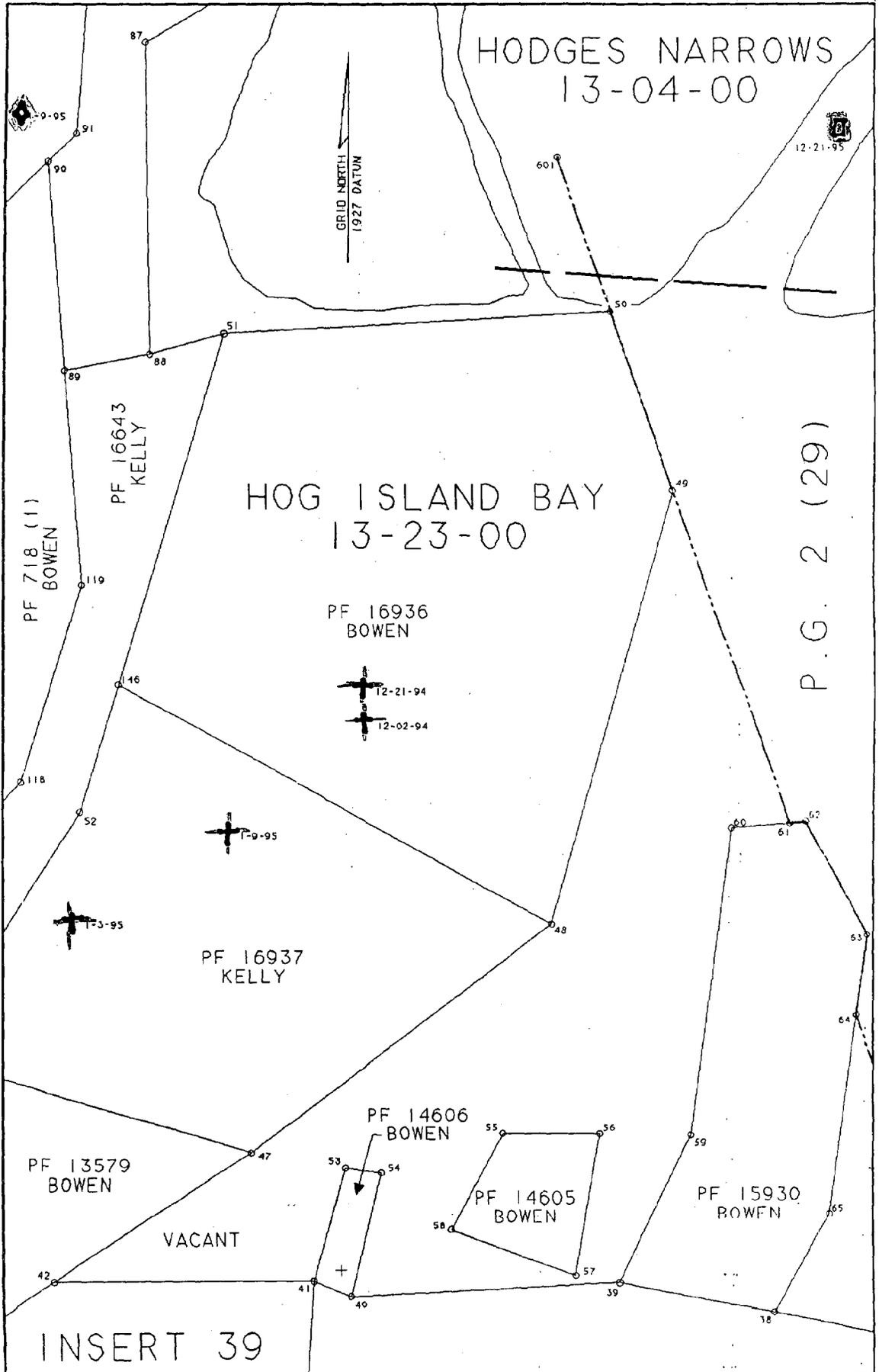
10-25-95

5-12-95

17

16





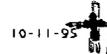
PF 12445  
BOWEN



GRID NORTH  
1927 DATUM



HOG ISLAND BAY  
13-23-00



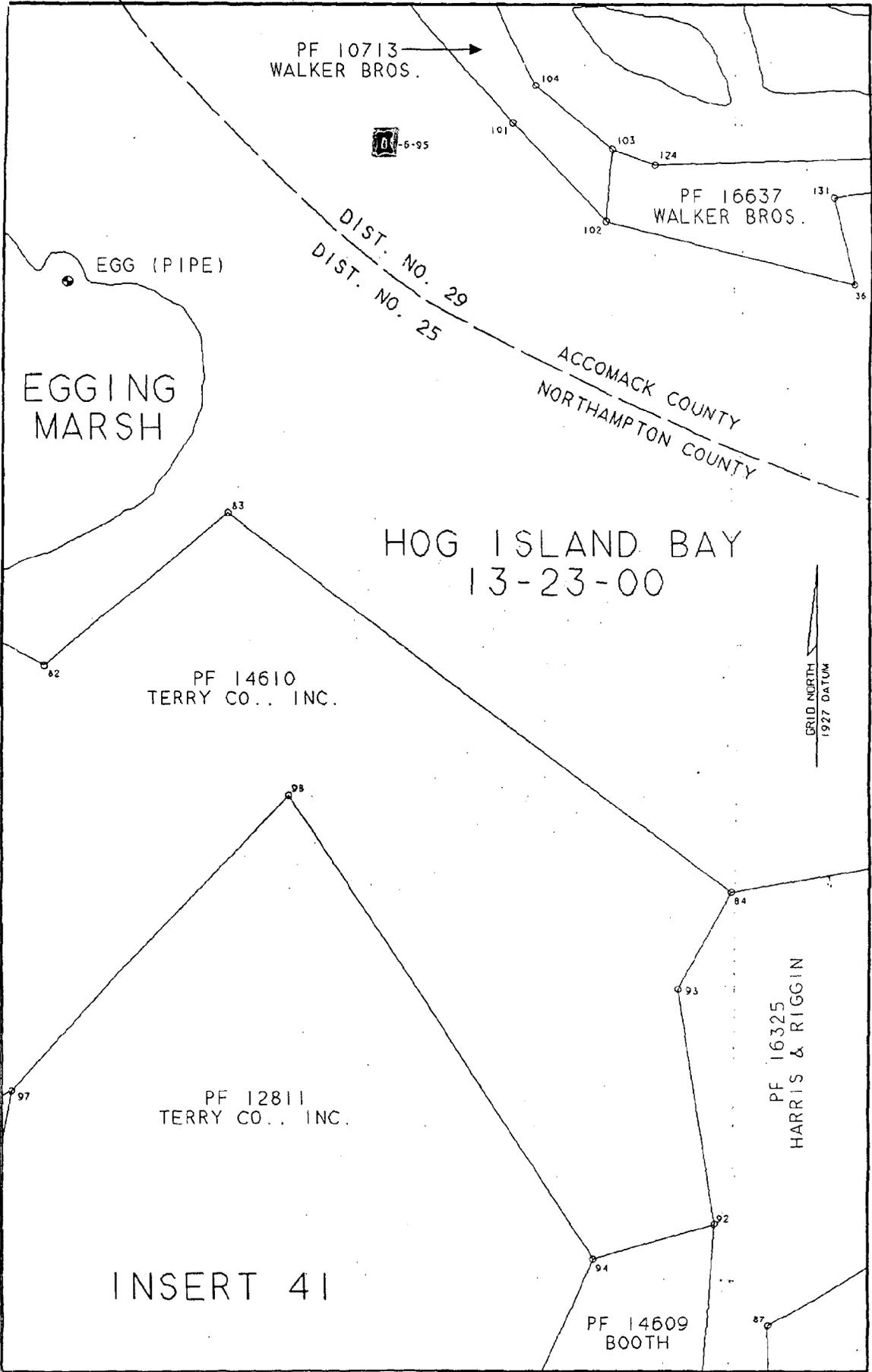
PF 12446  
BOWEN



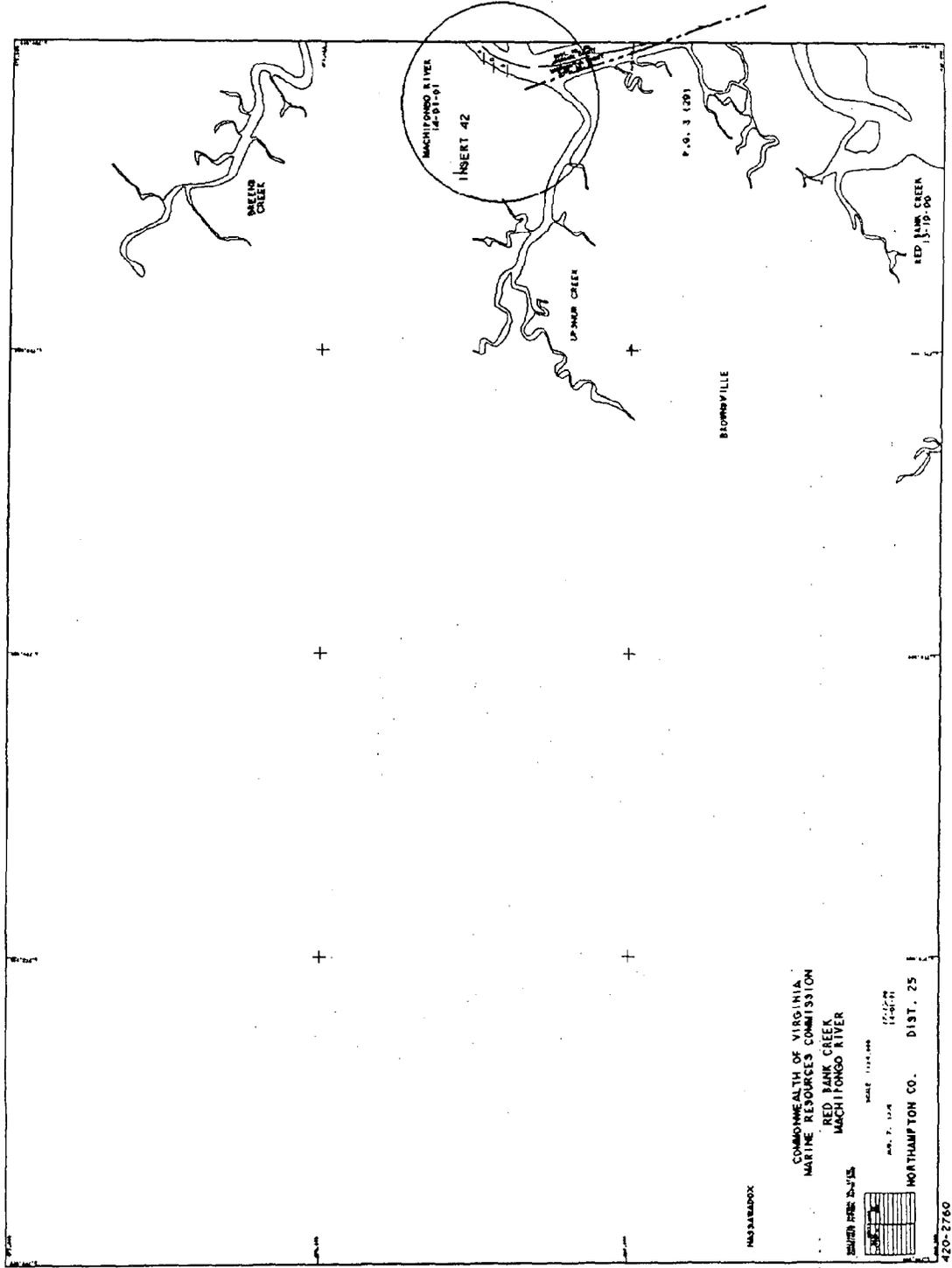
VACANT

INSERT 40

P.G. I (28-29)

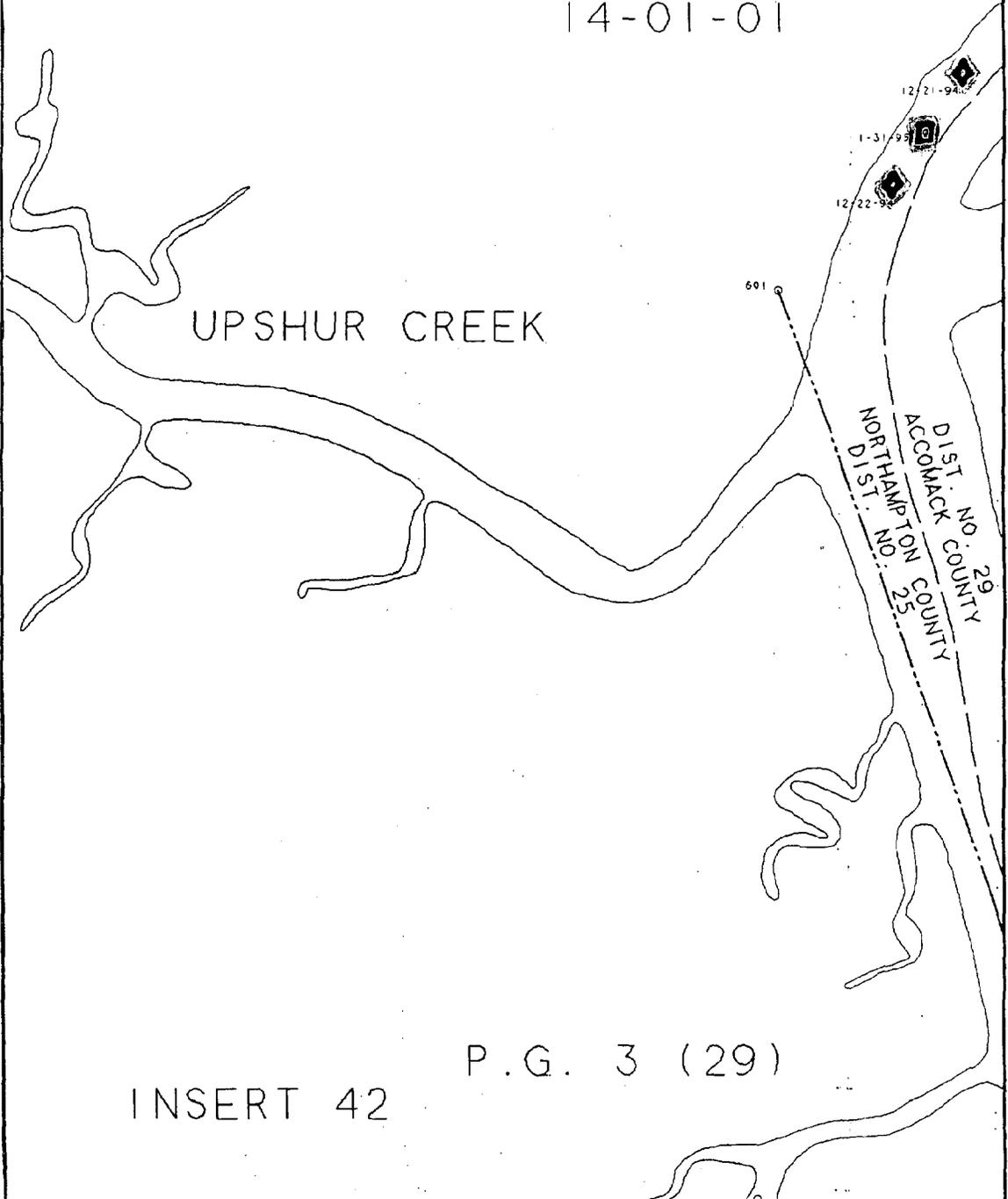


INSERT 41



GRID NORTH  
1927 DATUM

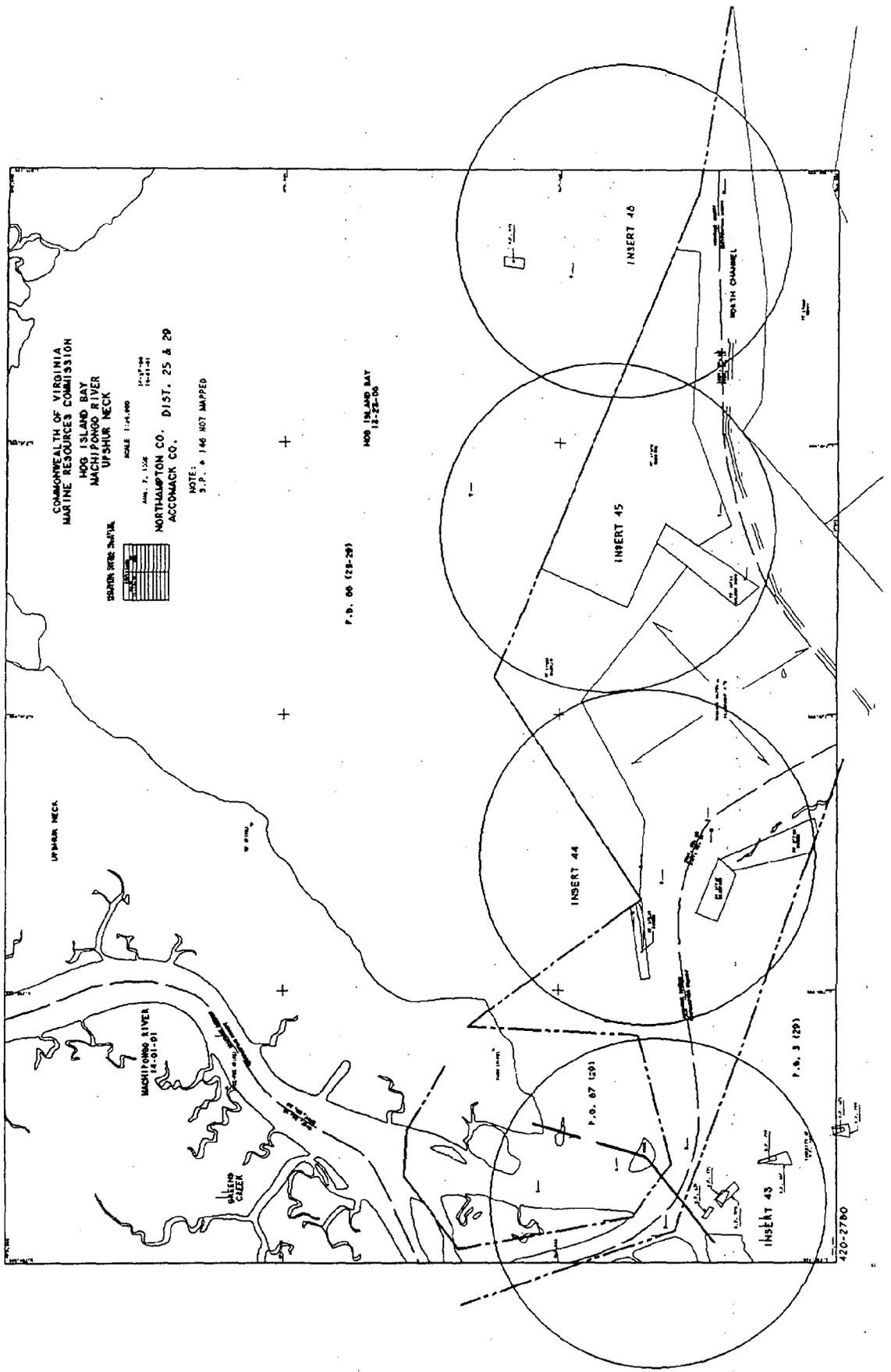
# MACHIPONGO RIVER 14-01-01

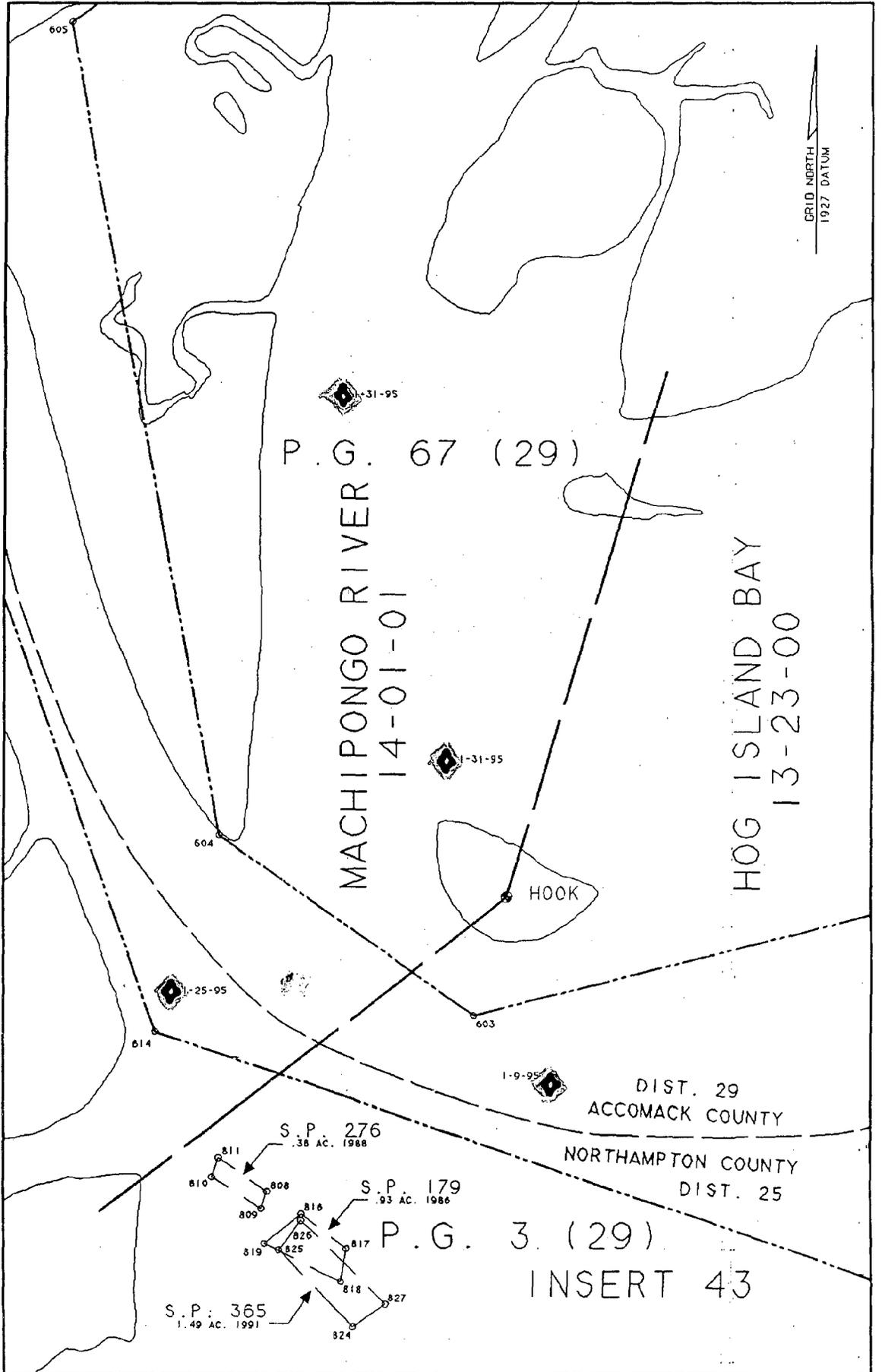


UPSHUR CREEK

DIST. NO. 29  
ACCOMACK COUNTY  
DIST. NO. 25  
NORTHAMPTON COUNTY

INSERT 42 P.G. 3 (29)





P.G. 66 (28 & 29)

HOG ISLAND BAY  
13-23-00

GRID NORTH  
1927 DATUM

PF 16841  
HAMBLIN

6-16-95

5-23-95

PF 13596  
BOWEN

4-27-95

ACCOMACK CO. DIST. NO. 29  
NORTHAMPTON CO. DIST. NO. 25

PF 16347  
BRADFORD

1-31-95

5-12-95

PF 16348  
BOWEN

P.G. 3 (29)

INSERT 44

INSERT 45



CEILD NORTH  
1927 DATUM

P.G. 66 (28-29)

PF 16841  
HAMBLIN

HOG ISLAND BAY  
13-23-00

PF 16838  
ROBBINS

PF 14601  
WALKER BROS



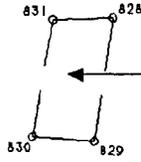
DIST. NO. 29

DIST. NO. 25

ACCOMACK

NORTHAMPTON

NORTH CHANNEL



S. P. 367  
1.47 AC. 1991

GRID NORTH  
1927 DATUM

P.G. 66 (28-29)



HOG ISLAND BAY  
13-23-00

PF 16838  
ROBBINS

36

37

610

DIST. NO. 29

ACCOMACK COUNTY

DIST. NO. 25

NORTHAMPTON COUNTY



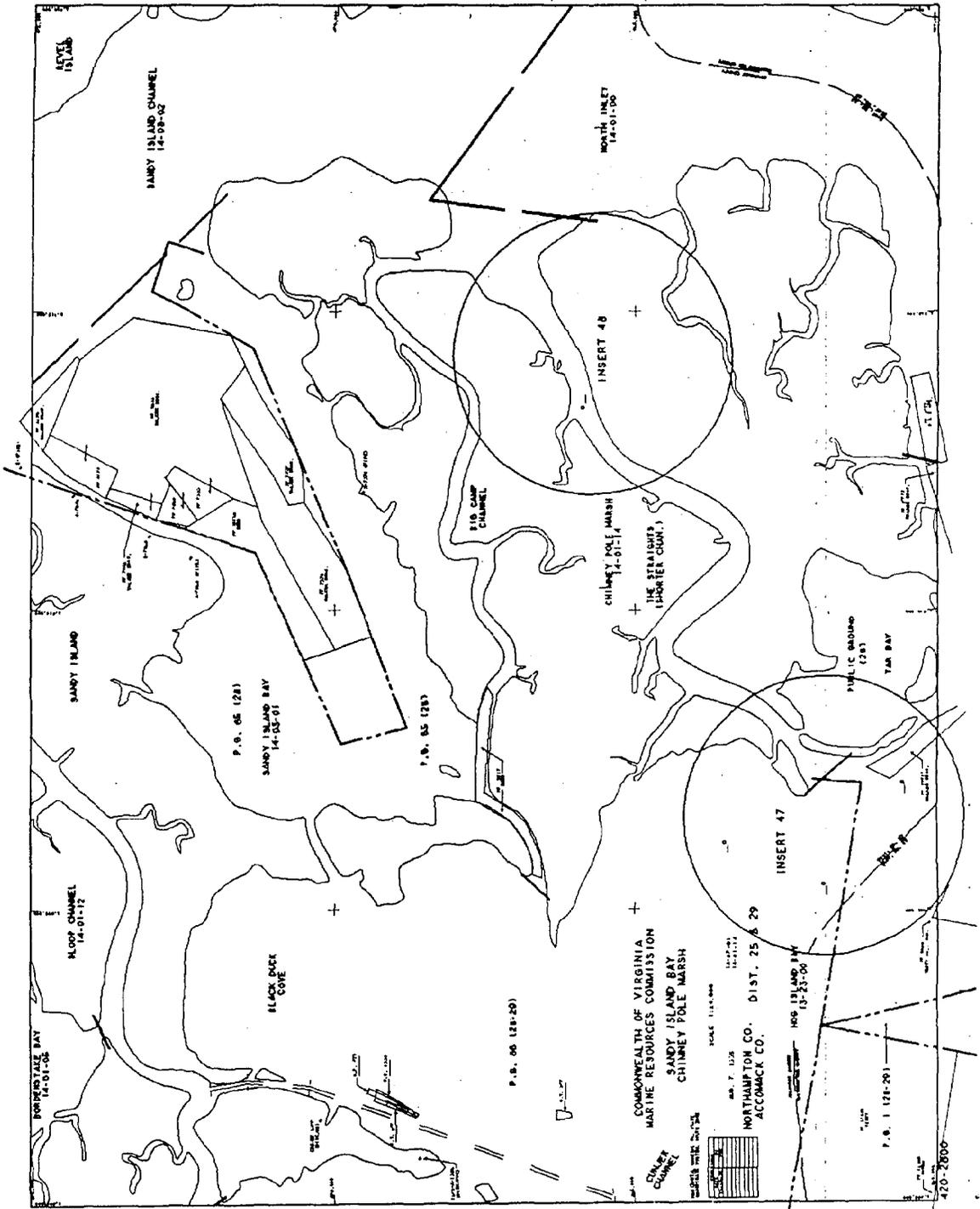
905  
900

NORTH CHANNEL

21

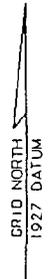
INSERT 46

PF 13440  
TERRY



HOG ISLAND BAY  
13-23-00

1-9-95



P. G. 66 (28-29)

THE STRAIGHTS

1-6-95

TAR BAY  
PUBLIC GROUND (28)

611

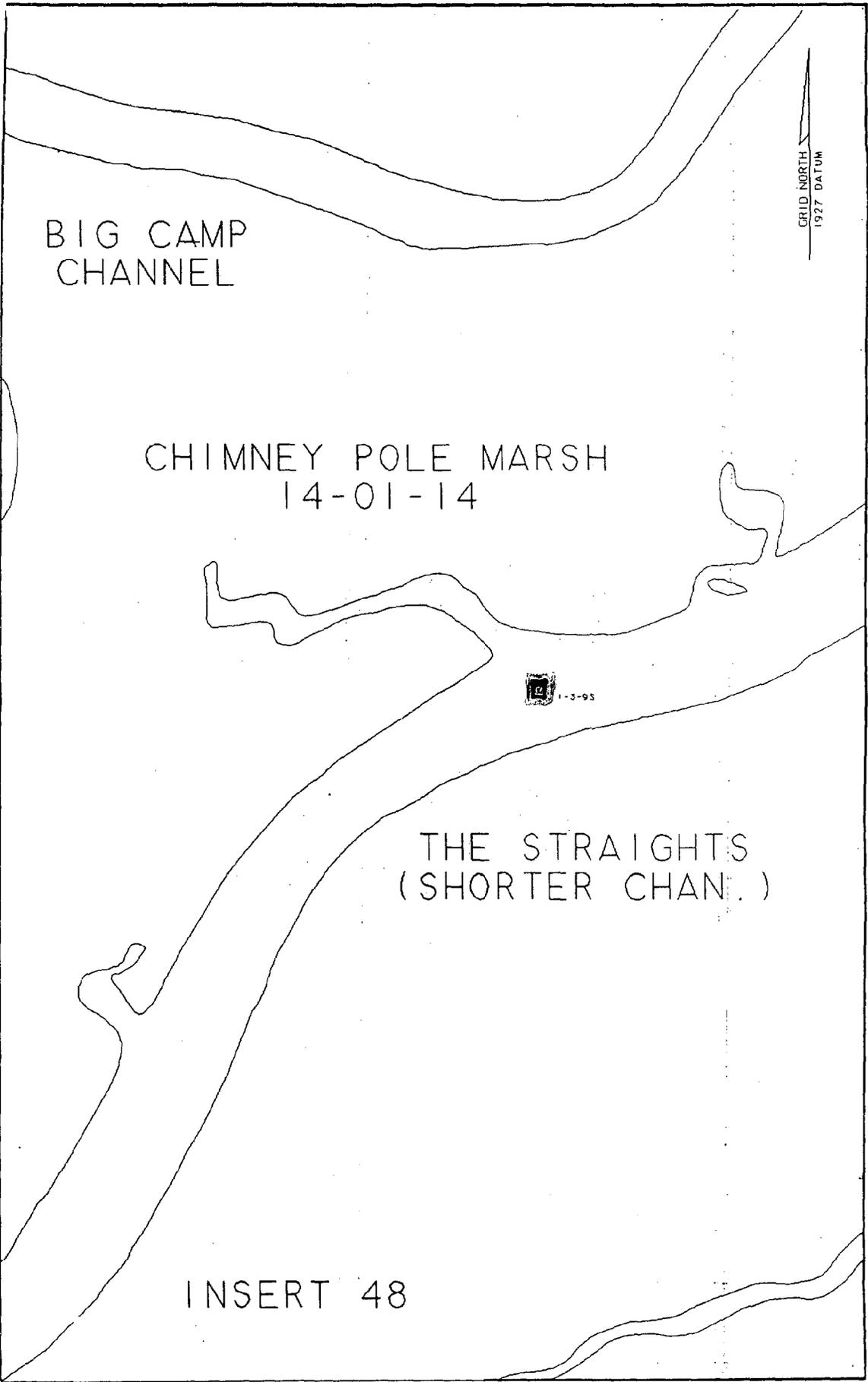
612

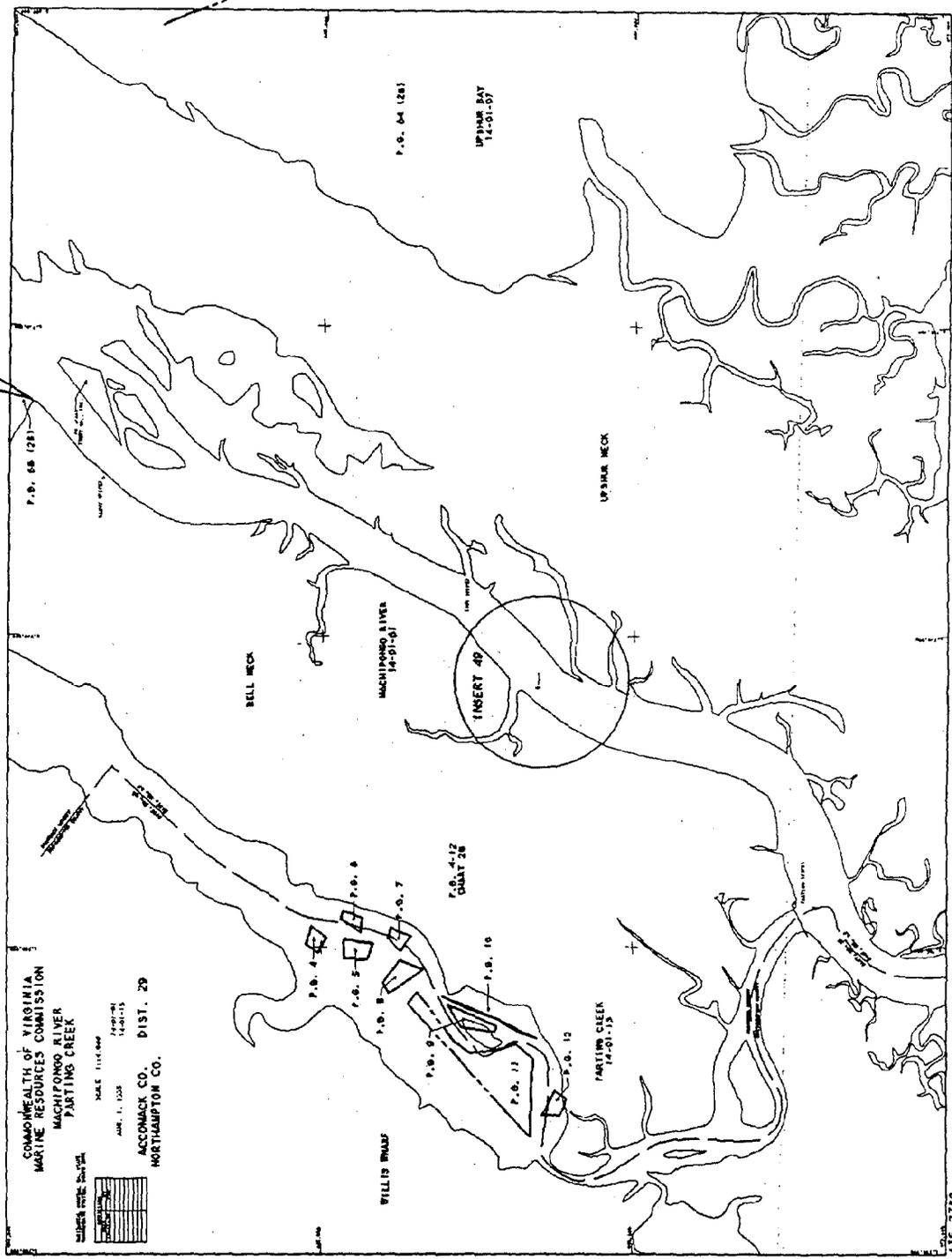
ACCOMACK  
DIST. NO. 29  
DIST. NO. 25  
NORTHAMPTON

1-6-95

INSERT 47

PF 10713  
WALKER BROS.





MACHIPONGO RIVER  
14-01-01

GRID NORTH  
1927 DATUM

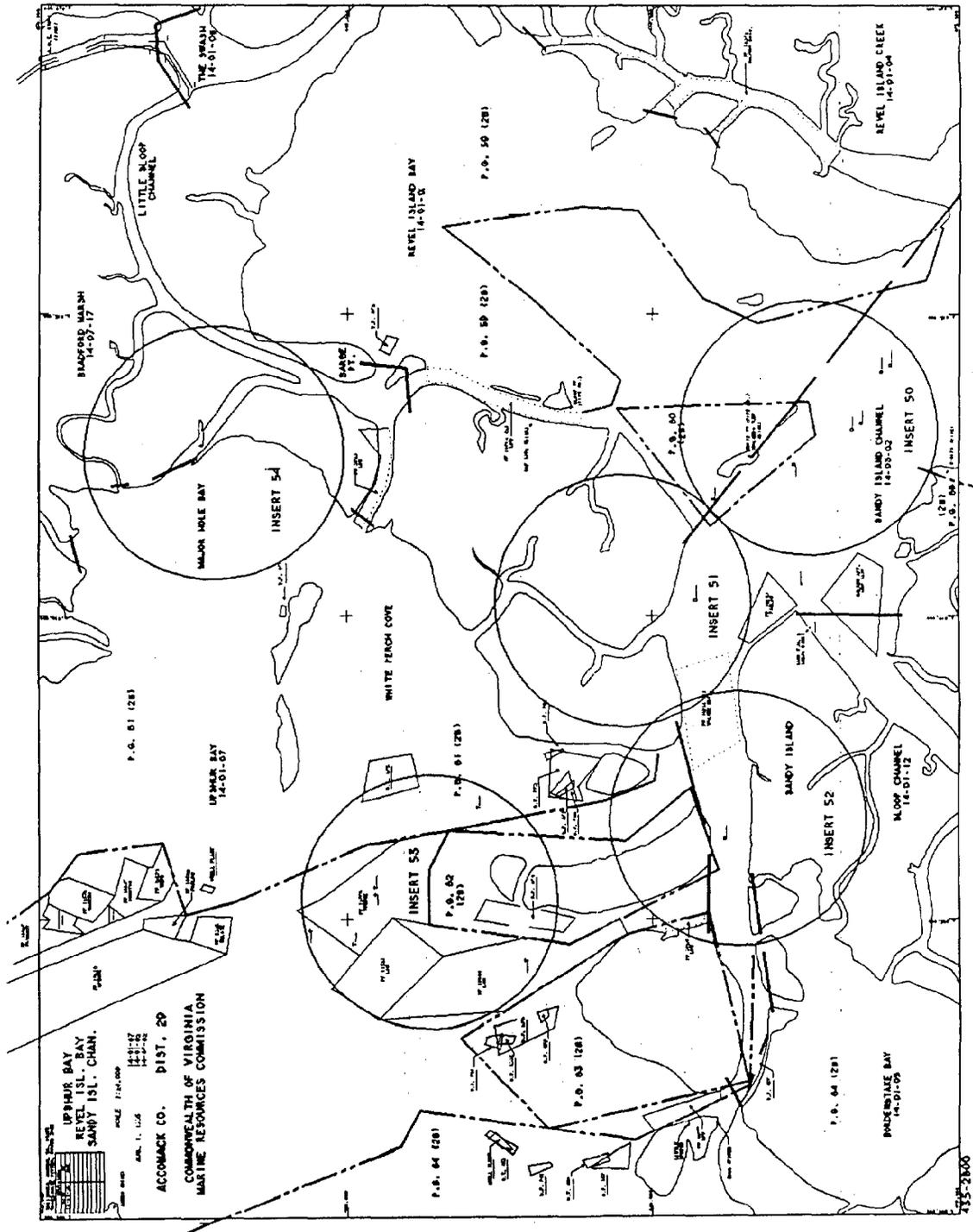
BELL NECK

KIWI (PIPE)

27-95

UPSHUR NECK

INSERT 49



GRID NORTH  
1927 DATUM

P.G. 60  
(28)

REVEL ISL. BAY  
14-03-02

3-95

(PIPE FD.)  
WHITE 33  
WALKERS TUMP  
(DISK)

1-27-95

602

603

2-22-94

2-22-94

SANDY ISLAND CHANNEL  
14-03-02

2-21-94

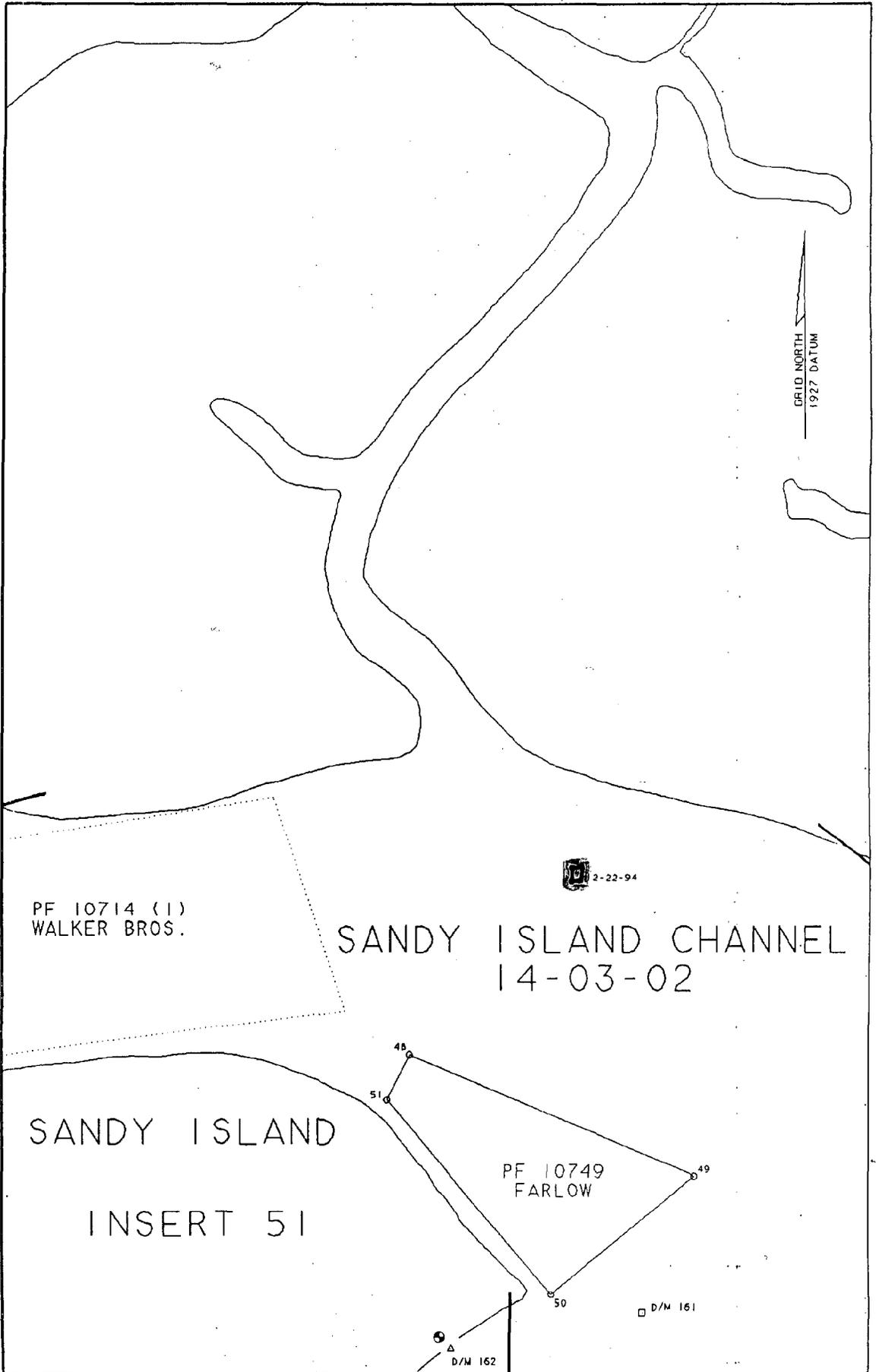
2-21-94

643

P.G. 65  
(28)

E-4170 (PIPE)

INSERT 50



PF 10714 (1)  
WALKER BROS.

2-22-94

SANDY ISLAND CHANNEL  
14-03-02

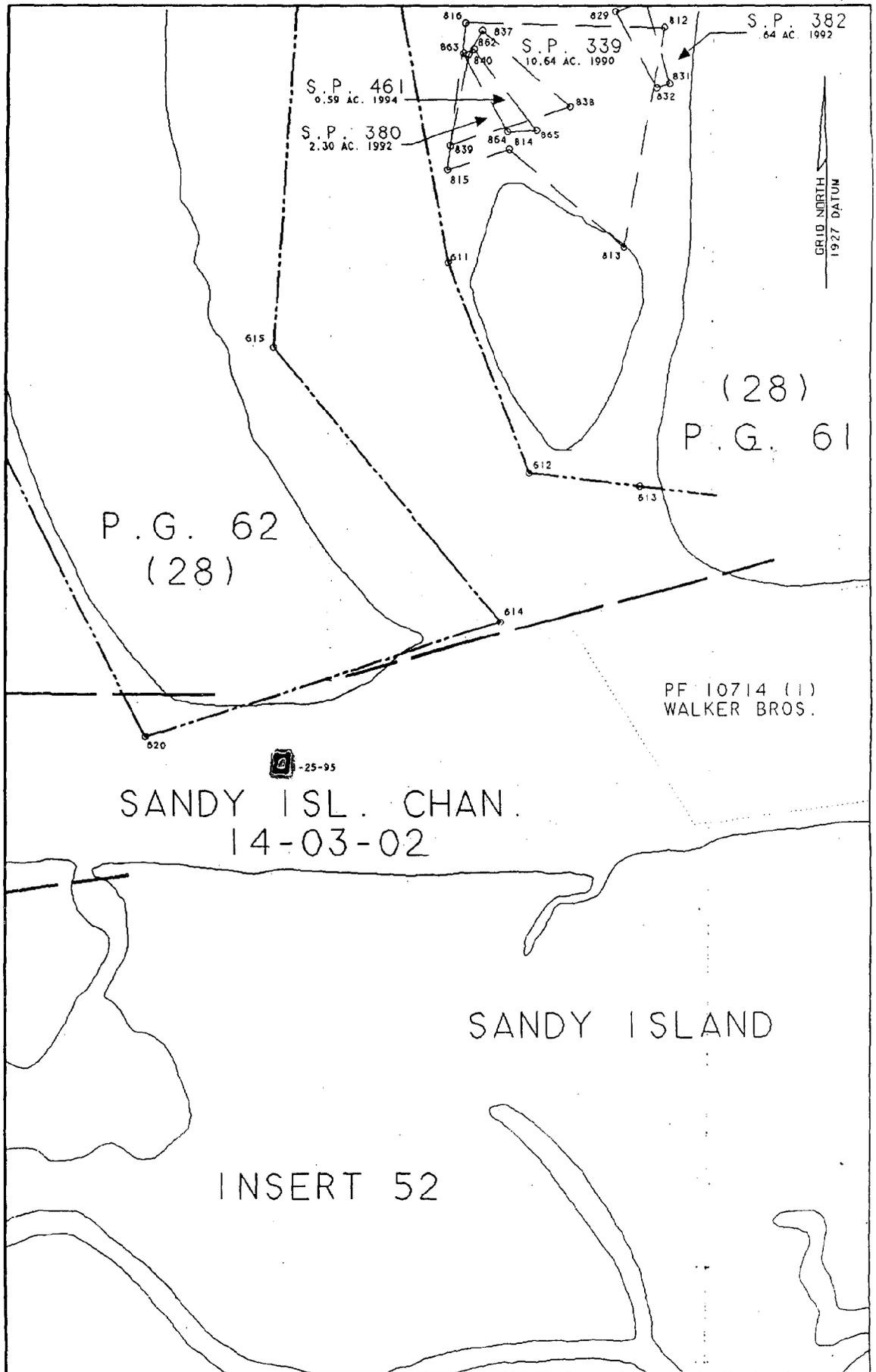
SANDY ISLAND

INSERT 51

PF 10749  
FARLOW

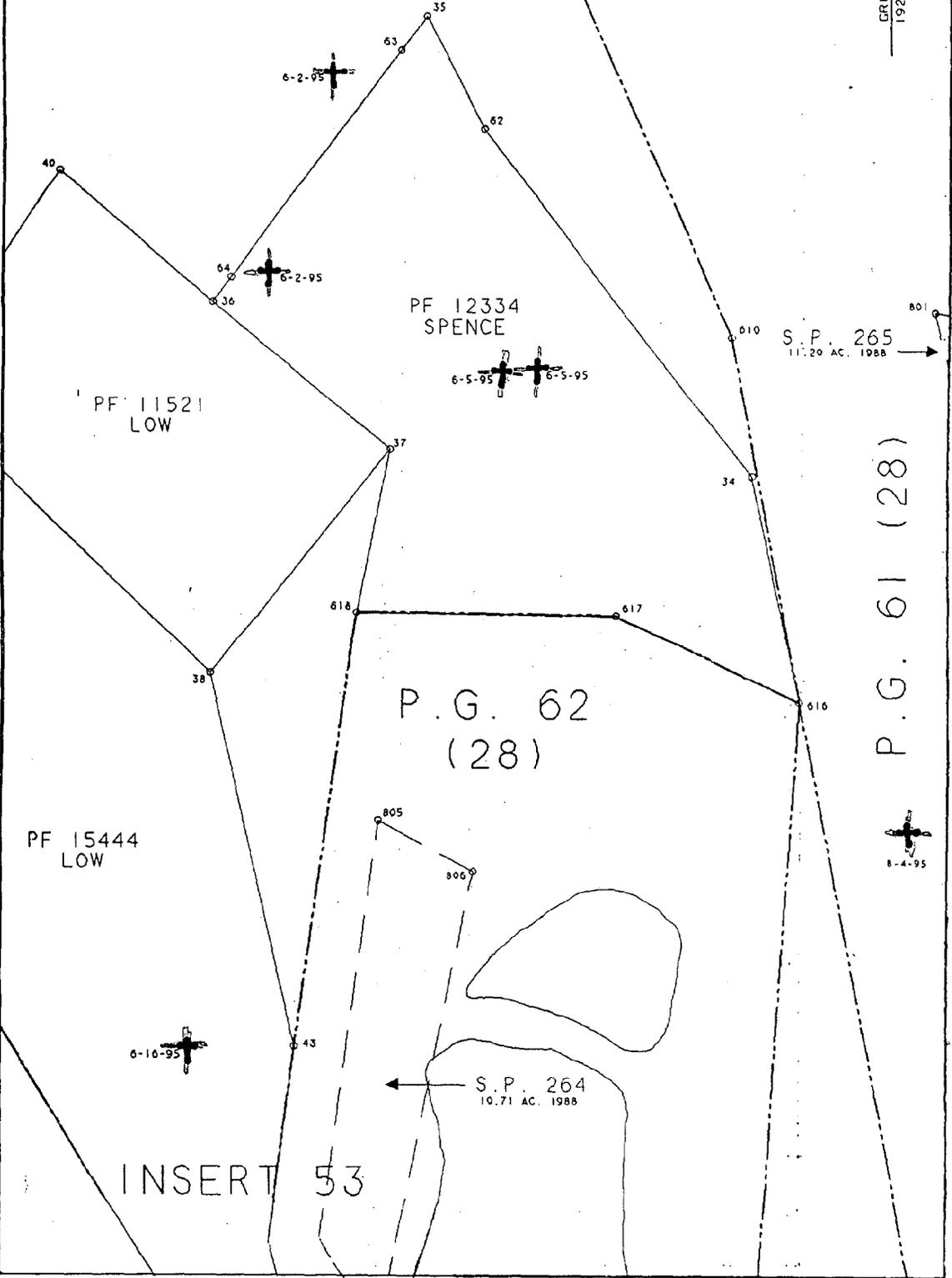
D/M 162

D/M 161



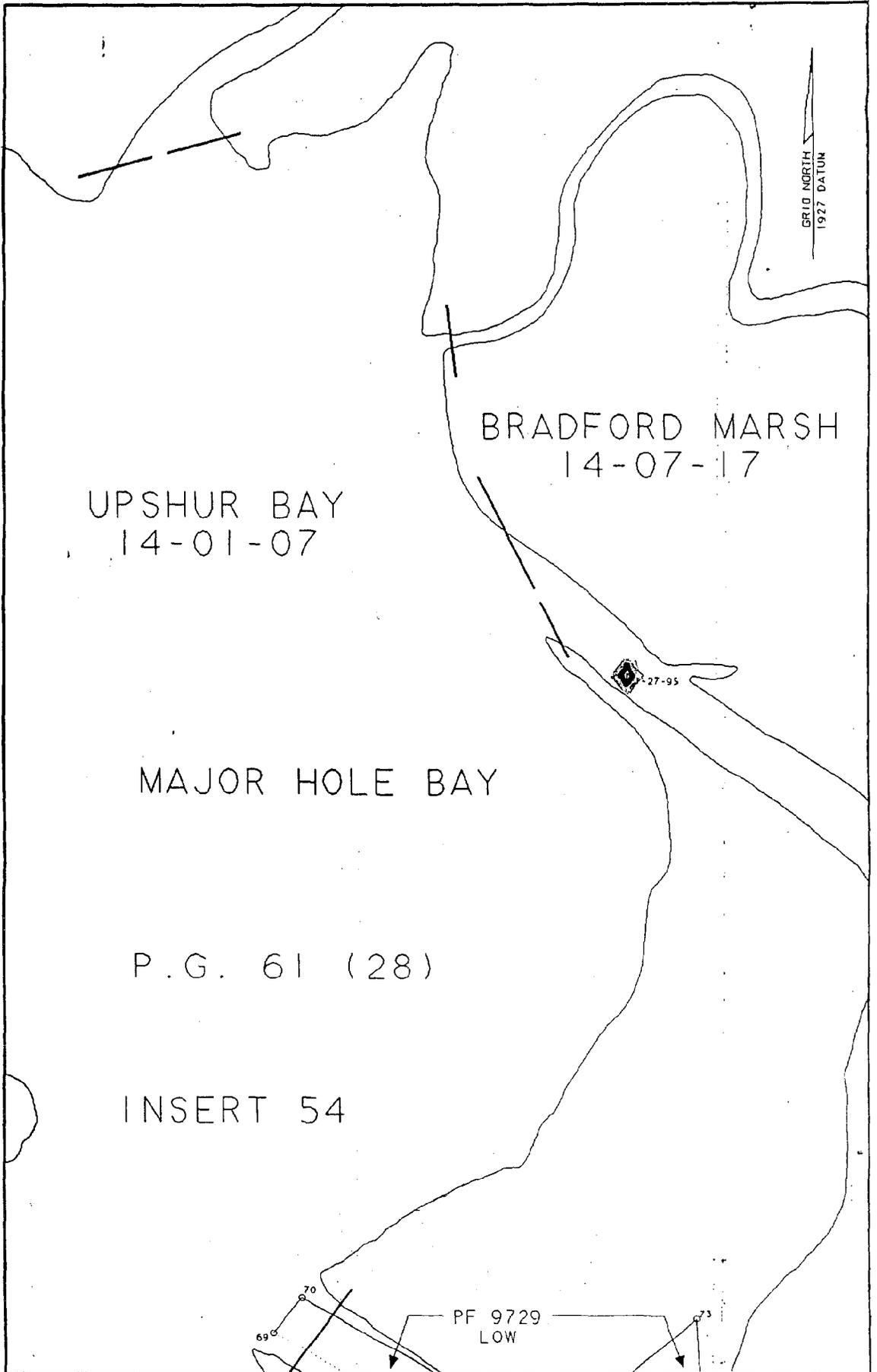
UPSHUR BAY  
14-01-07

GRID NORTH  
1927 DATUM



P.G. 61 (28)

INSERT 53



UPSHUR BAY  
14-01-07

BRADFORD MARSH  
14-07-17

MAJOR HOLE BAY

P.G. 61 (28)

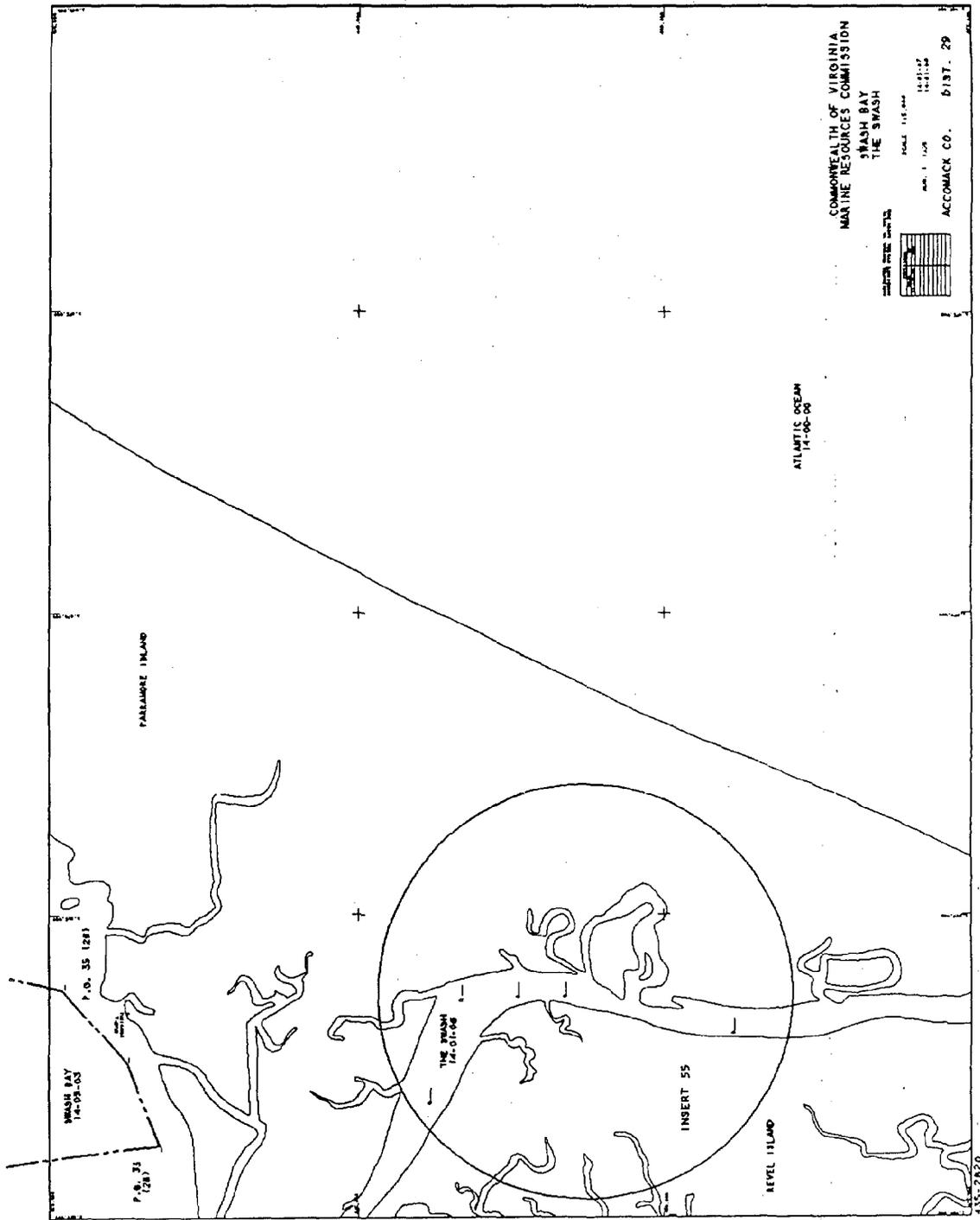
INSERT 54

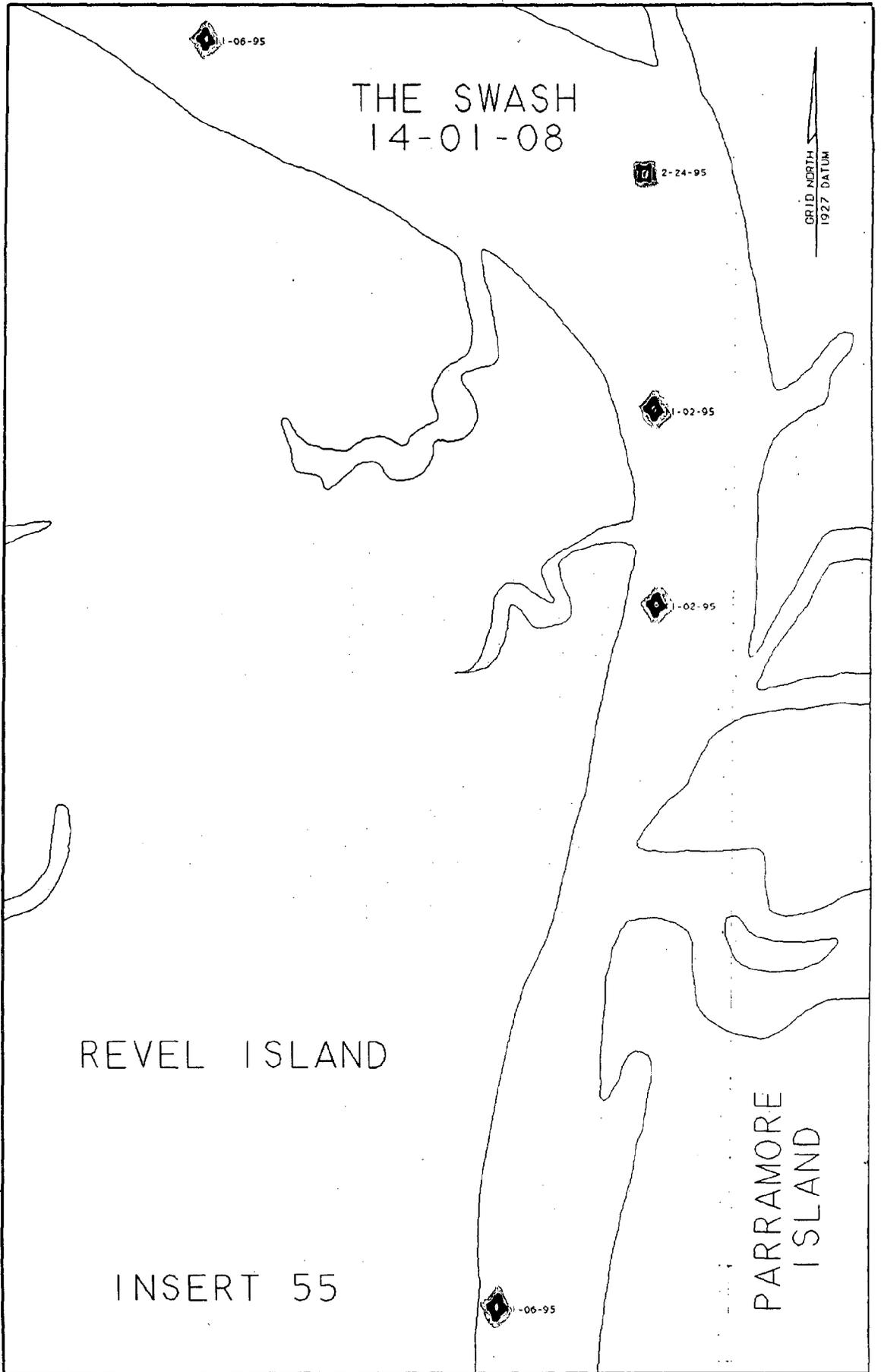
PF 9729  
LOW

69

70

73



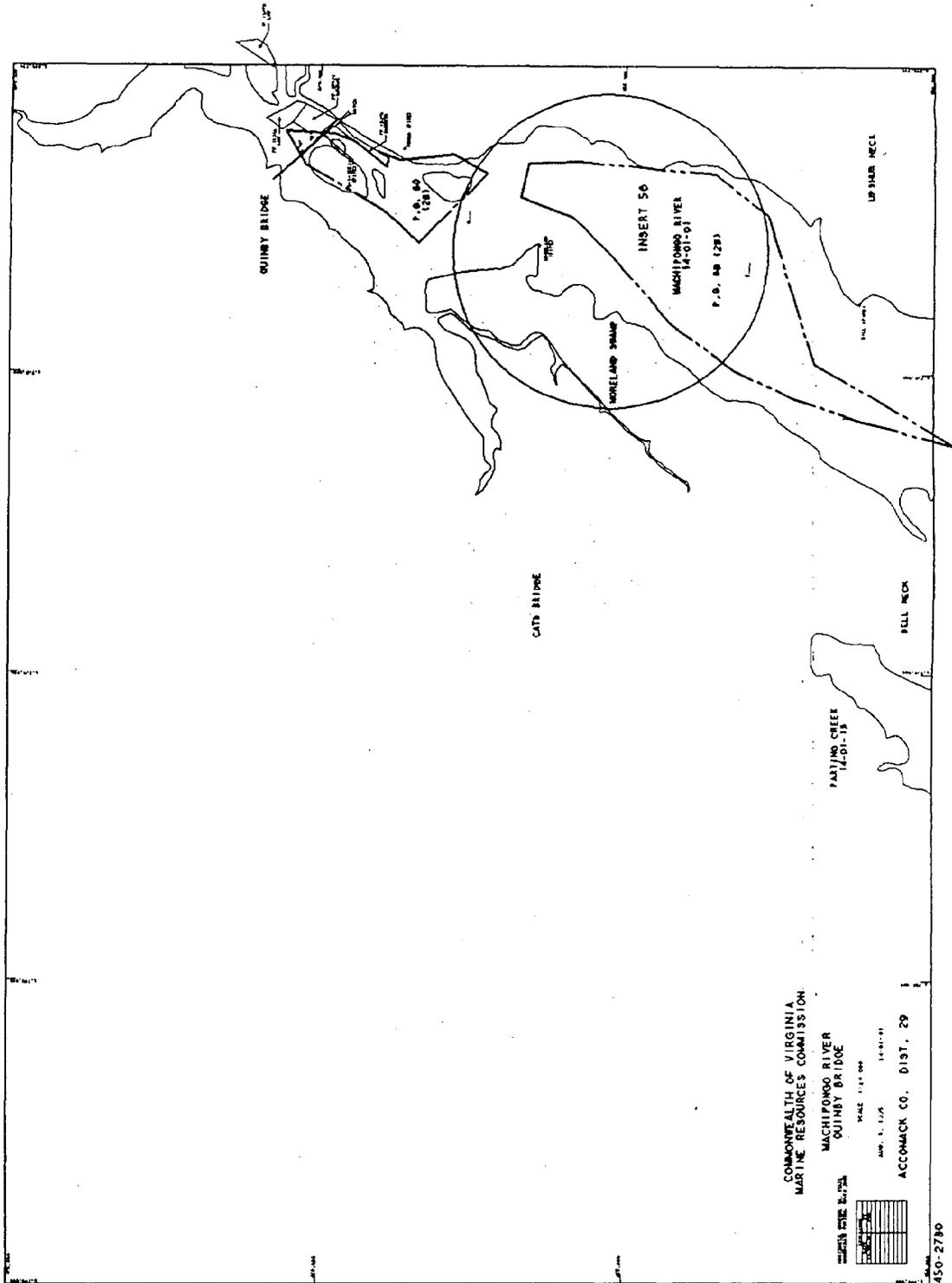


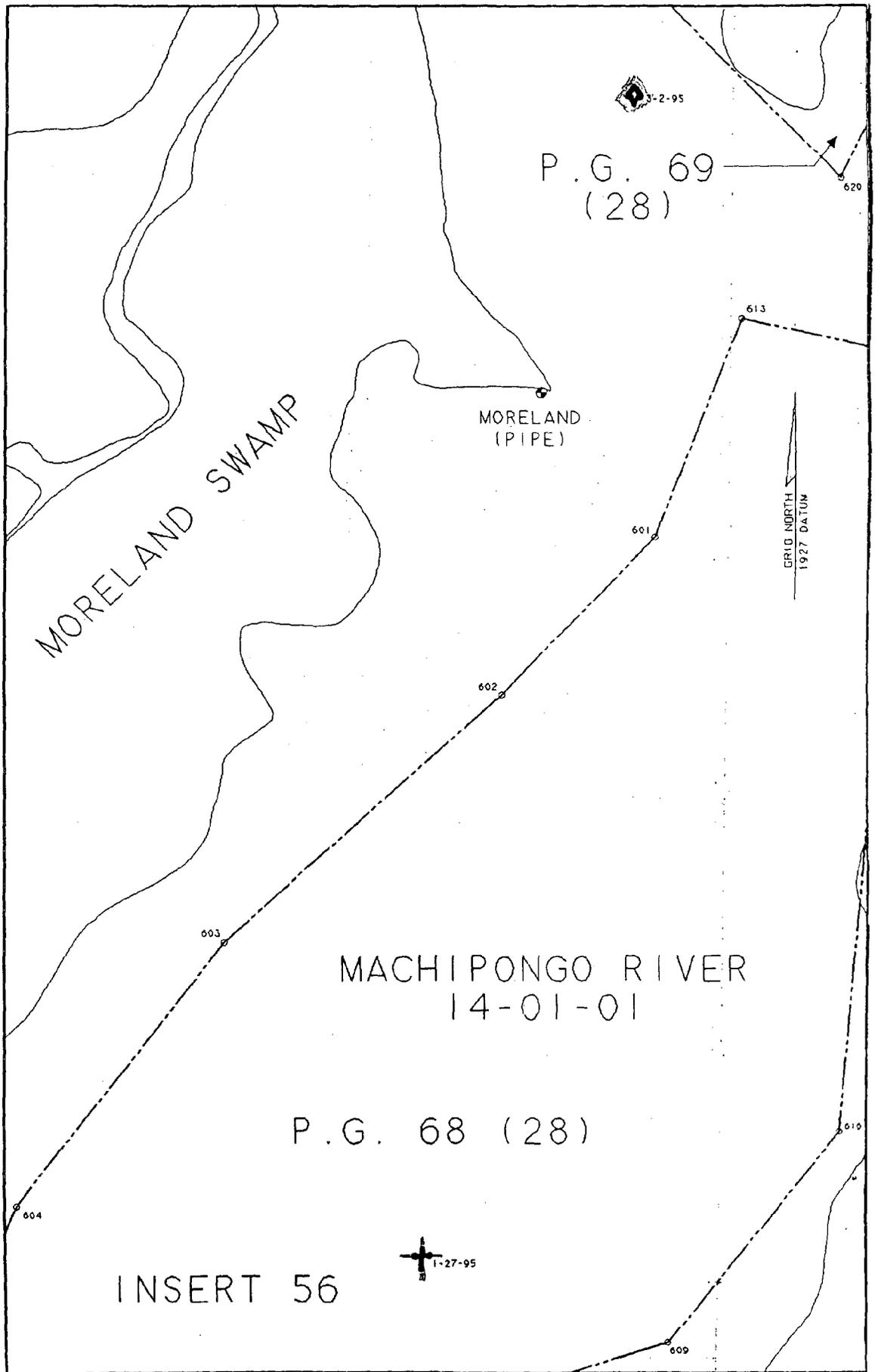
REVEL ISLAND

INSERT 55

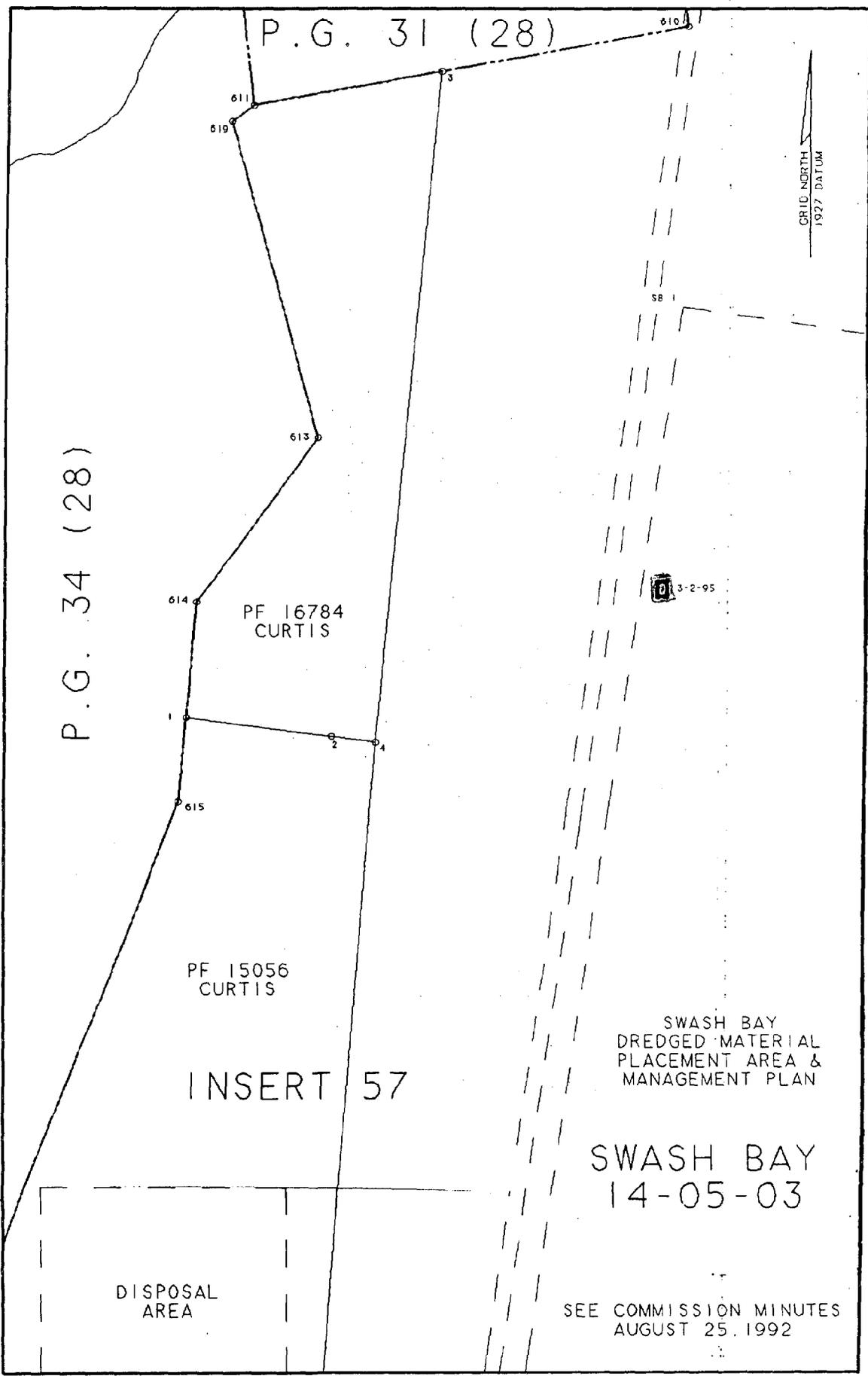
PARRAMORE  
ISLAND

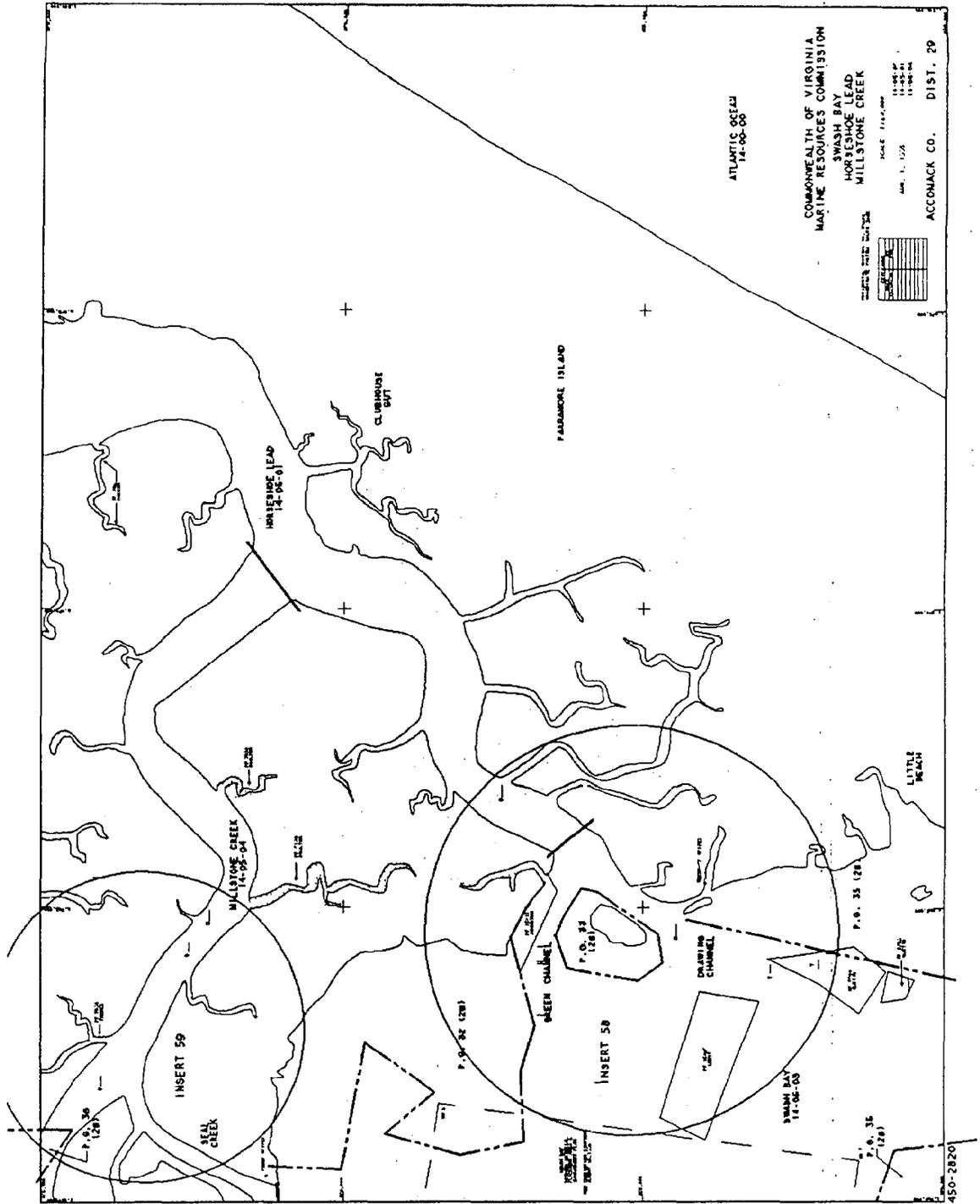
GRID NORTH  
1927 DATUM

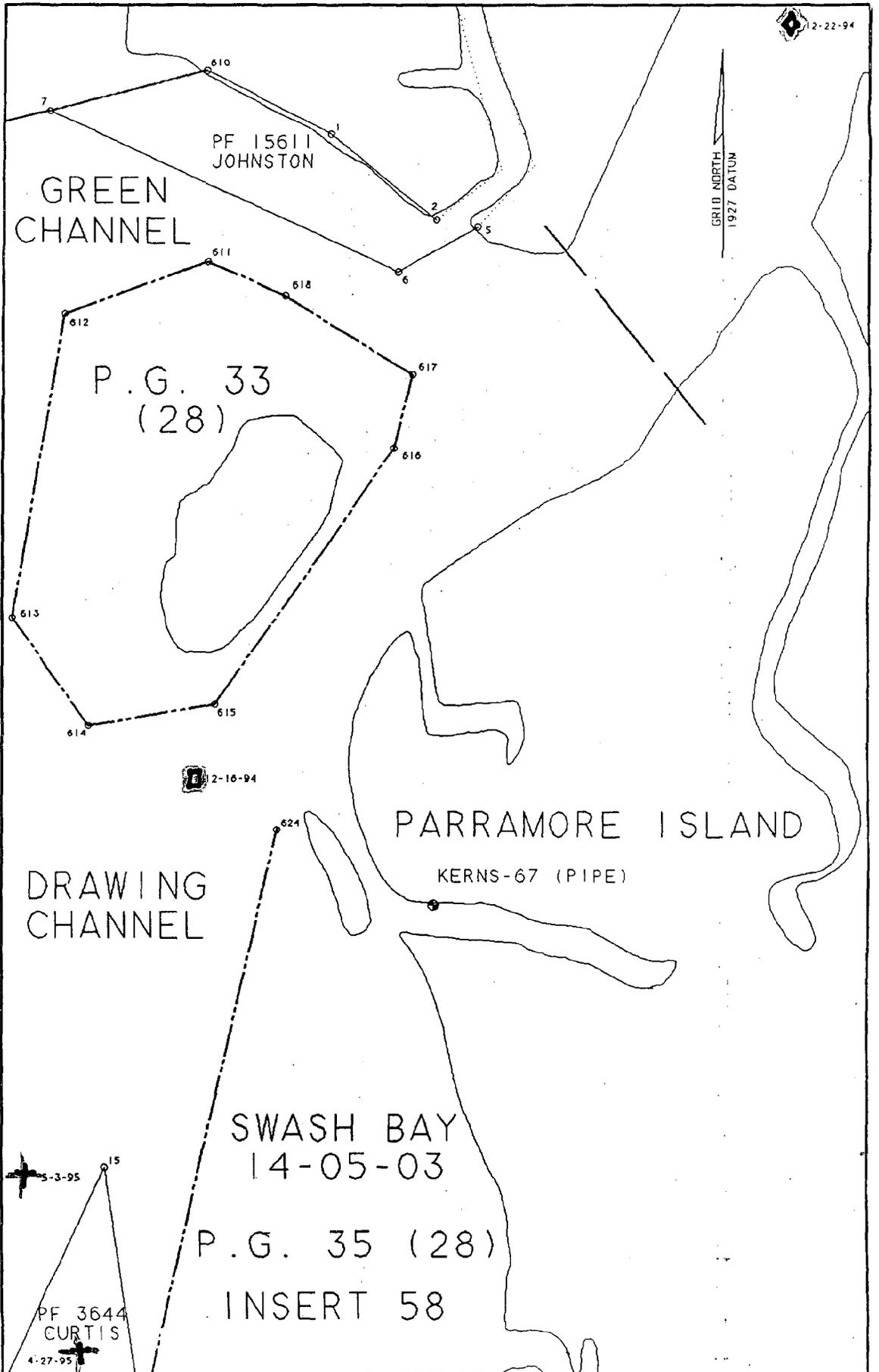


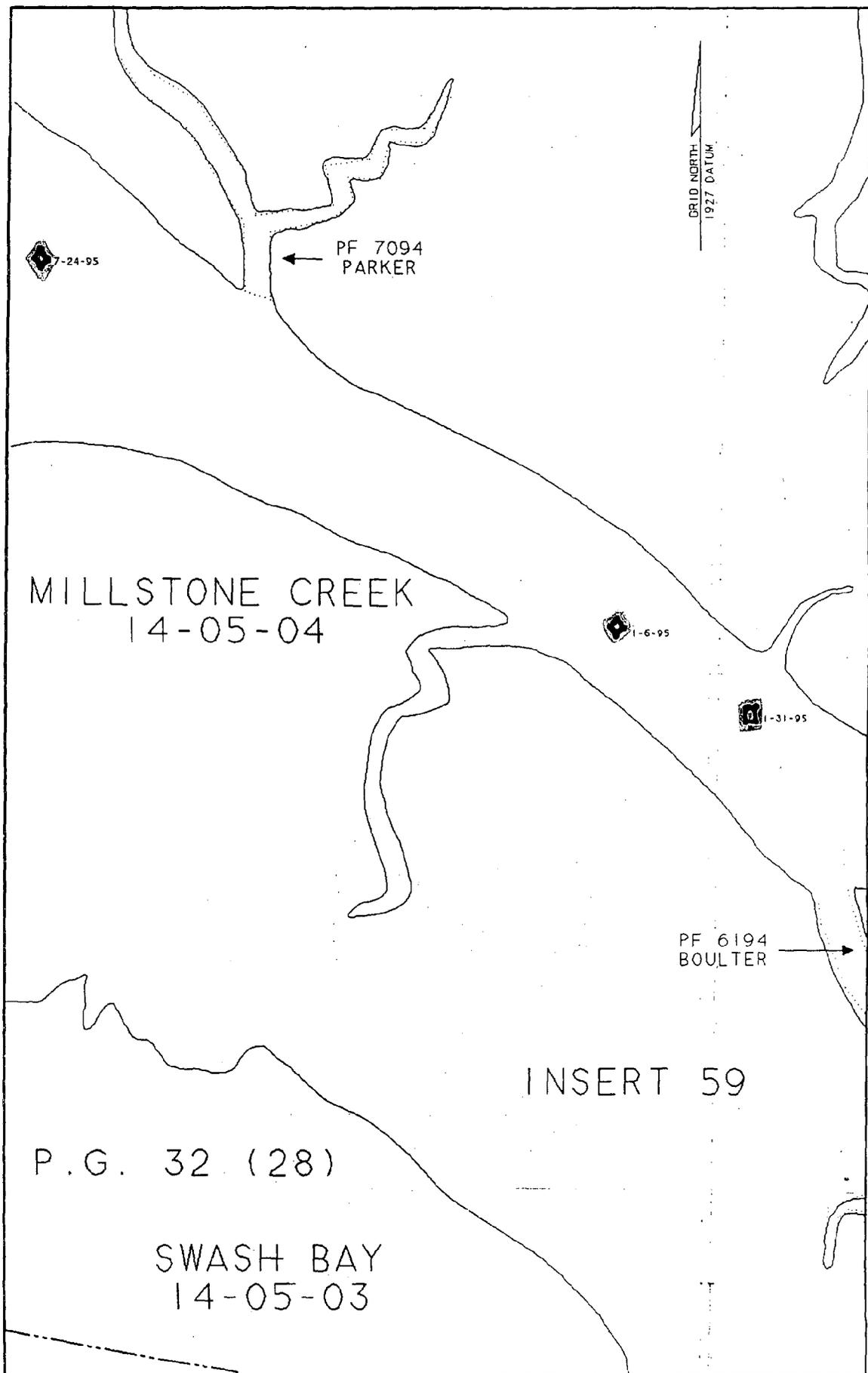












7-24-95

PF 7094  
PARKER

GRID NORTH  
1927 DATUM

MILLSTONE CREEK  
14-05-04

1-6-95

1-31-95

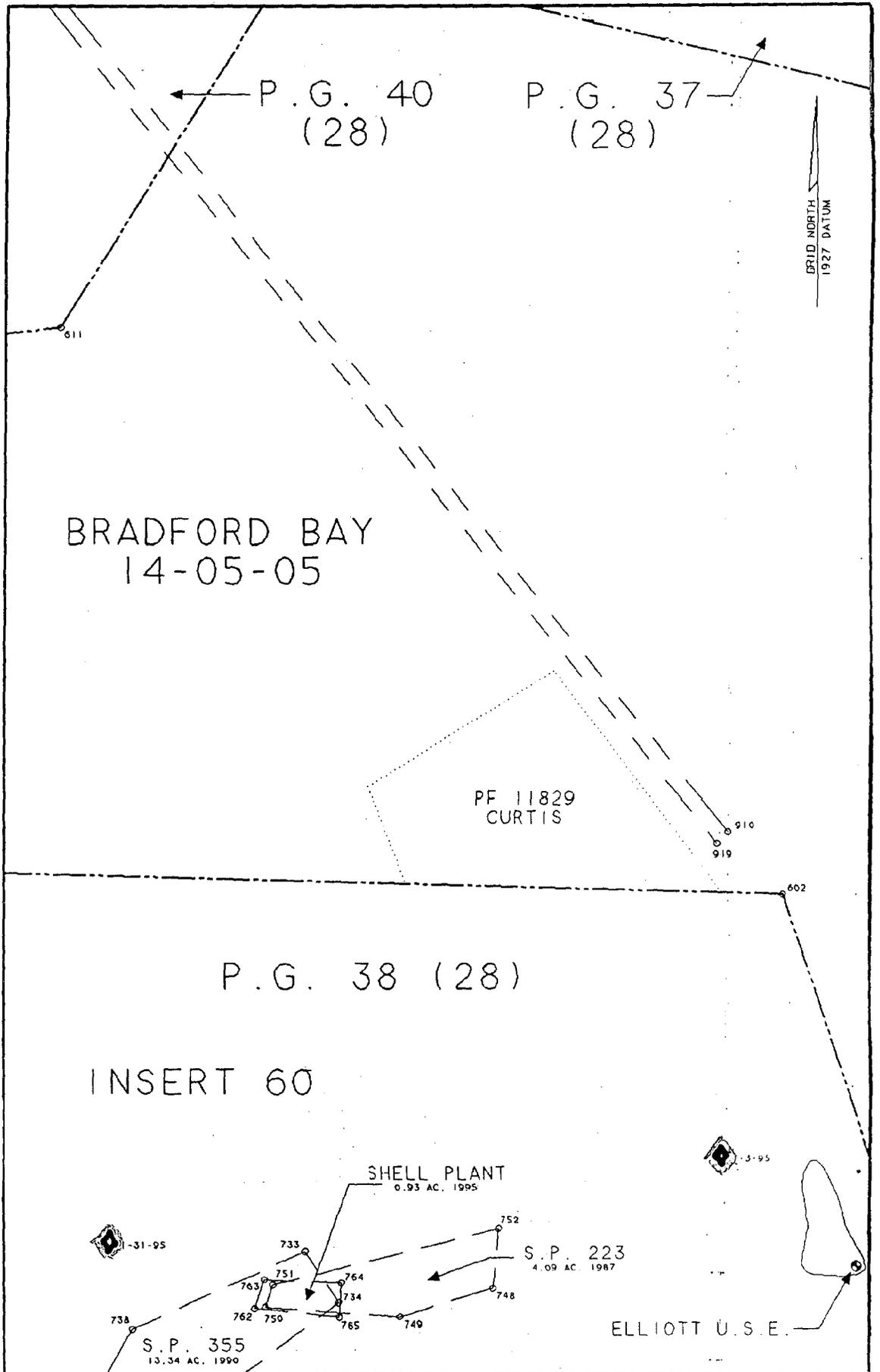
PF 6194  
BOULTER

INSERT 59

P.G. 32 (28)

SWASH BAY  
14-05-03





BRADFORD BAY  
14-05-05

P.G. 40  
(28)

P.G. 37  
(28)

BRID NORTH  
1927 DATUM

PF 11829  
CURTIS

P.G. 38 (28)

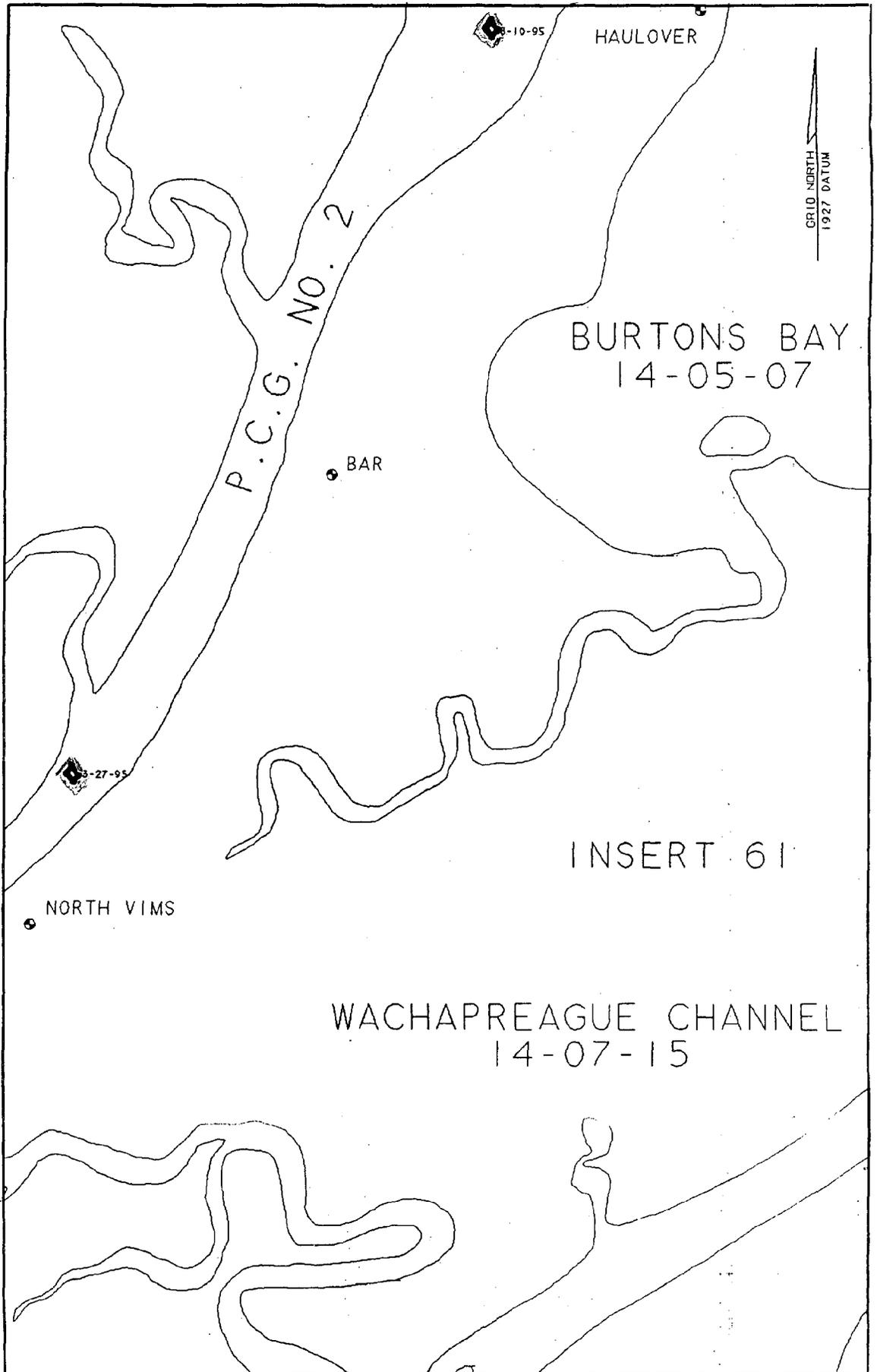
INSERT 60

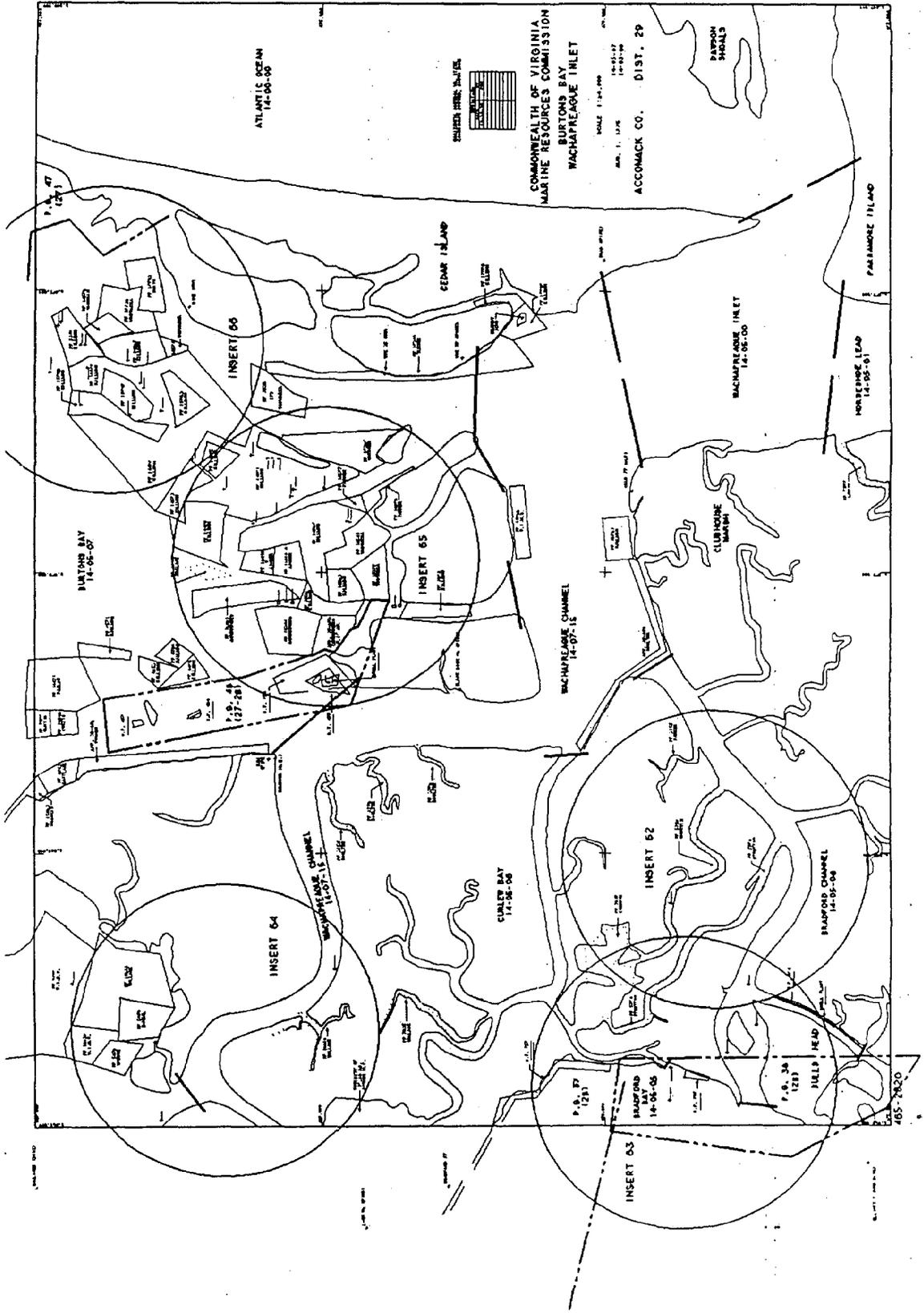
SHELL PLANT  
0.93 AC. 1995

S.P. 223  
4.09 AC. 1987

S.P. 355  
13.34 AC. 1990

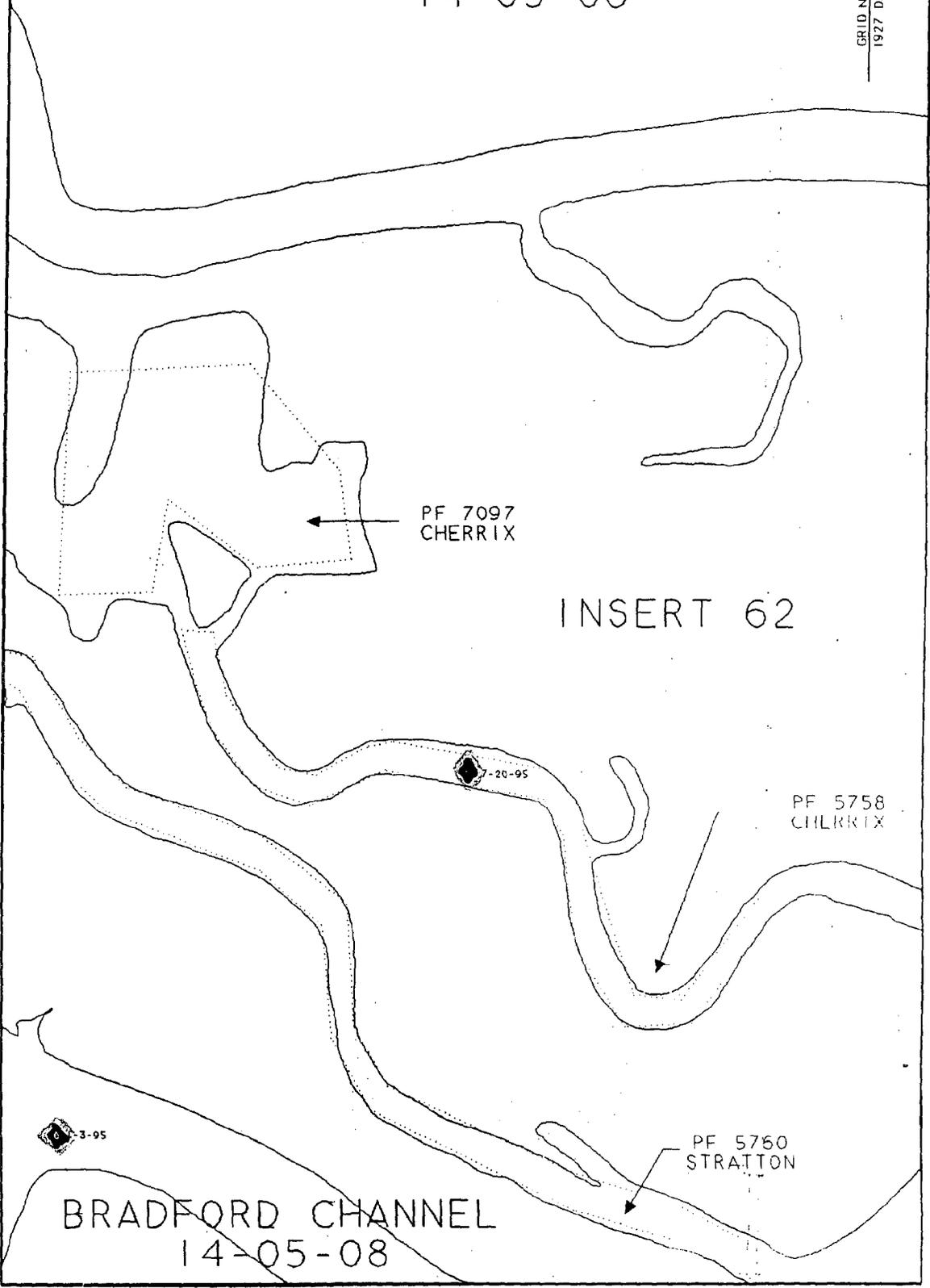
ELLIOTT U.S.E.



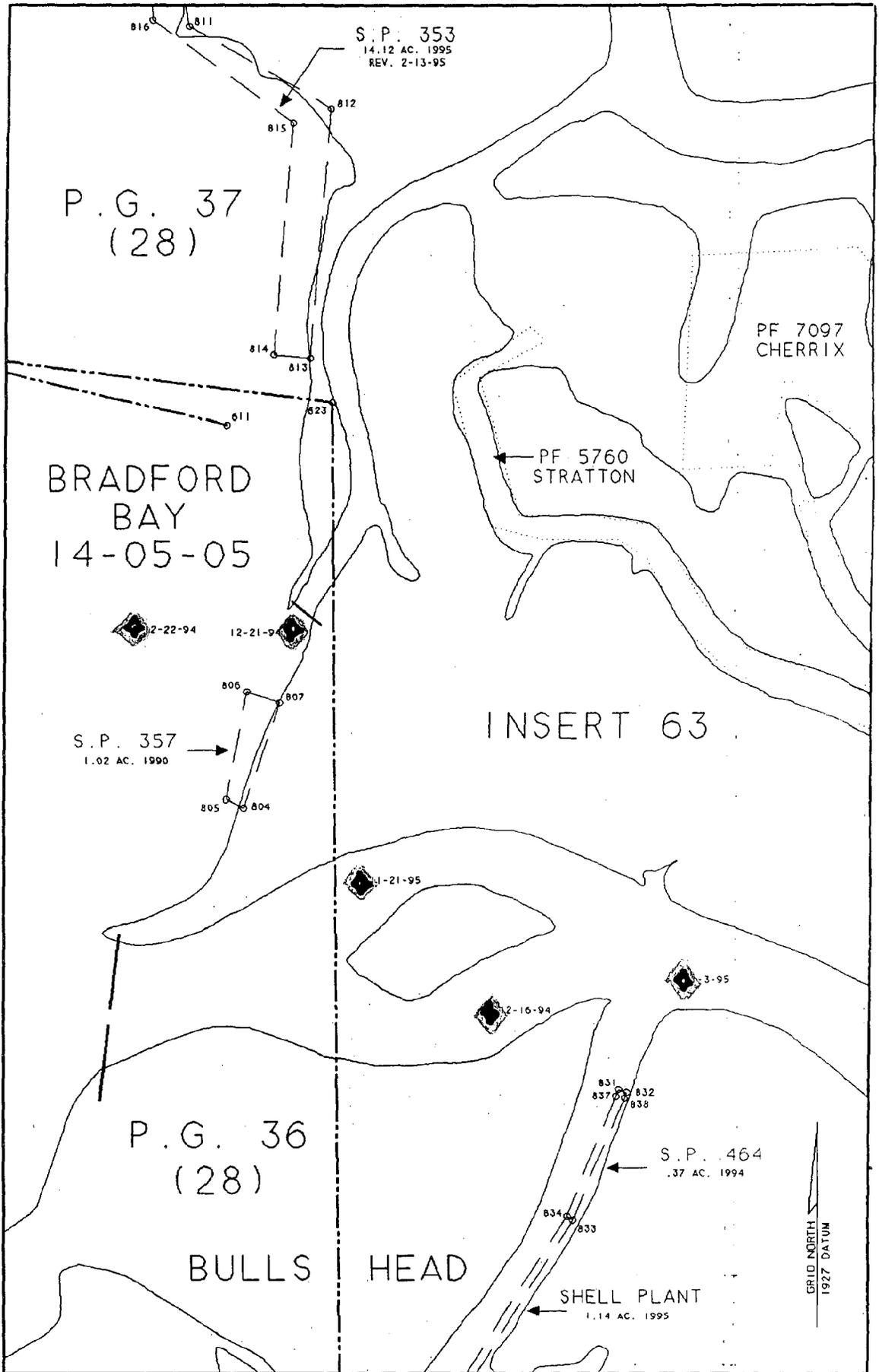


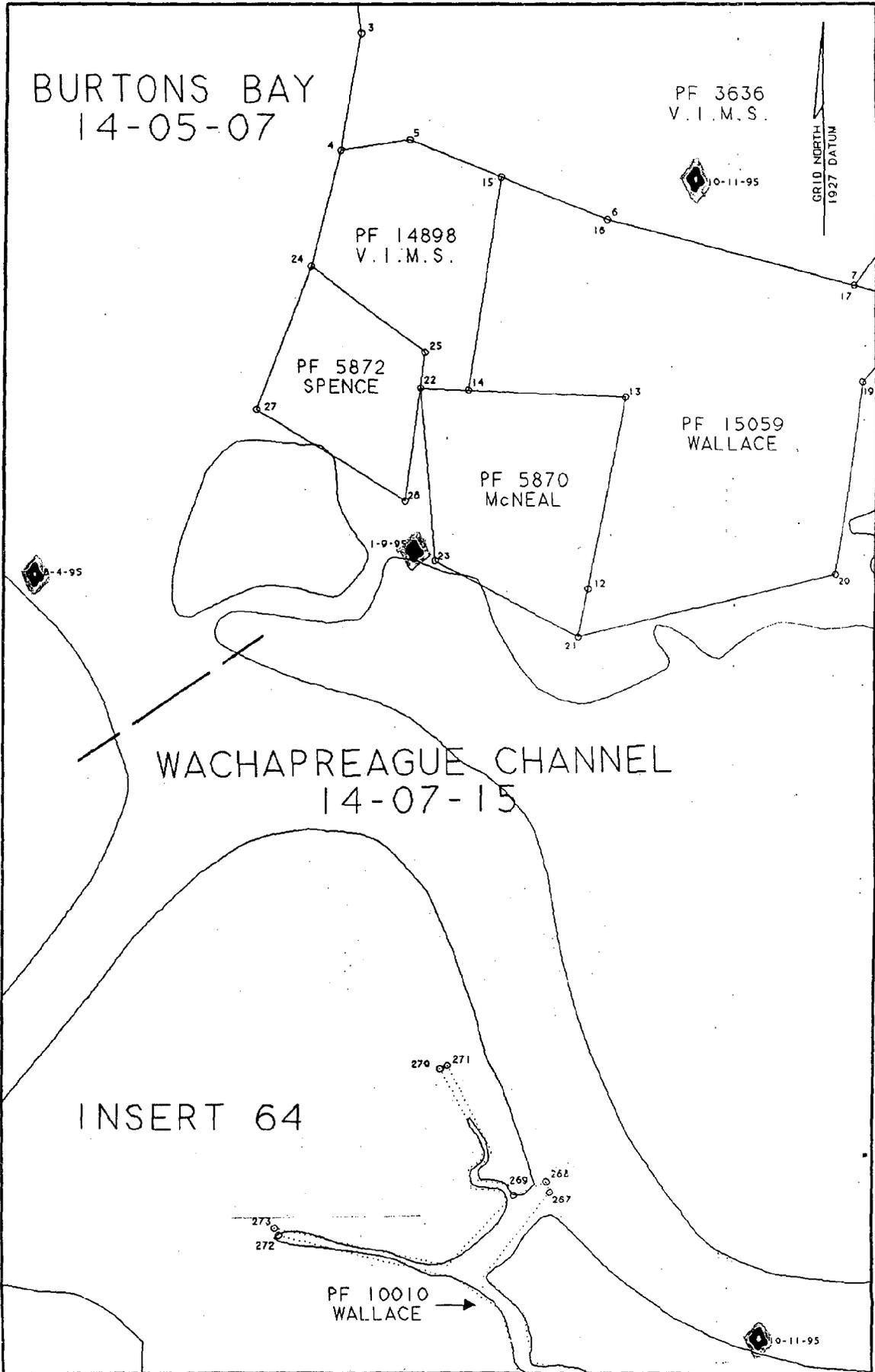
CURLEW BAY  
14-05-06

GRID NORTH  
1927 DATUM



BRADFORD CHANNEL  
14-05-08





BURTONS BAY  
14-05-07

PF 3636  
V.I.M.S.

PF 14898  
V.I.M.S.

PF 5872  
SPENCE

PF 5870  
McNEAL

PF 15059  
WALLACE

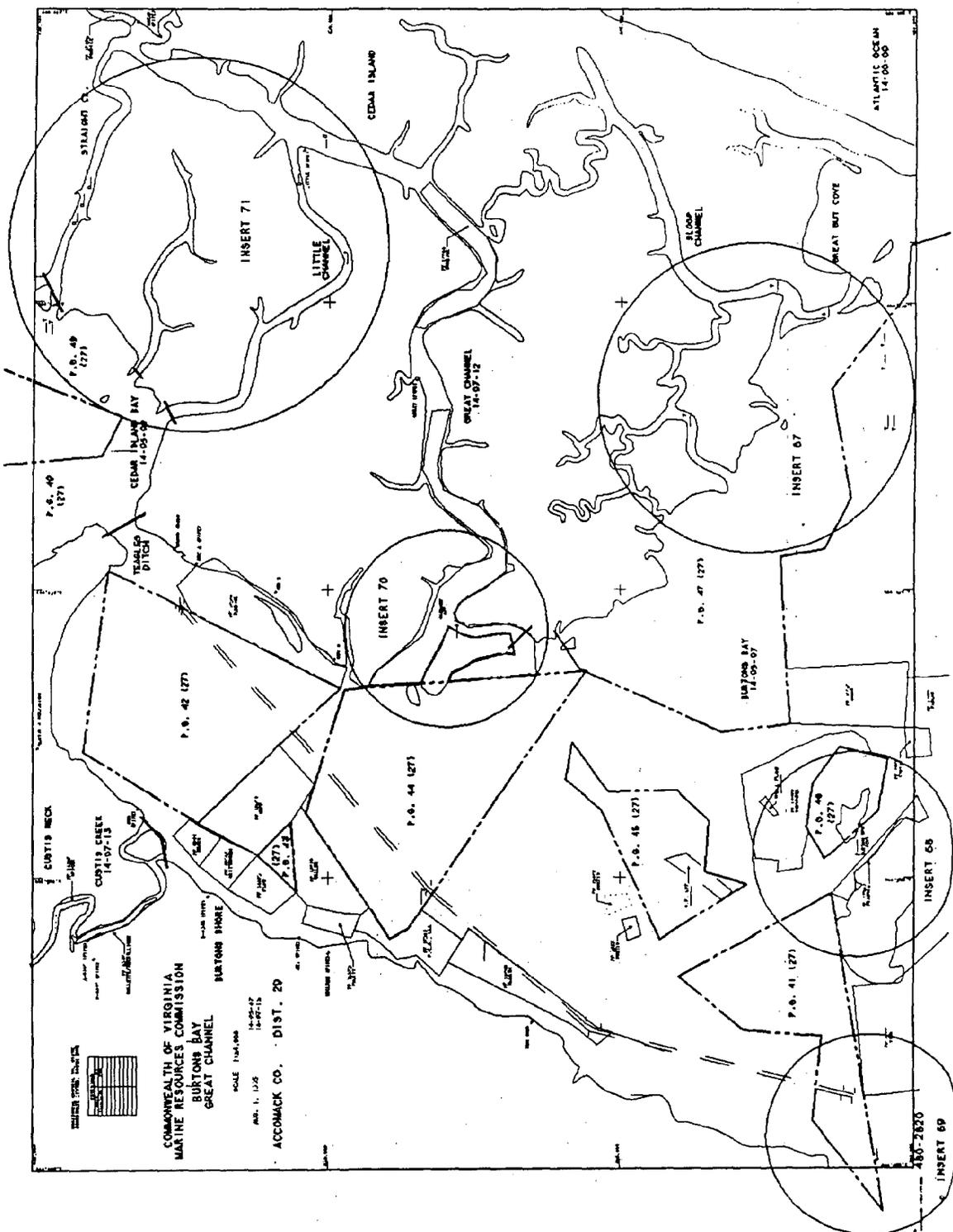
WACHAPREAGUE CHANNEL  
14-07-15

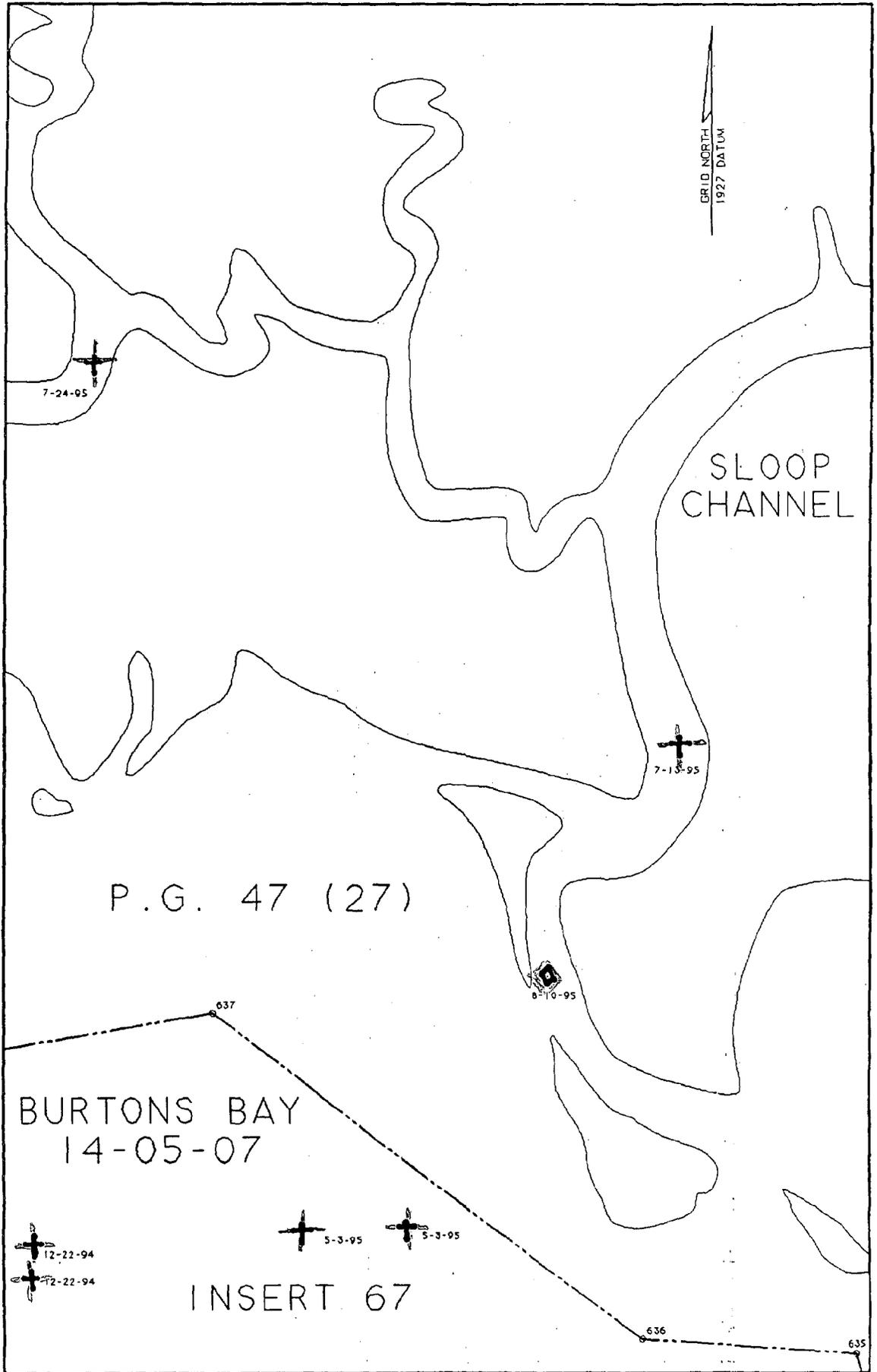
INSERT 64

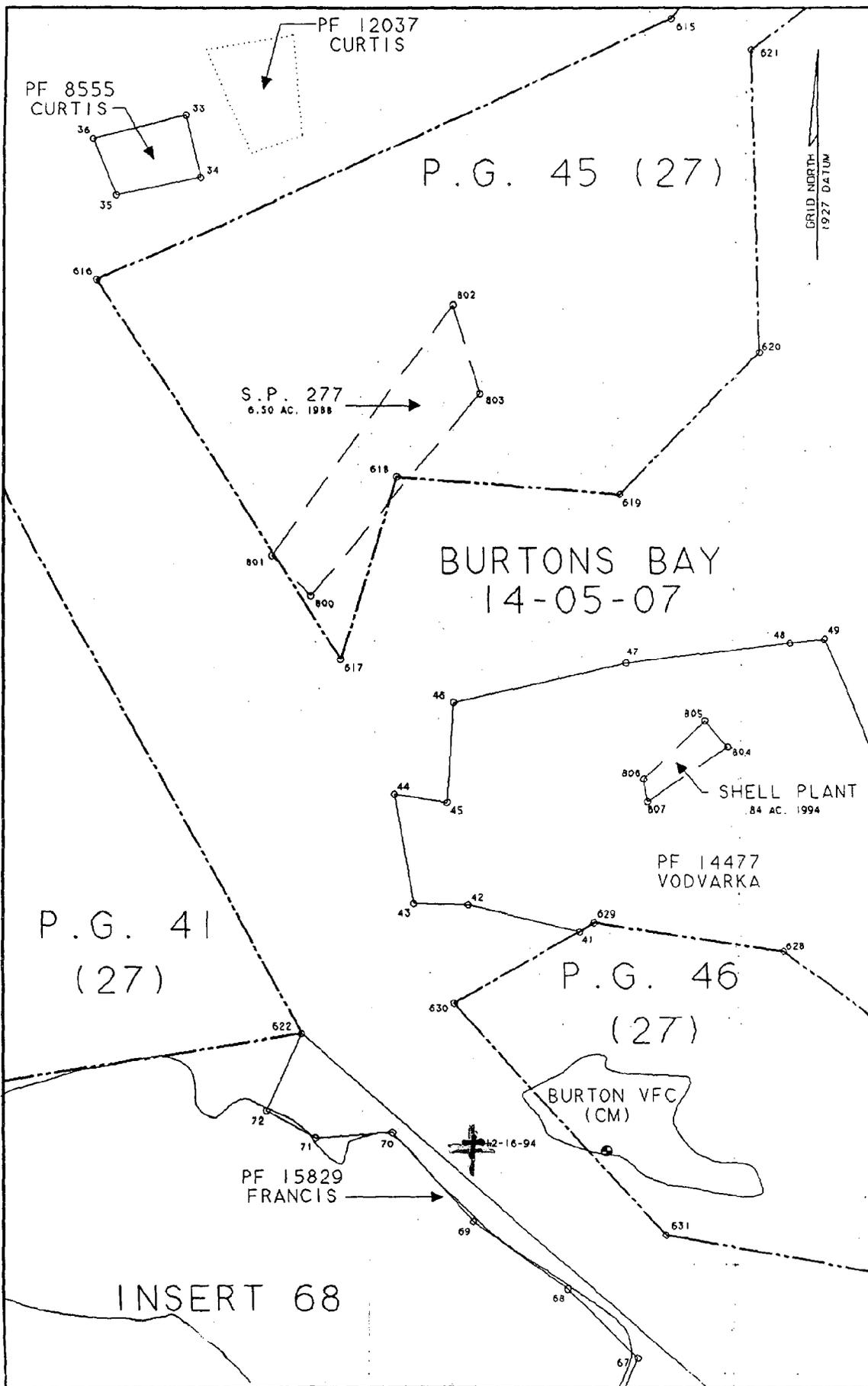
PF 10010  
WALLACE →



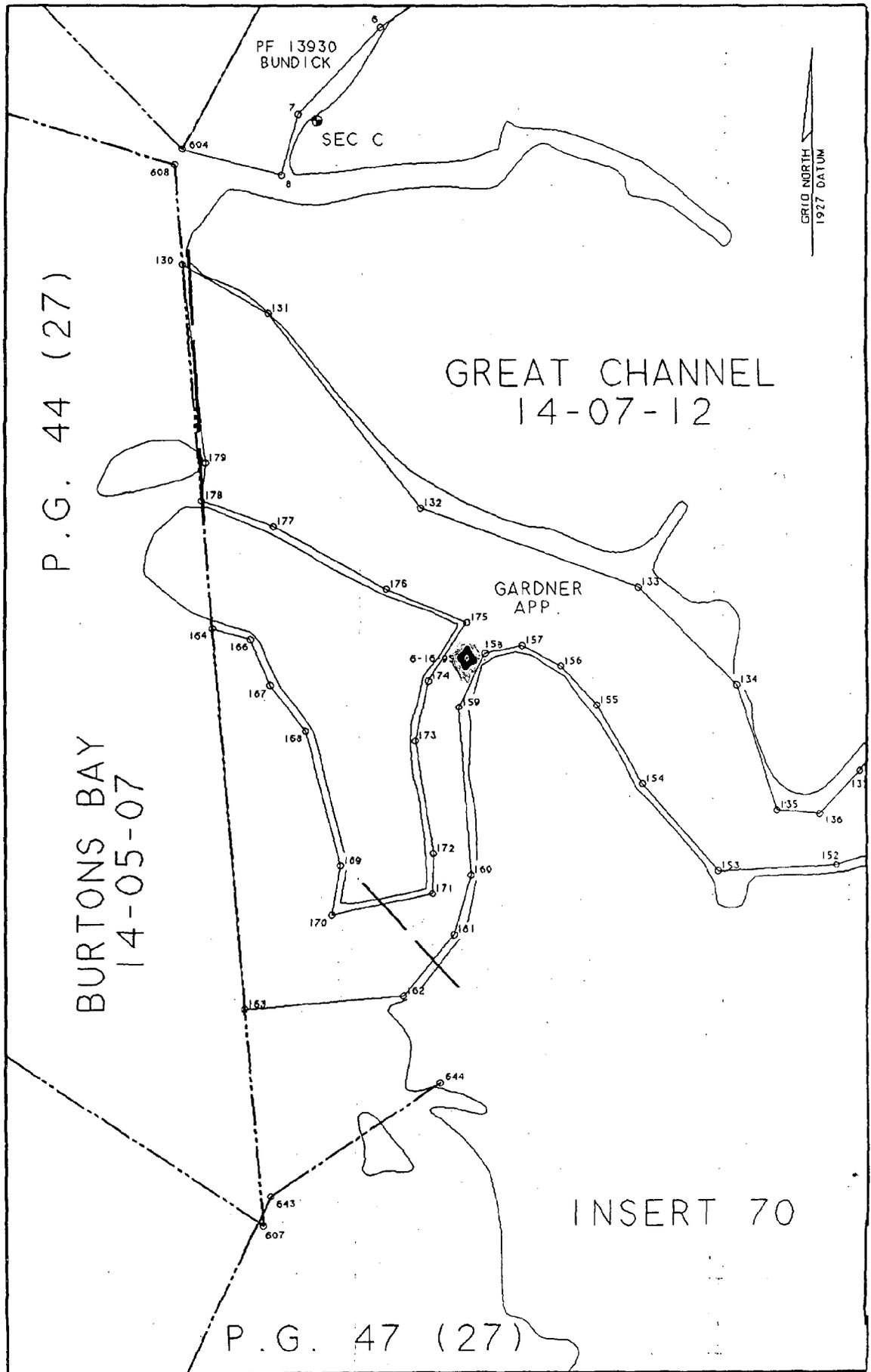




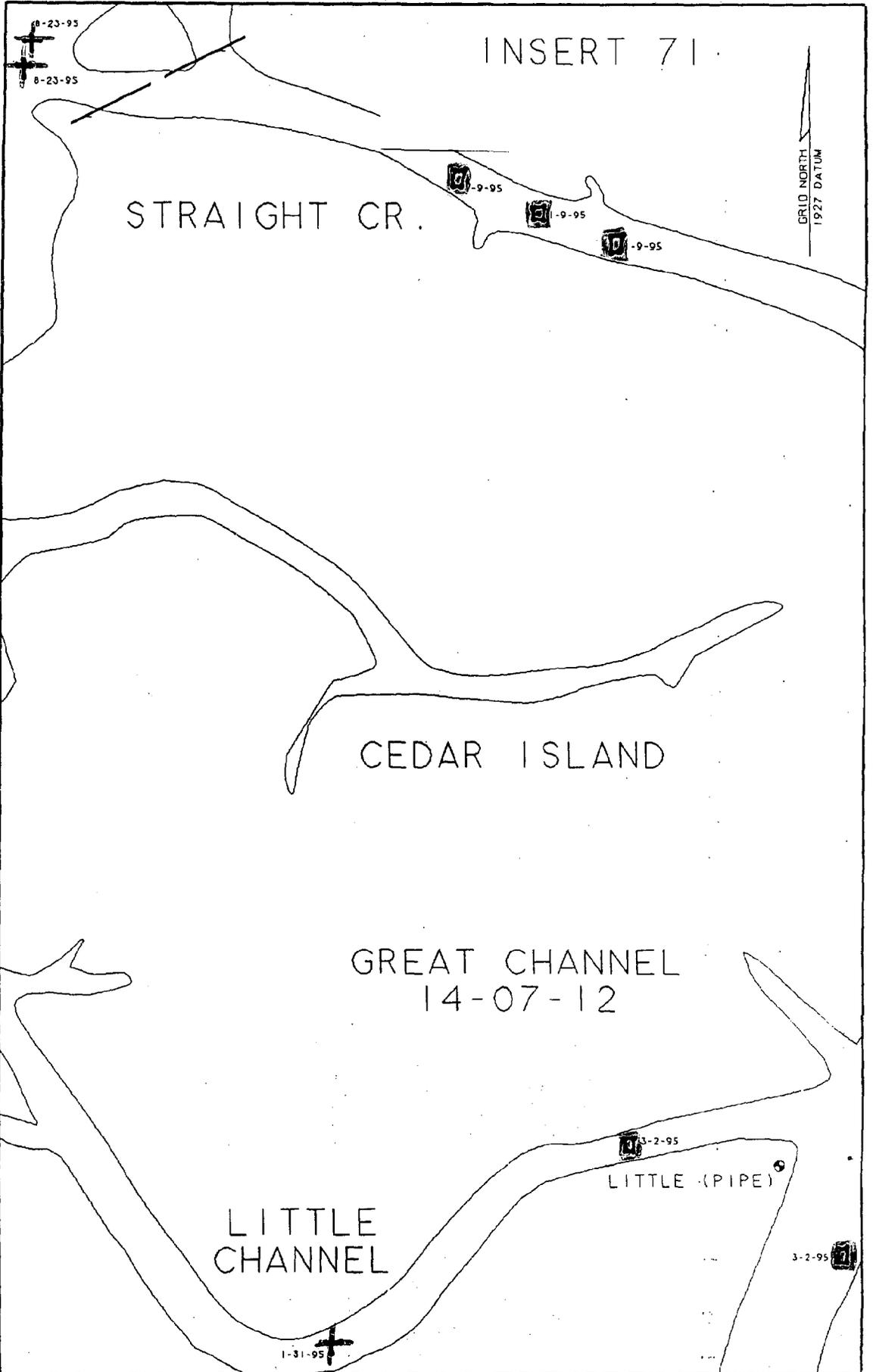


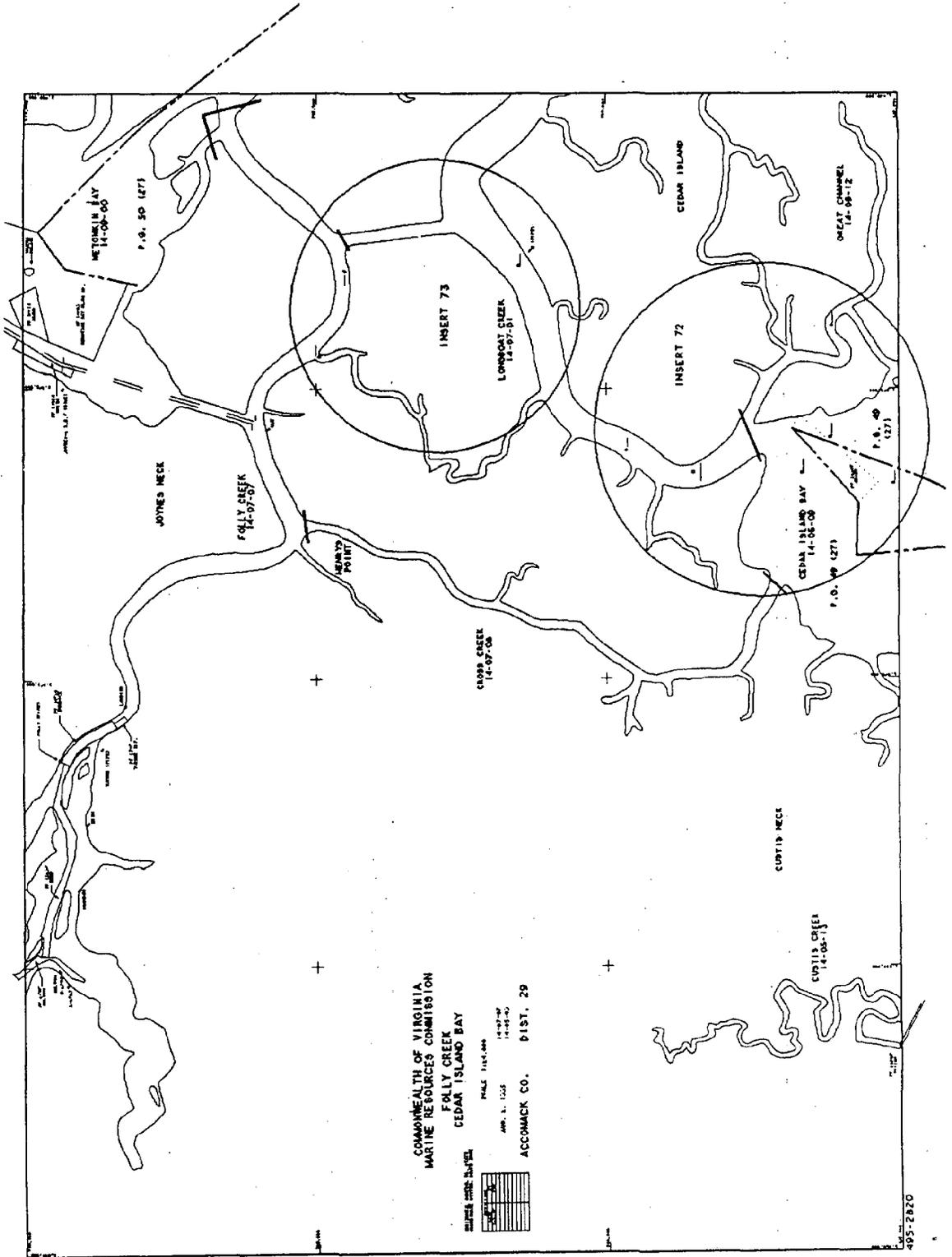


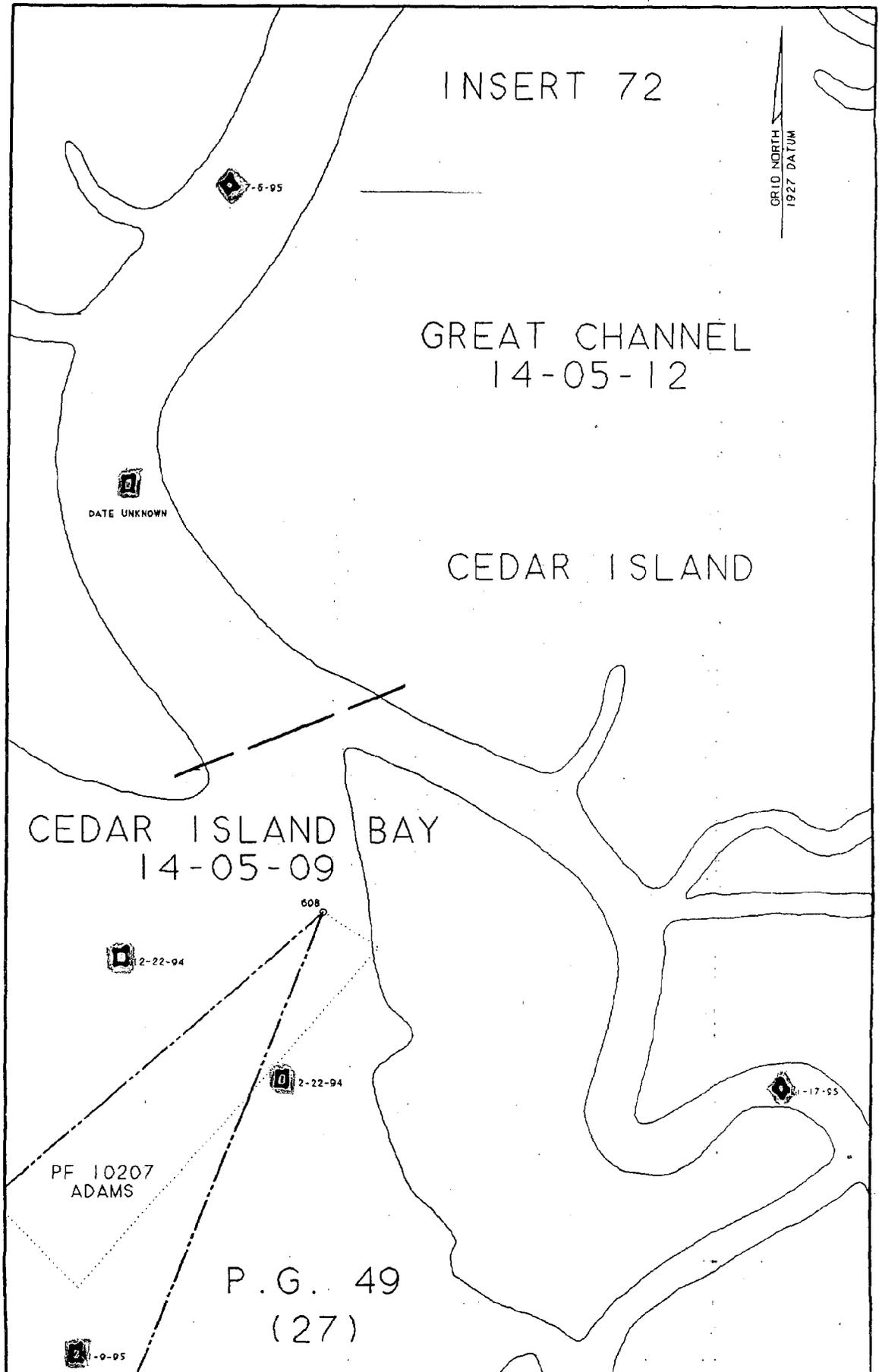


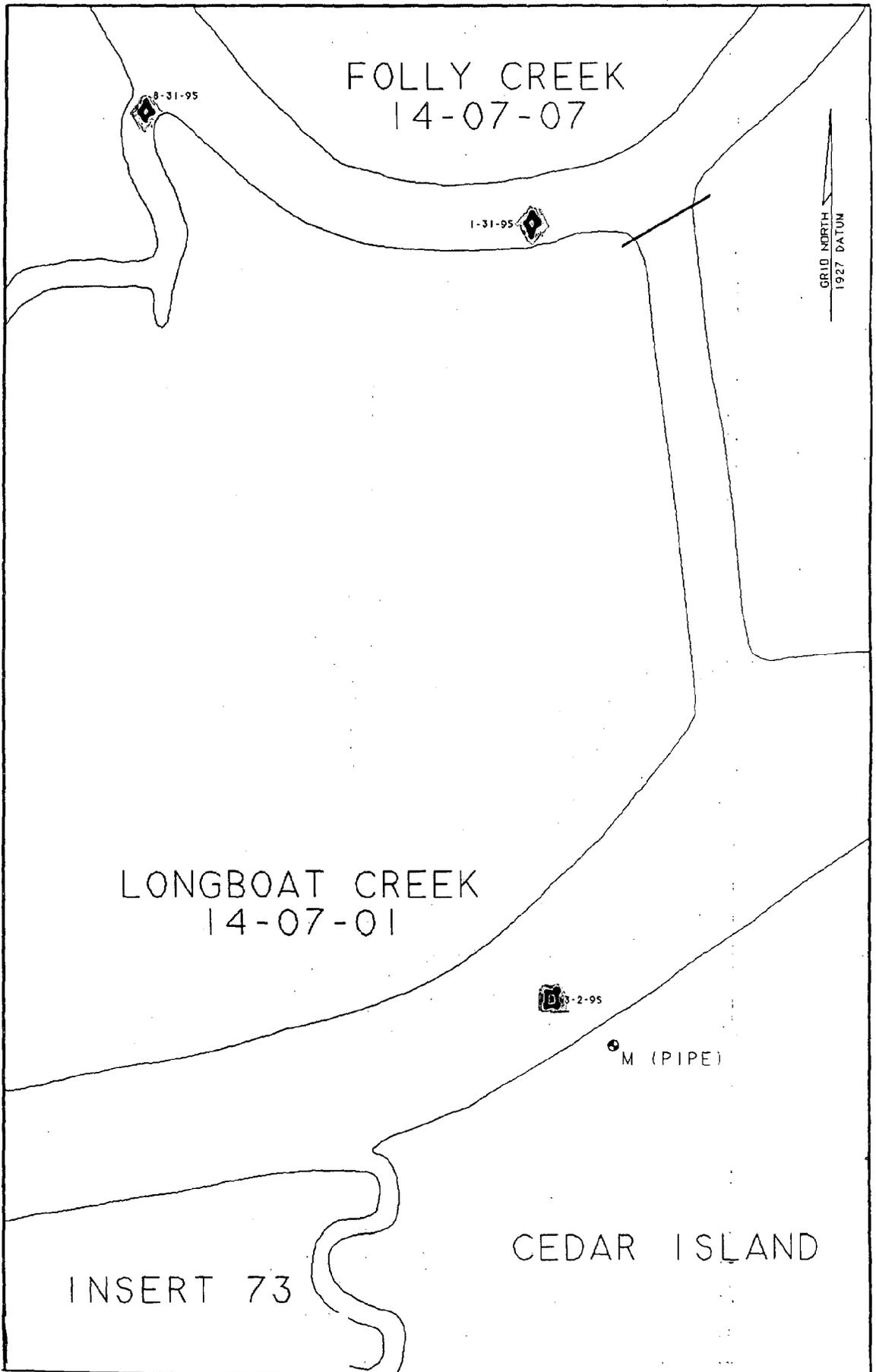


INSERT 71

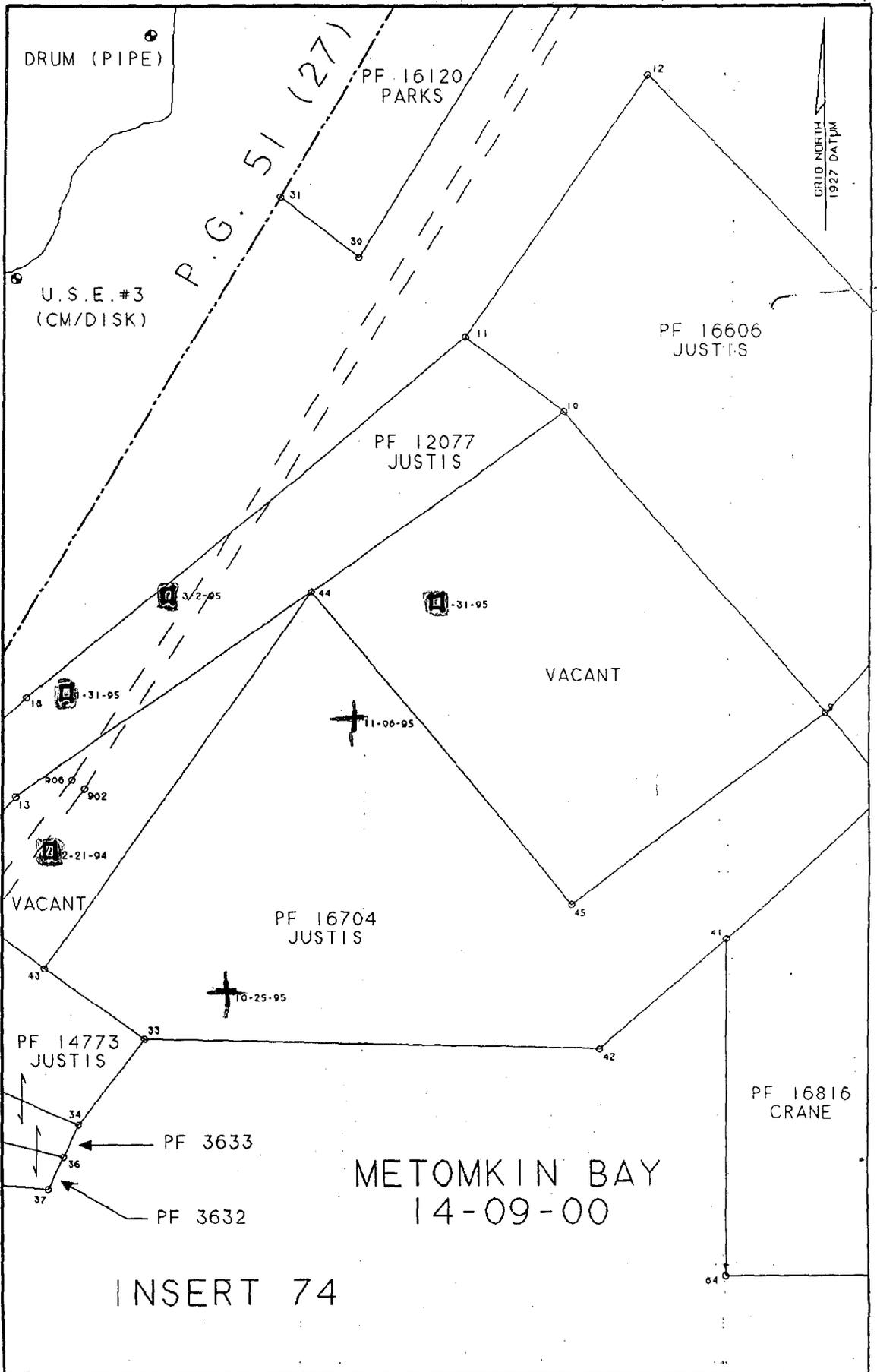




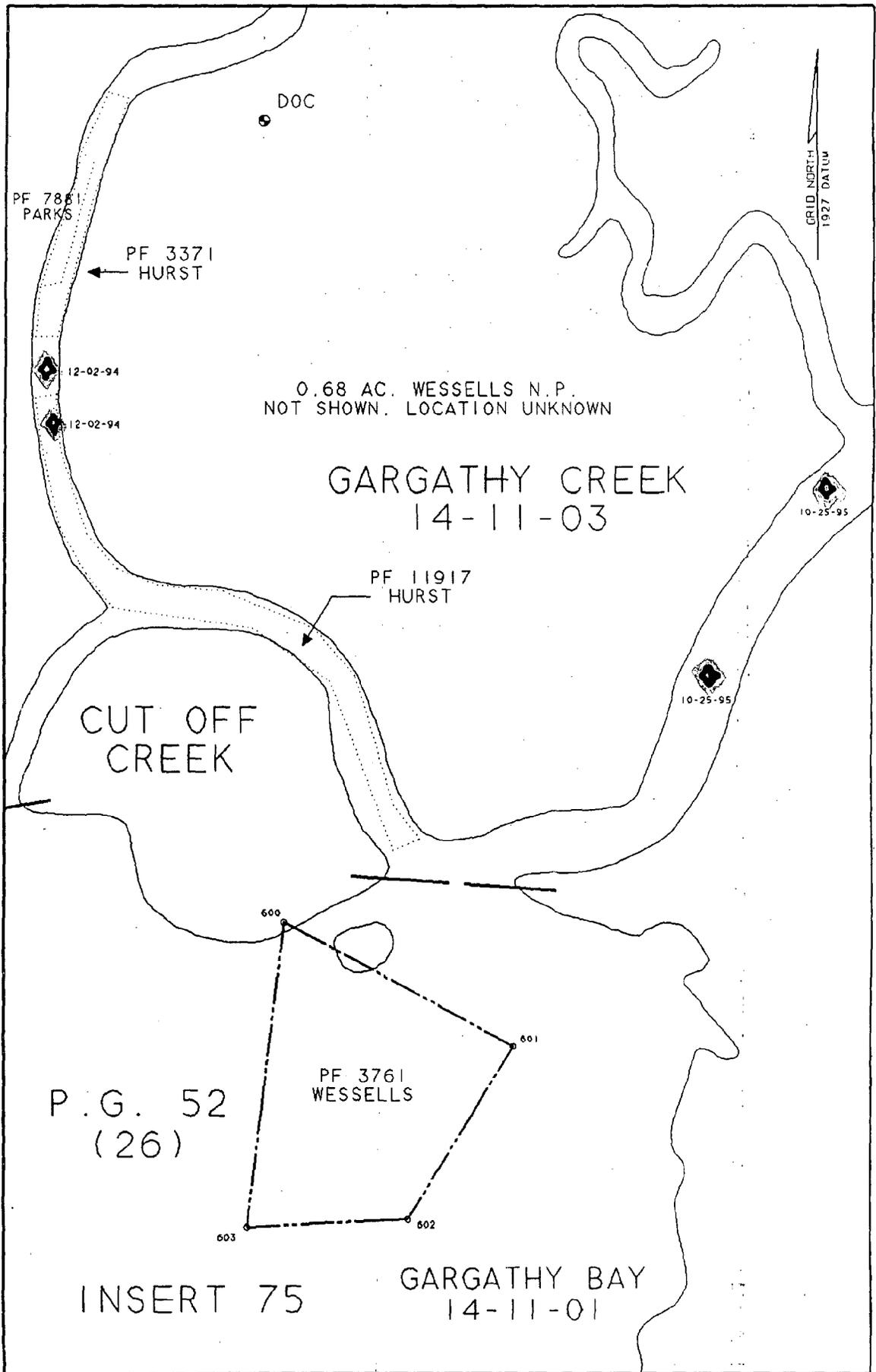












0.68 AC. WESSELLS N.P.  
NOT SHOWN. LOCATION UNKNOWN

GARGATHY CREEK  
14-11-03

CUT OFF  
CREEK

P.G. 52  
(26)

PF 3761  
WESSELLS

INSERT 75

GARGATHY BAY  
14-11-01

DR. JACK'S GUT  
14-11-13

2-24-95

GARGATHY CREEK  
14-11-03

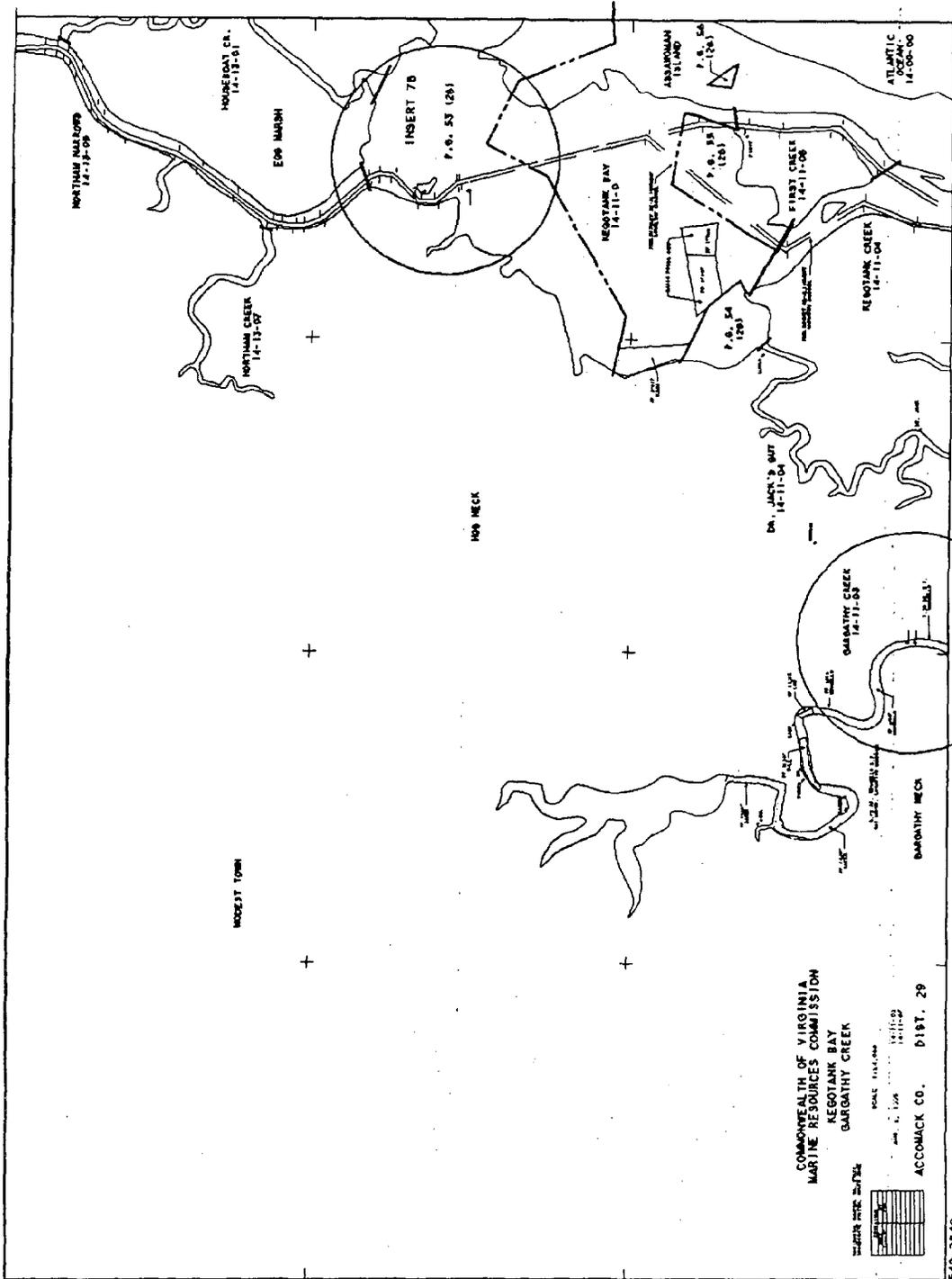
10-25-95

WIRE PASSAGE  
14-09-09

GRID NORTH  
1927 DATUM

INSERT 76

METOMKIN  
ISLAND



GRID NORTH  
1927 DATUM

RAMP  
7  
8  
10  
11  
13  
14  
PF 11915  
LOW  
PF 2412  
WESSELLS

DENNIS

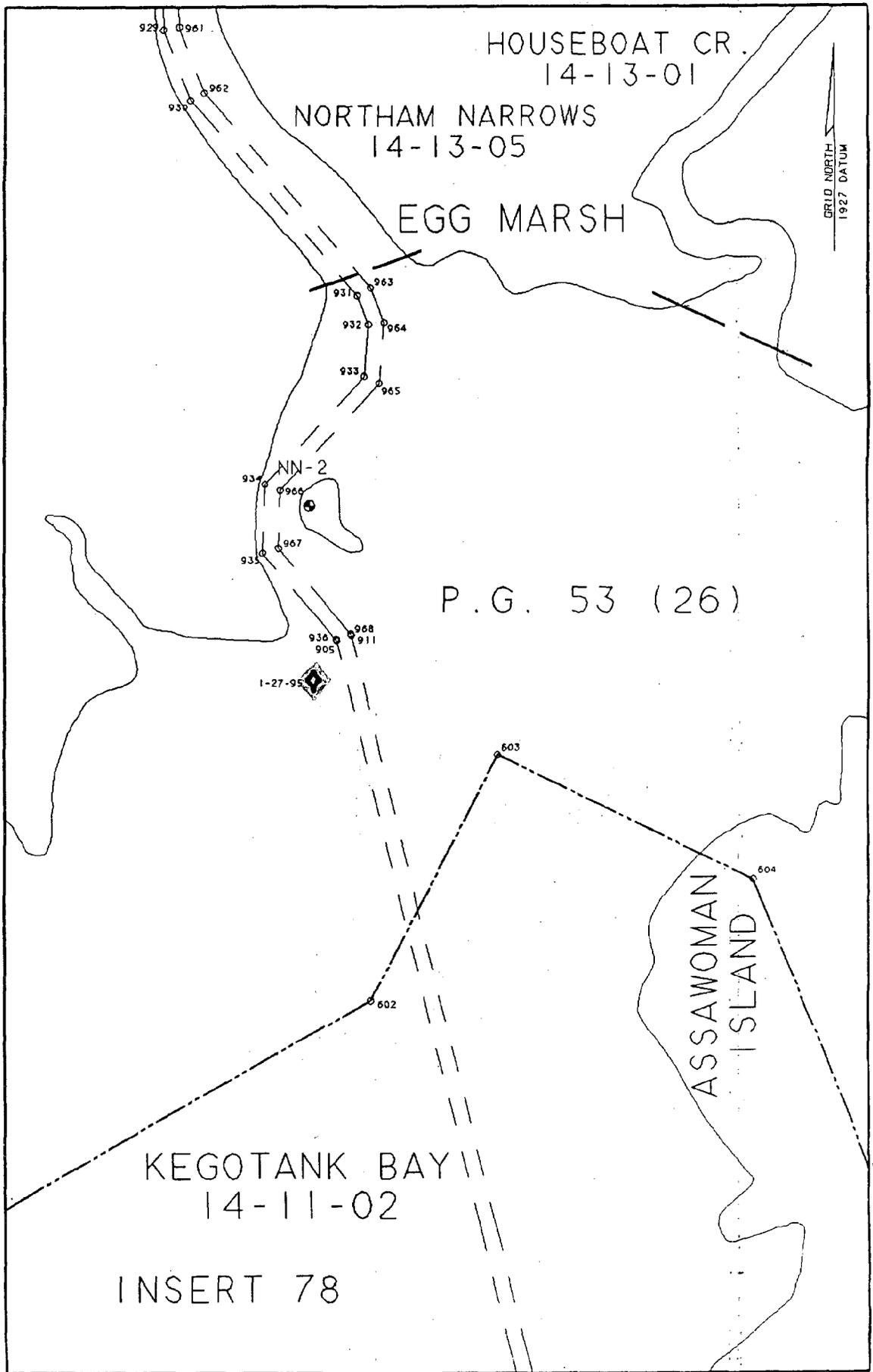
GARGATHY CREEK  
14-11-03

PF 2413  
WESSELLS

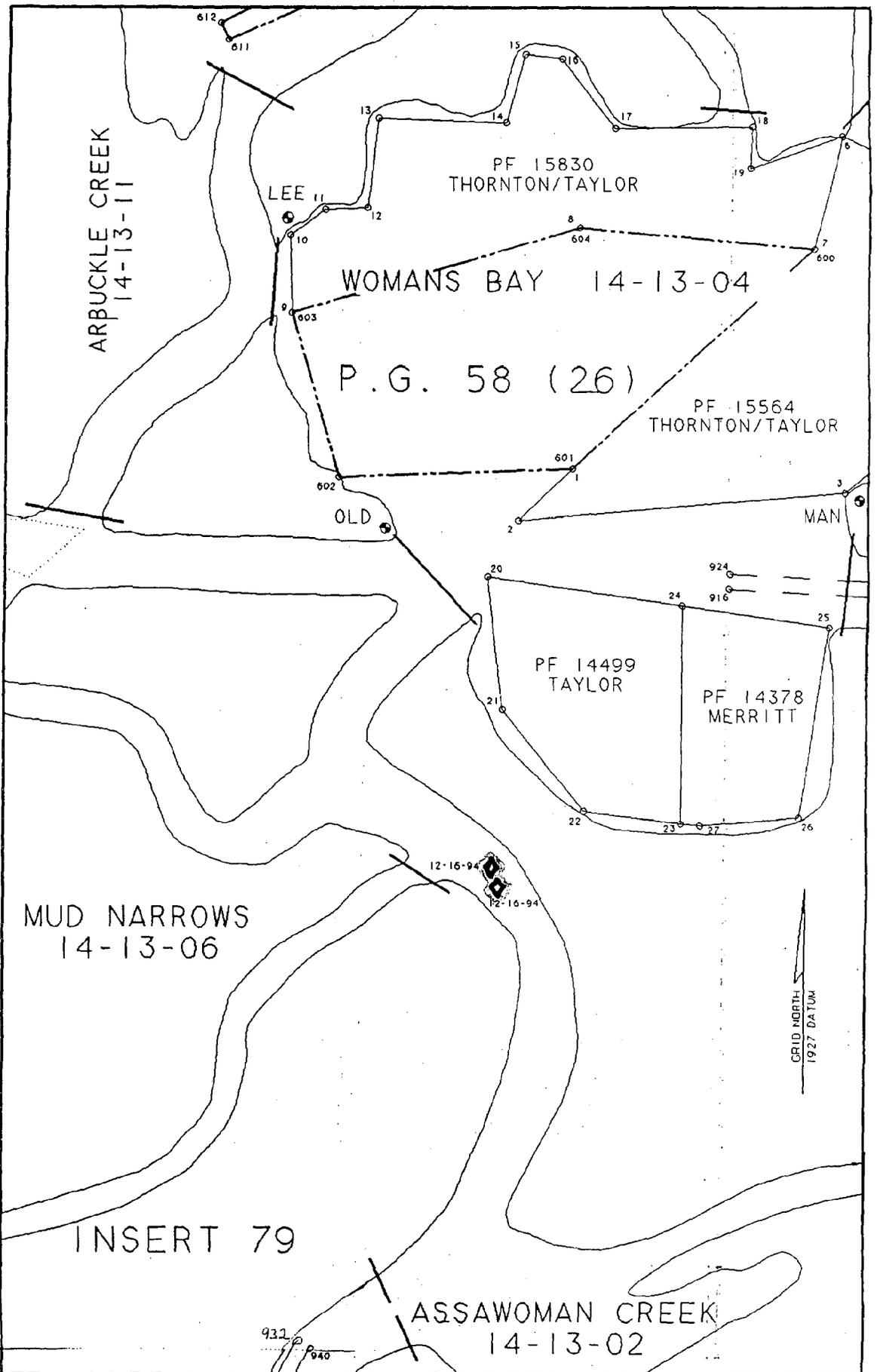
GARGATHY NECK  
INSERT 77

1-3-95  
1-3-95

1.98 AC. N.P.  
WESSELLS







SRIO NORTH  
1977 DATUM

CAT CREEK  
14-13-10

1-27-95

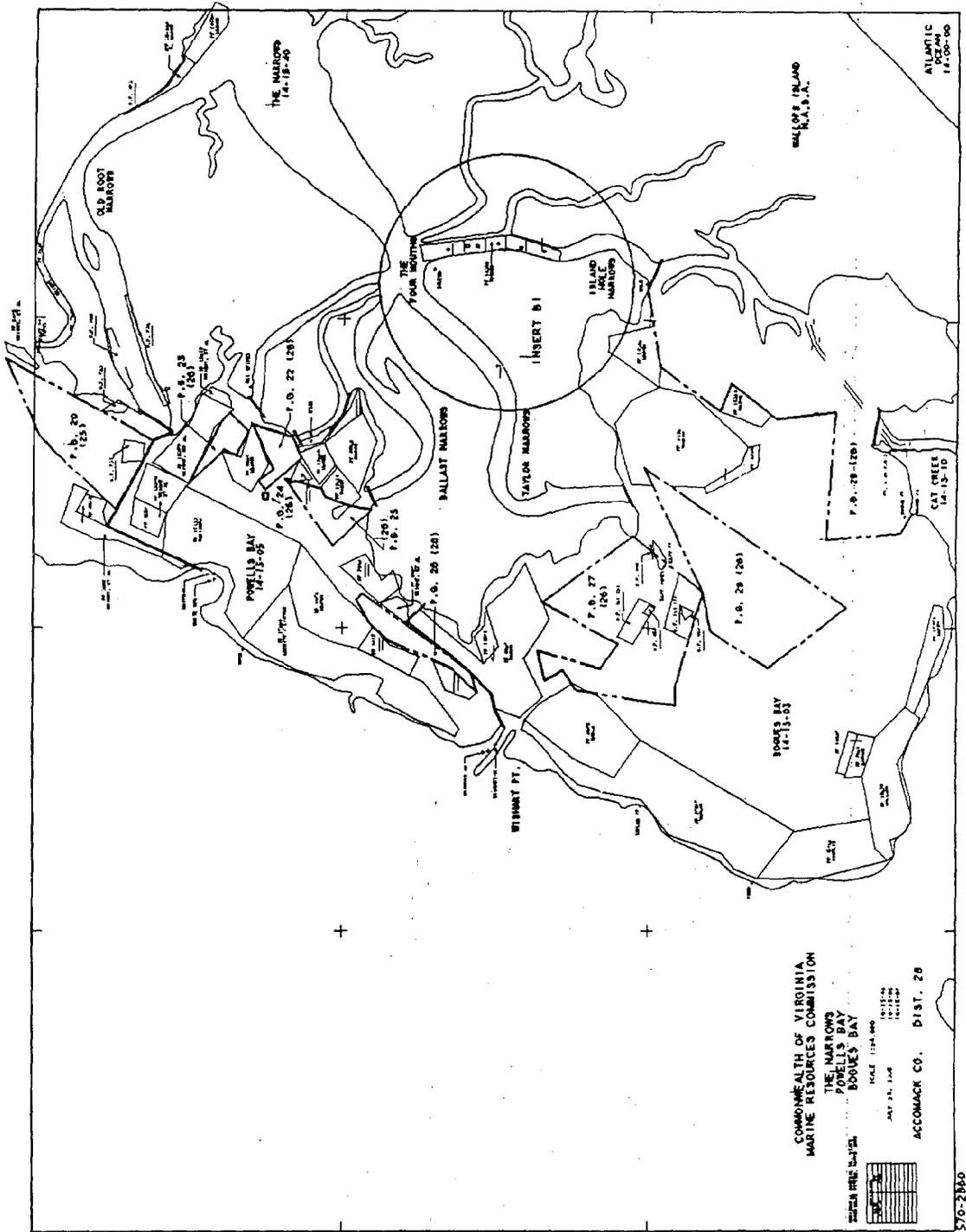
1-31-95

3-24-95

WALLOPS ISLAND  
N.A.S.A.

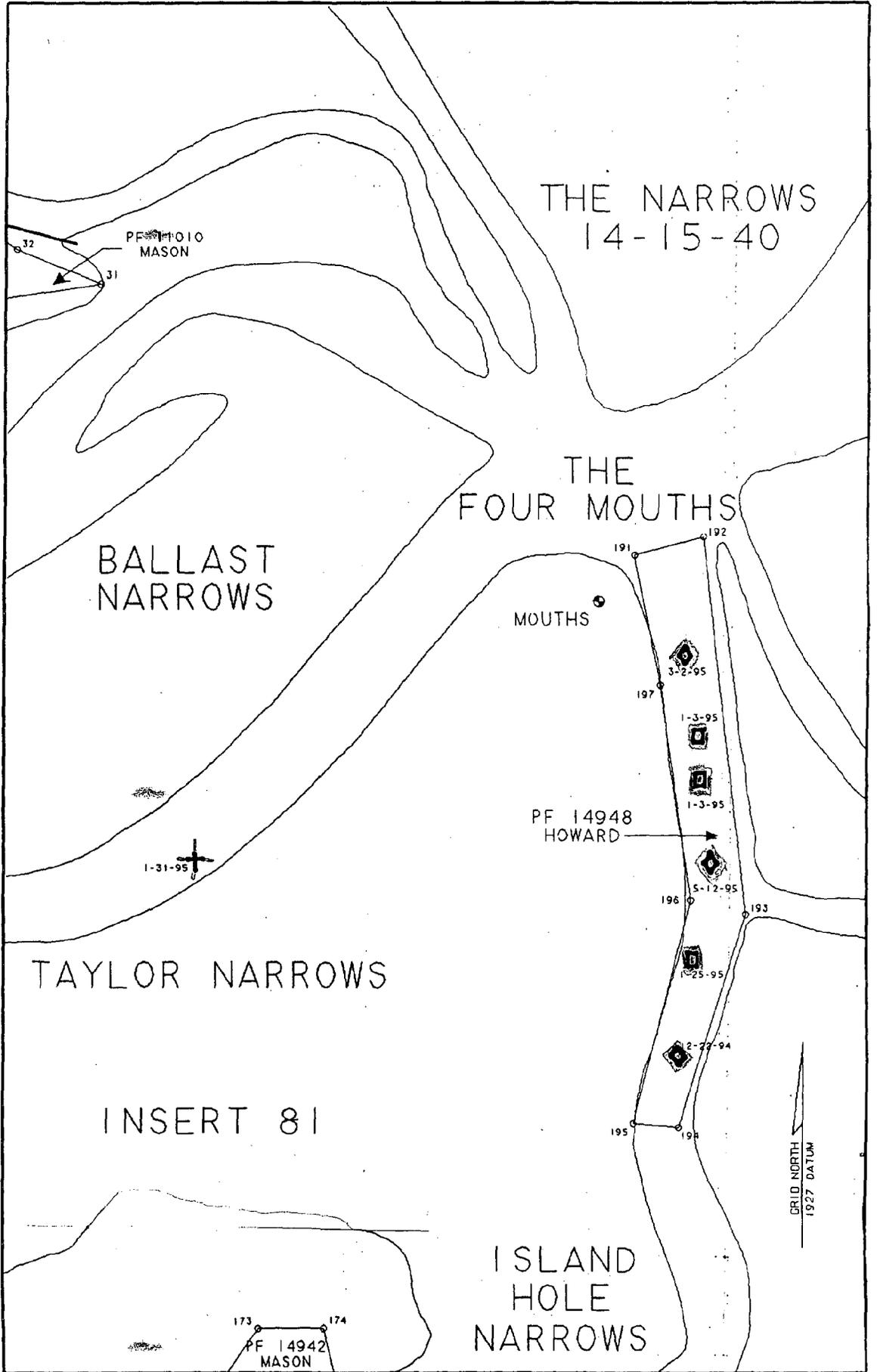
DIST. NO. 28  
DIST. NO. 29

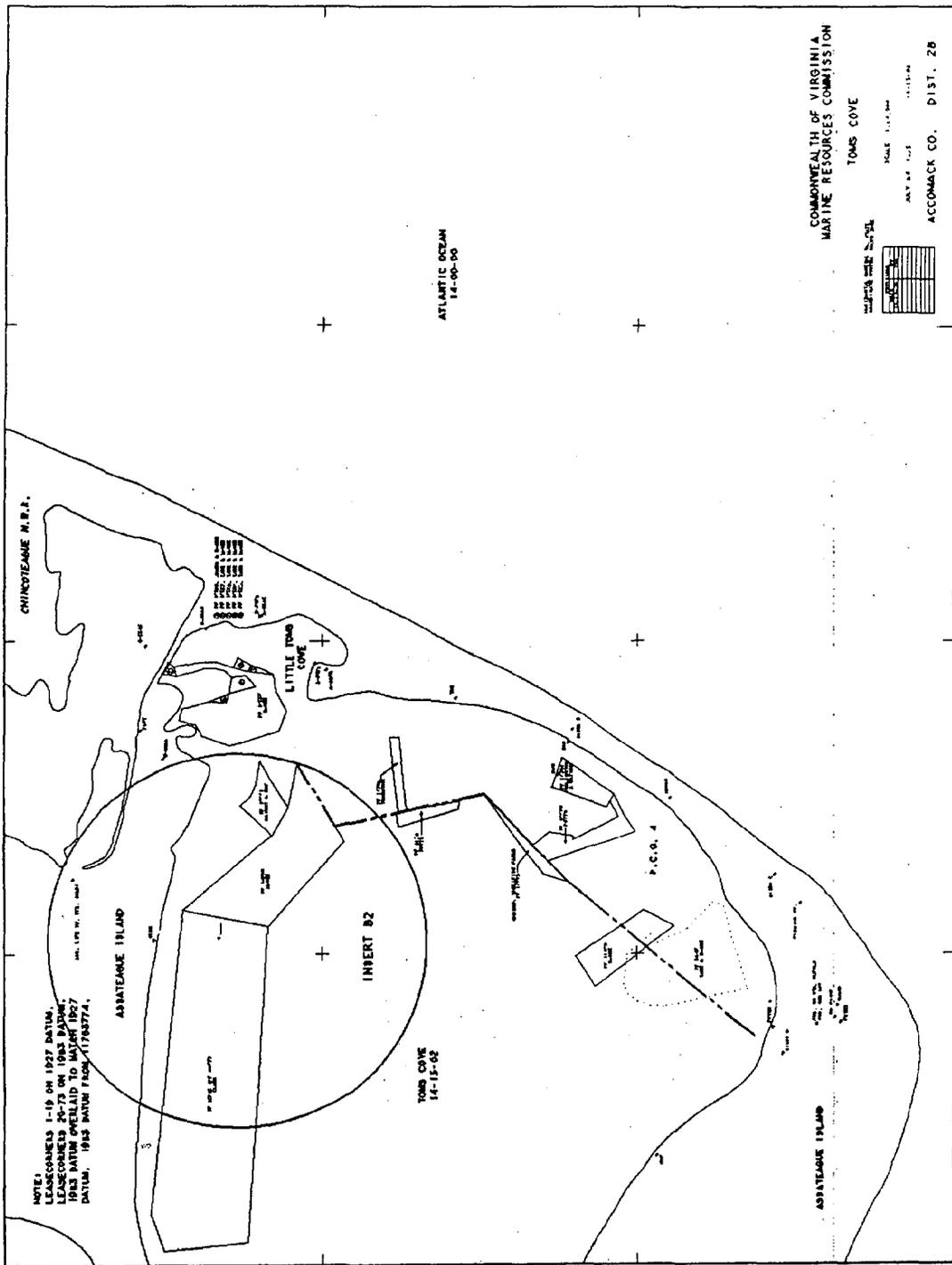
INSERT 80



COMMONWEALTH OF VIRGINIA  
 MARINE RESOURCES COMMISSION  
 THE NARROWS  
 POWELL'S BAY  
 HOOKER'S BAY  
 SCALE 1:24,000  
 JULY 24, 1948  
 10:15 AM  
 141520  
 ACCOMACK CO. DIST. 28

570-2840





CHINCOTEAGUE N.W.R.  
ASSATEAGUE ISLAND

GIBB

GRID NORTH  
1927 DATUM

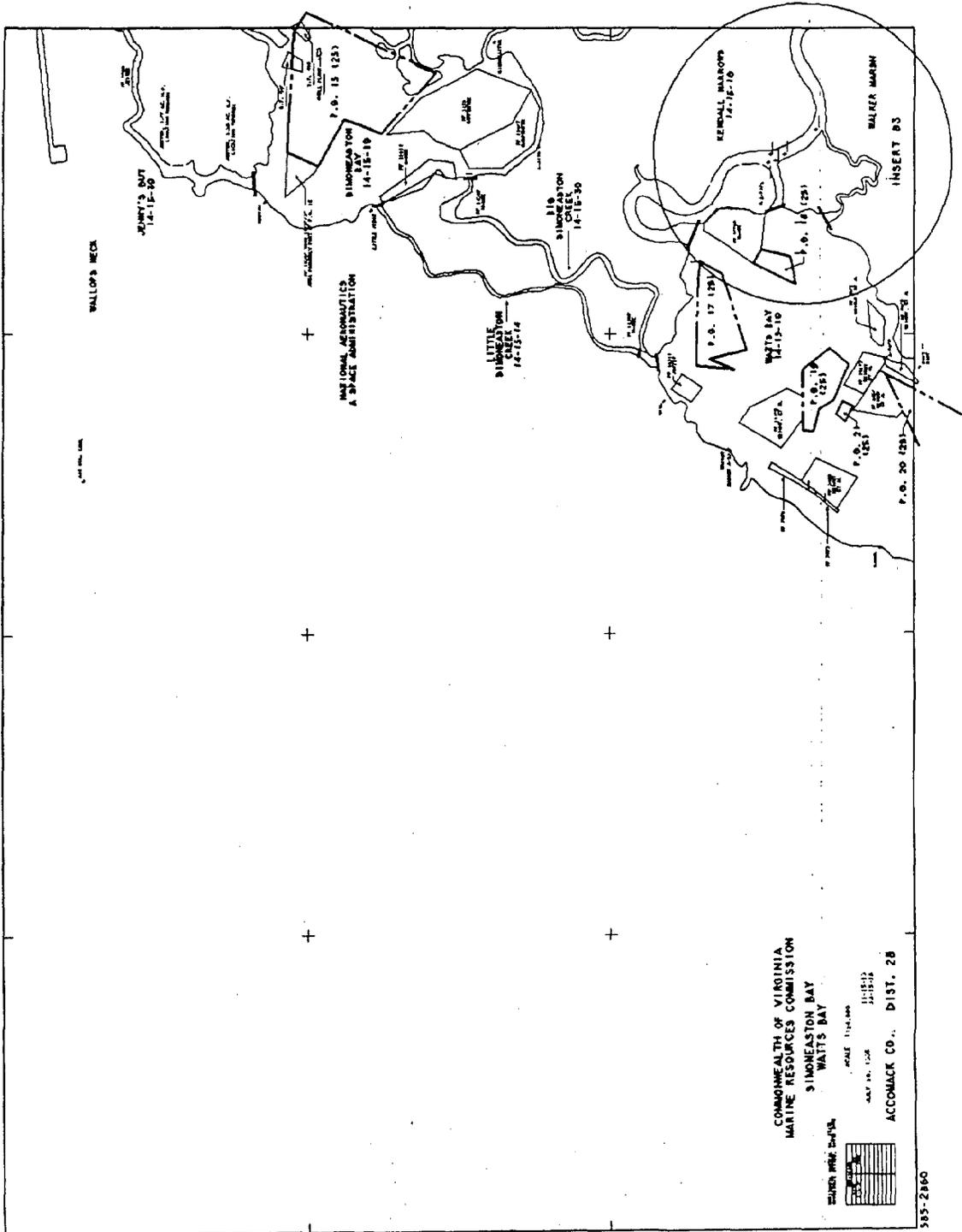
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CLARK

2-24-95

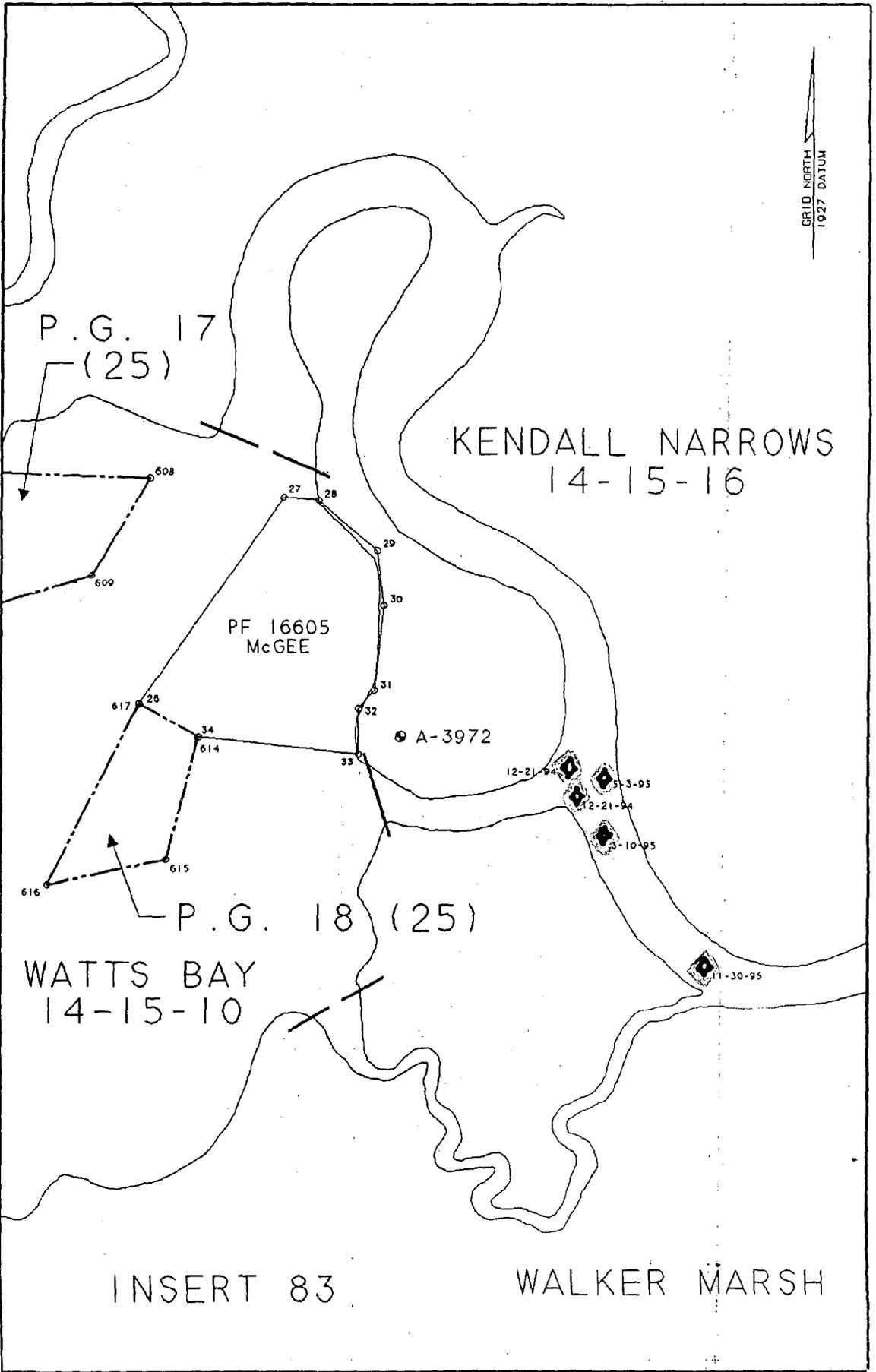
PF 14708  
McGEE

TOMS COVE  
14-15-02

INSERT 82



GRID NORTH  
1927 DATUM



P.G. 17  
(25)

KENDALL NARROWS  
14-15-16

PF 16605  
McGEE

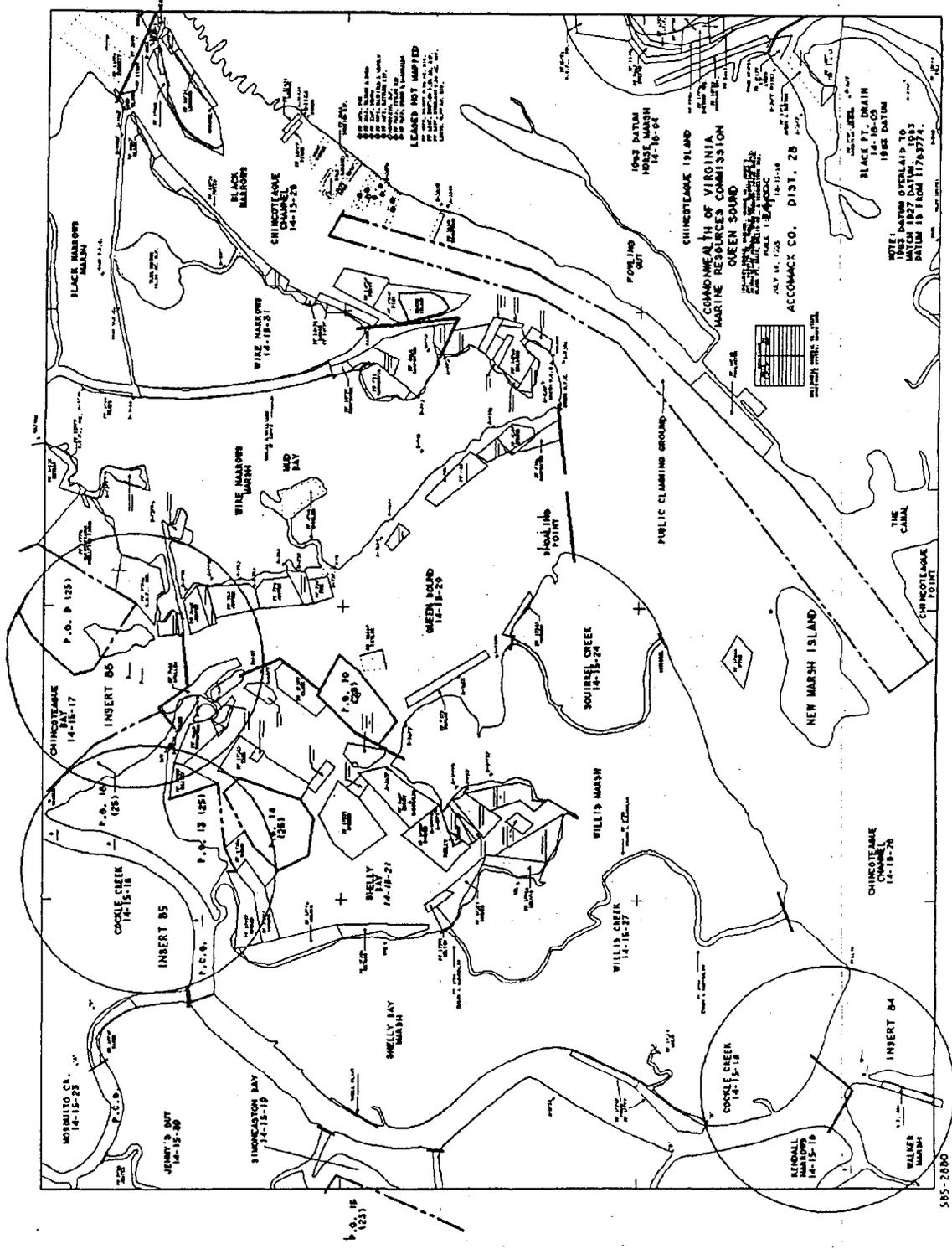
A-3972

P.G. 18 (25)

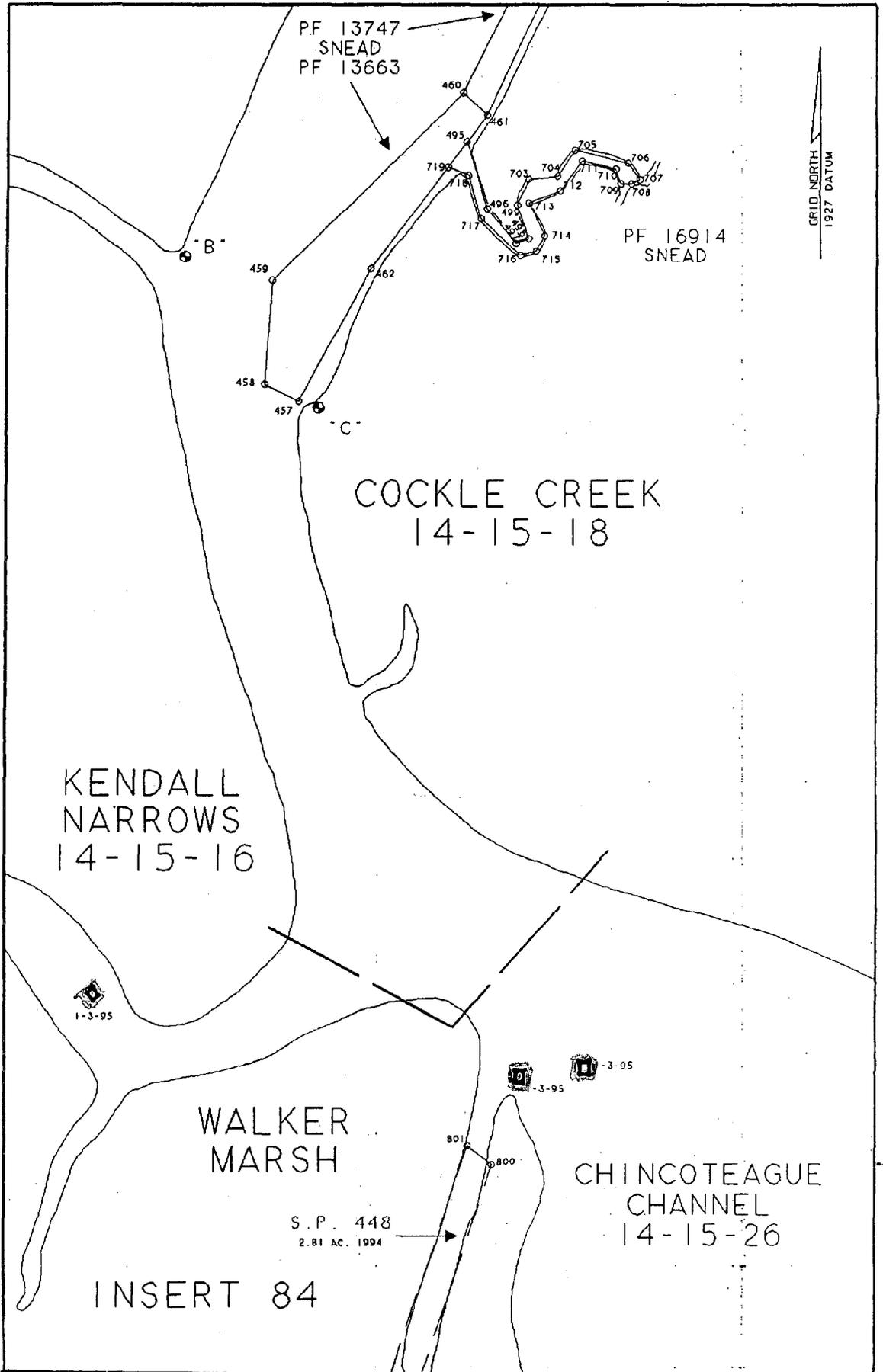
WATTS BAY  
14-15-10

INSERT 83

WALKER MARSH



585-2880



INSERT 85

COCKLE CREEK  
14-15-18

11-21-95

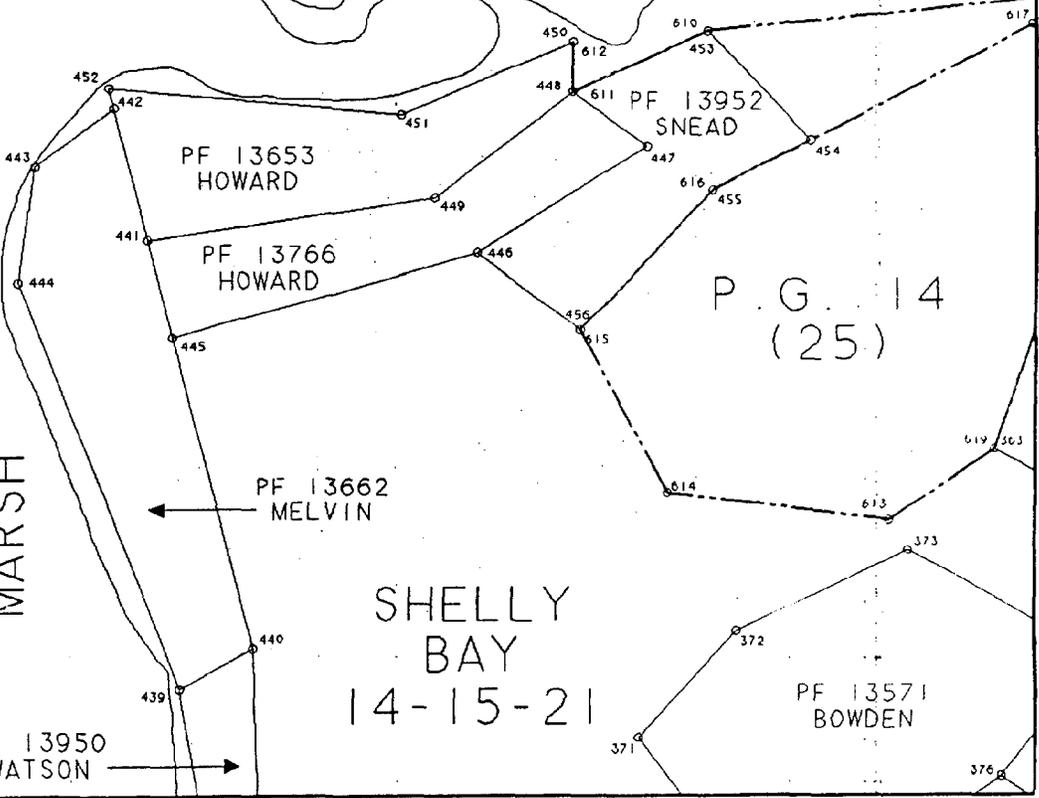
11-06-95

GRID NORTH  
1927 DATUM

P.C.G.

11-06-95

P.G. 13 (25)



SHELLY BAY  
MARSH

SHELLY BAY  
14-15-21

P.G. 14  
(25)

PF 13950  
WATSON

PF 13662  
MELVIN

PF 13653  
HOWARD

PF 13766  
HOWARD

PF 13952  
SNEAD

PF 13571  
BOWDEN

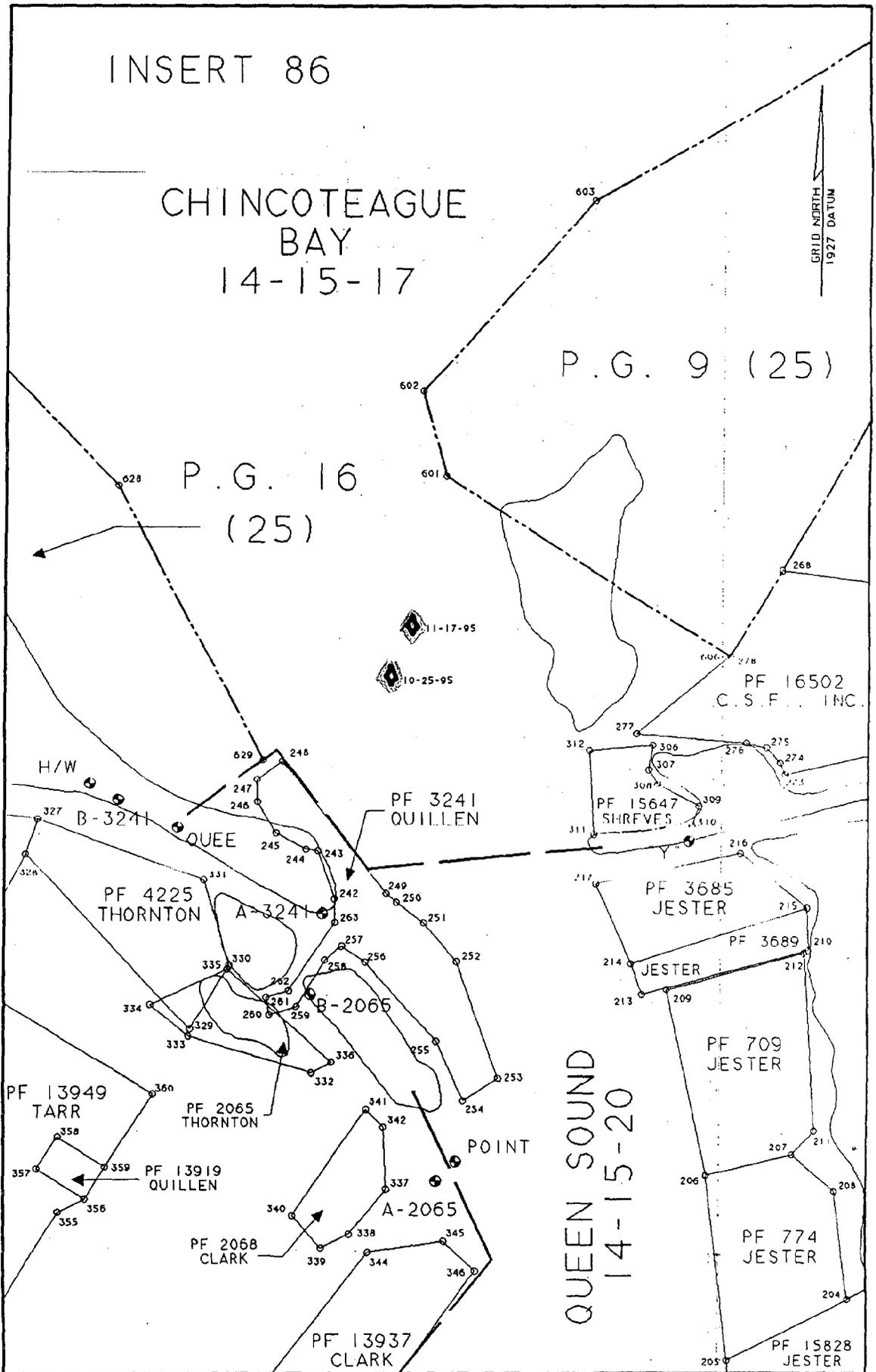
INSERT 86

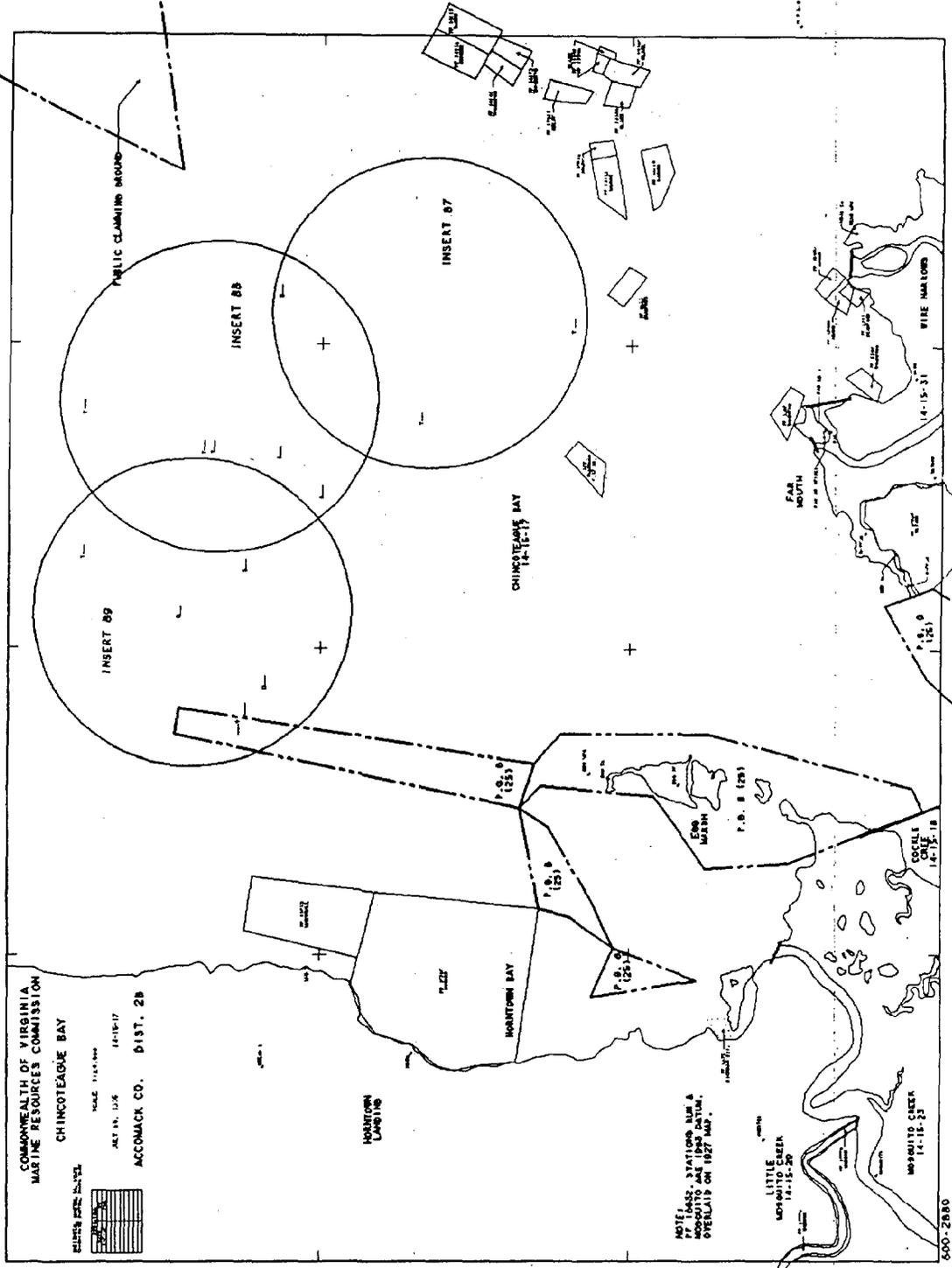
CHINCOTEAGUE BAY  
14-15-17

GRID NORTH  
1927 DATUM

P.G. 9 (25)

P.G. 16  
(25)





9-95

GRID NORTH  
1927 DATUM

T-3-95

CHINCOTEAGUE BAY  
14-15-17

6-95

INSERT 87

GRID NORTH  
1927 DATUM

1-3-95

CHINCOTEAGUE BAY  
14-15-17

1-3-95  
1-9-95

1-9-95

1-9-95

INSERT 88

GRID NORTH  
1927 DATUM



# CHINCOTEAGUE BAY 14-15-17

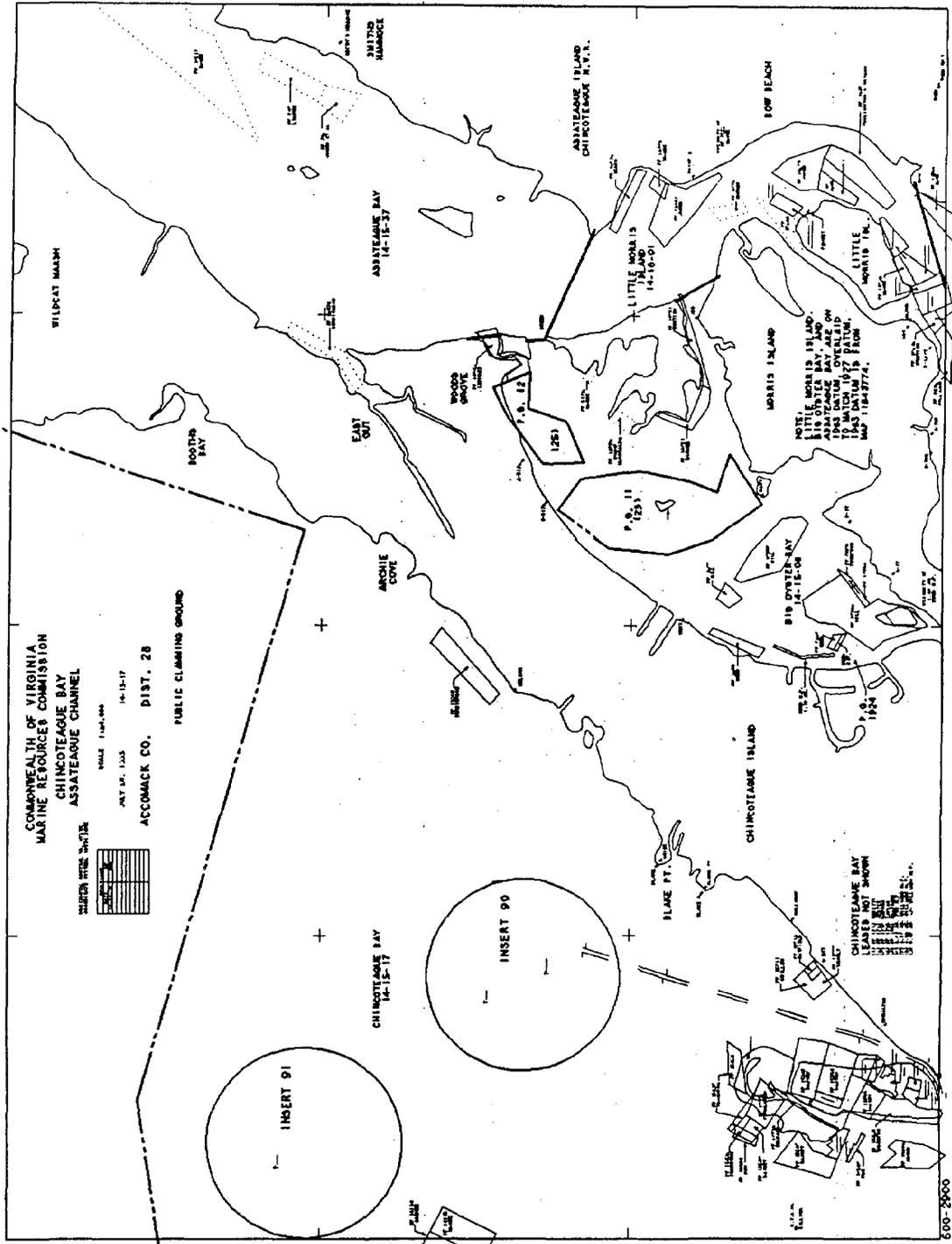
601 602



P.G. 6  
(25)



INSERT 89



GRID NORTH  
1927 DATUM

# CHINCOTEAGUE BAY

14-15-17

1-3-95

12-22-94

005 0911

INSERT 90

PUBLIC CLAMMING GROUND

GRID NORTH  
1927 DATUM

601

CHINCOTEAGUE BAY  
14-15-17

1-6-95

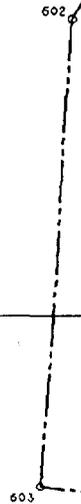
INSERT 91



INSERT 92

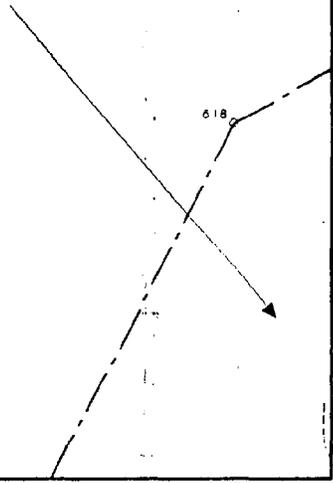
GRID NORTH  
1927 DATUM

P.G. NO. 2



CHINCOTEAGUE BAY  
14-15-17

PUBLIC CLAMMING GROUND



PF 14683  
MARSHALL

GRID NORTH  
1927 DATUM

15

14

1-3-95

CHINCOTEAGUE BAY  
14-15-17

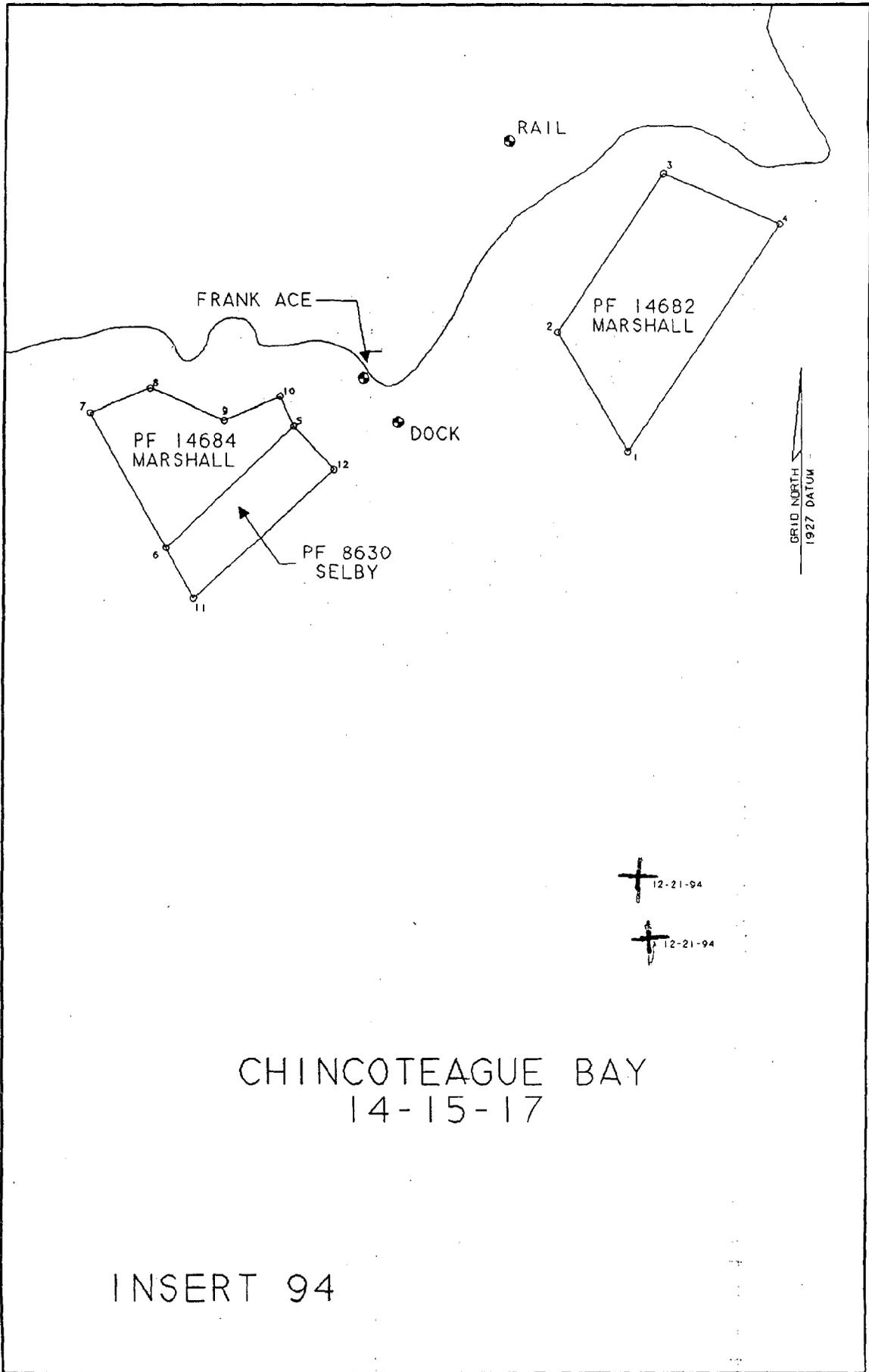
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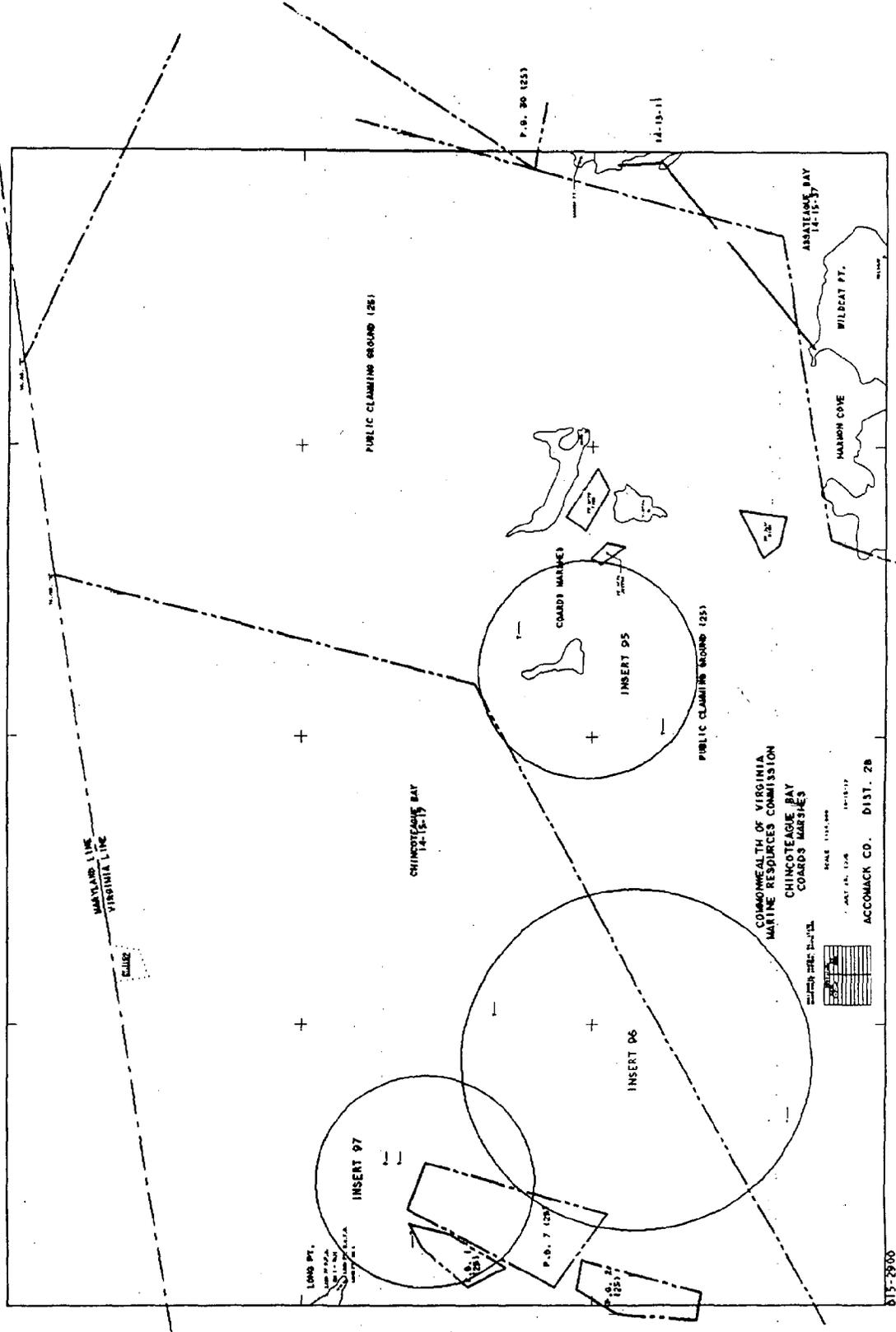
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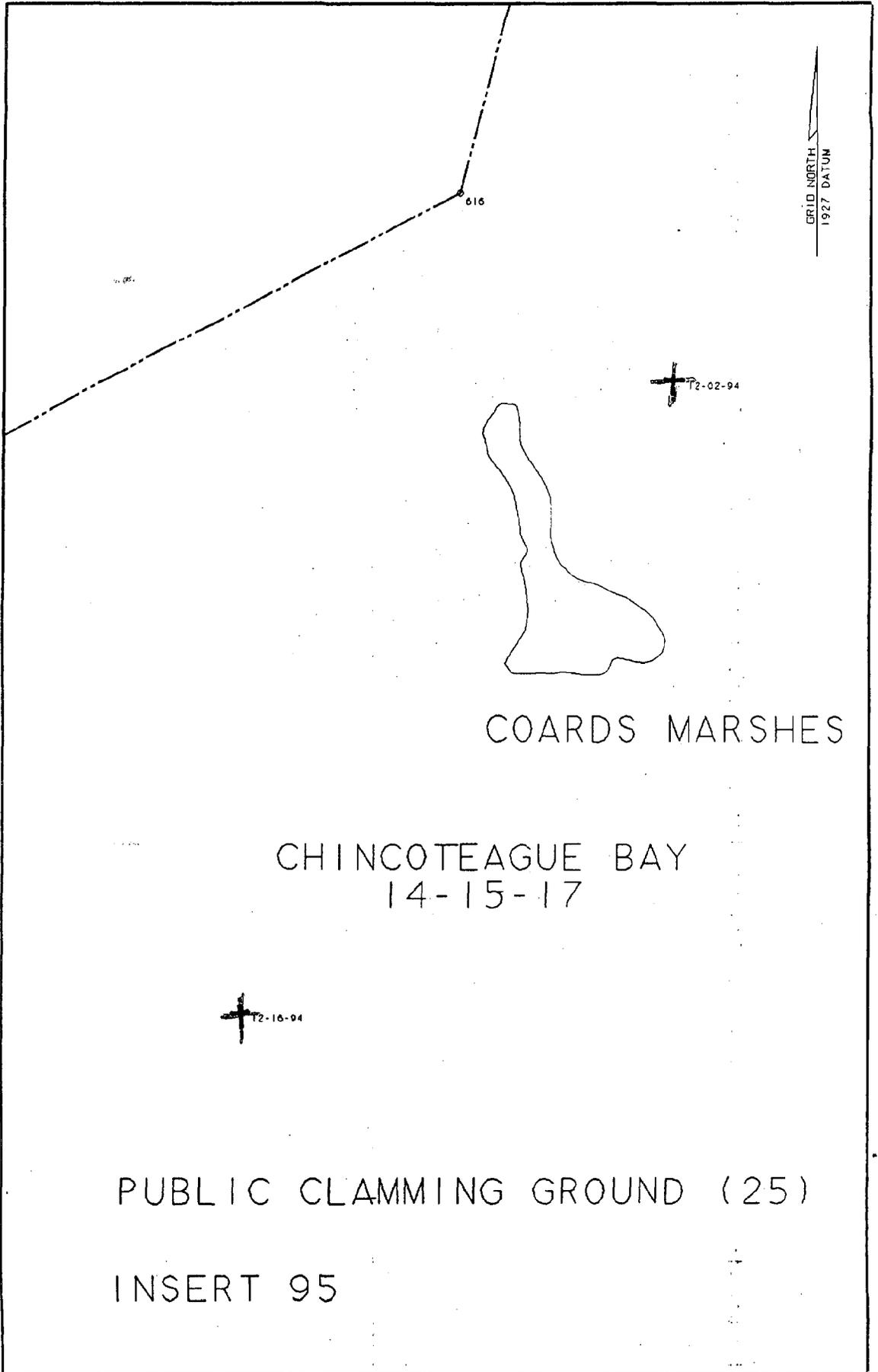
1-3-95

INSERT 93

1-31-95



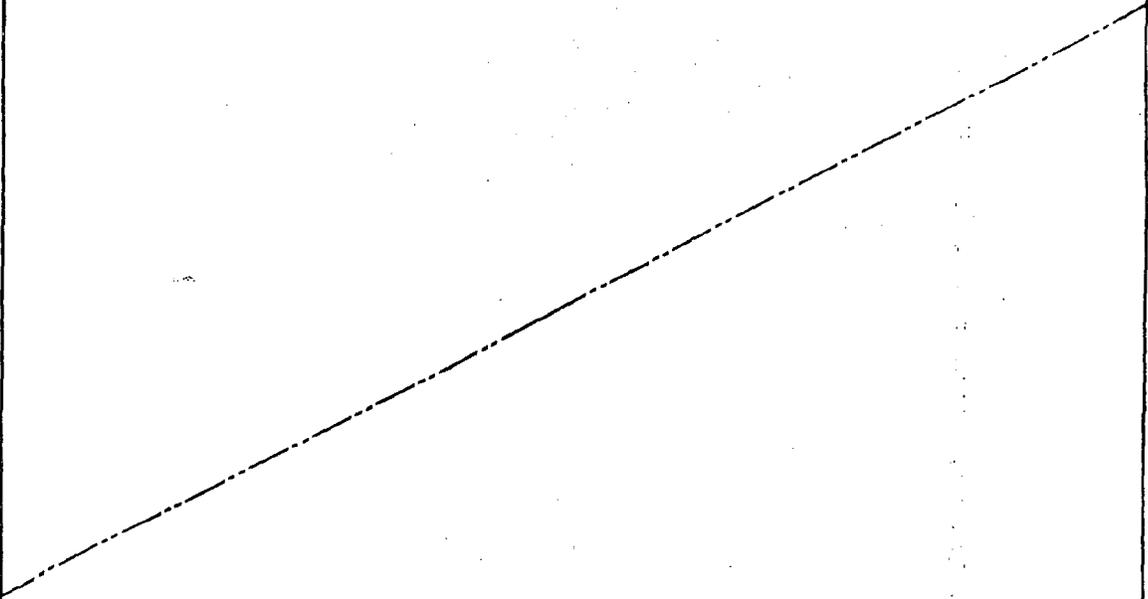






GRID NORTH  
1927 DATUM

CHINCOTEAGUE BAY  
14-15-17



PUBLIC CLAMMING GROUND (25)

INSERT 96



INSERT 97

GRID NORTH  
1927 DATUM

LONG PT.

LONG 33 V.F.C.

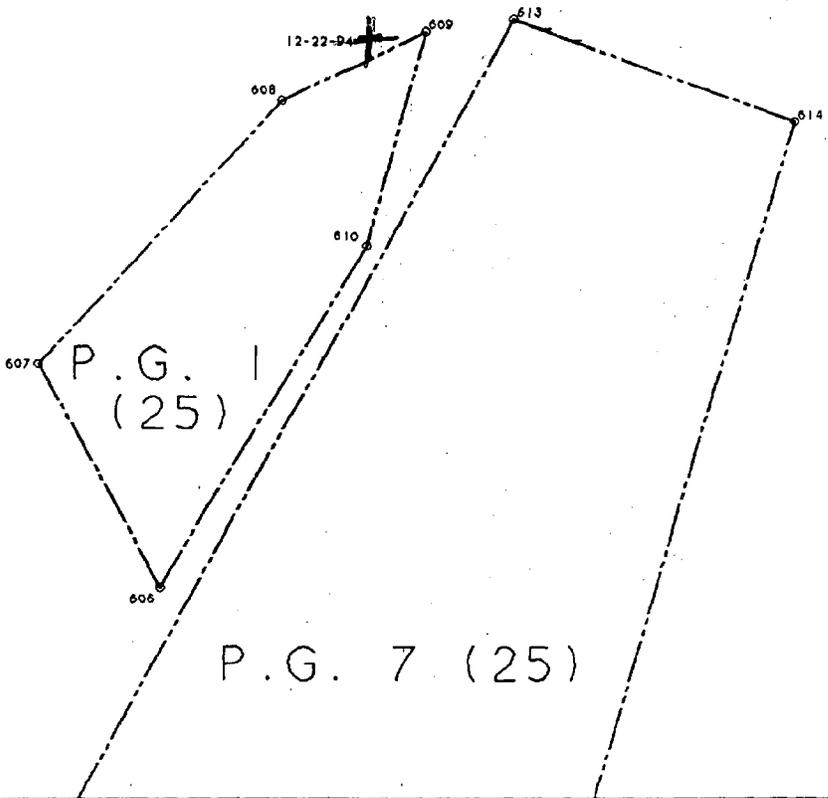
RM 1 - 8291



LONG PT. M.S.F.C.

LONG PT. RM 1

CHINCOTEAGUE BAY  
14-15-17



Appendix II. Benthic invertebrates (number of individuals and biomass) from Spider Crab Bay, (A) before and (B) after dredging. [Major taxa: A=amphipod, B=bivalve, D=decapod, G=gastropod, P=polychaete, O=other.]

(A)

Station	Major Taxa	Species	Number	Wet weight
Plot A, Rep 1	A	Corophium sp.	1	0.036
	A	Ampleisca sp.	10	0.3
	B	unidentified bivalve	1	--
	B	Tellina sp.	10	1.114
	B	Ensis directus or E. minor	189	12.374
	D	Pinnixa sp.	1	0.109
	D	Libinia spp.	2	2.213
	D	Xanthidae	3	2.282
	D	Alpheus heterochelis	9	4.332
	G	Anachis avara	1	0.365
	G	Nassarius vibex	3	3.367
	O	unidentified isopod	1	--
	O	Phoronis sp.	fragments	--
	P	Nereis spp.	fragments	--
	P	unidentified scale worm	fragments	--
	P	Maldanidae	fragments	--
	P	Diopatra cuprea	fragments	--
	P	Pectinaria gouldii	1	0.46
	P	Arabellidae	6	0.958
	P	Glycera sp.	4	1.096
P	Hesionidae	1	--	
Plot A, Rep 2	A	Ampleisca sp.	7	0.274
	A	Corophium sp.	3	0.047

	B	Tellina sp.	7	0.55
	B	Ensis spp.	151	12.53
	D	Upogebia affinis	1	1.662
	D	Xanthidae	2	4.48
	D	Alpheus heterochelis	2	0.94
	G	Odostomia sp.	1	0.049
	G	Anachis avara	3	1.074
	G	Polinices duplicatus	1	0.365
	O	Thyone briareus	1	80.1
	O	Phoronis sp.	1	0.012
	O	Ceriantheopsis americanus	fragment	--
	P	Diopatra cuprea	fragment	--
	P	Nereis succinea	1	0.036
	P	Drilloneis sp.	1	0.111
	P	Glycera sp.	1	0.3
	P	Maldanidae	2	0.083
	P	Sabellaria sp.	1	0.104
Plot A, Rep 3	A	Corophium sp.	1	0.108
	A	Ampleisca sp.	10	0.373
	B	Noetia ponderosa	1	2.53
	B	Tellina sp.	1	0.045
	B	Ensis spp.	178	12.42
	B	Ensis spp. * (note large size)	1	8.344
	B	Tagelus spp.	1	0.07
	D	Xanthidae	2	0.787
	D	Palaemonetes sp.	2	0.531
	D	Libinia emarginata	1	4.108
	D	Upogebia affinis	1	0.989
	D	Alpheus heterochelis	6	2.745
	D	Libinia dubia	1	0.845

	G	<i>Anachis ayara</i>	2	0.569
	O	<i>Thyone briareus</i>	1	56.35
	O	<i>Phoronis</i> sp.	fragments	--
	P	Capitellidae	fragment	--
	P	unidentified scale worm	fragments	0.723
	P	Arabellidae	5	0.886
	P	<i>Glycera</i> sp.	3	0.109
Plot B, Rep 1	A	<i>Corophium</i>	2	0.065
	A	<i>Ampelisca</i> sp.	1	0.032
	B	<i>Macoma phenax</i> ?	1	0.614
	B	<i>Macoma balthica</i> ?	1	0.079
	B	<i>Anadara ovalis</i>	1	87.02
	B	<i>Tellina</i> sp.	28	2.557
	B	<i>Tagelus</i> spp.	5	3.35
	B	<i>Ensis</i> spp.	119	30.533
	D	<i>Upogebia affinis</i>	2	0.49
	D	<i>Libinia dubia</i>	1	0.257
	D	<i>Alpheus heterochelis</i>	3	0.757
	D	<i>Callinassa atlantica</i>	1	2.432
	D	Xanthidae	1	0.689
	G	<i>Turbonilla interrupta</i>	1	0.006
	G	<i>Anachis ayara</i>	3	0.715
	G	<i>Nassarius vibex</i>	1	1.111
	P	Flabelligeridae	1	0.087
	P	Harmothoinae	1	0.345
	P	Arabellidae	5	1.504
	P	<i>Neries succinea</i>	1	0.117
	P	Terebellidae	1	0.108
	P	Maldanidae	3	0.108

Plot B, Rep 2	A	Ampleisca sp.	13	0.604
	A	Corophium sp.	4	0.123
	A	Caprellidae	2	0.019
	B	Ensis spp.	41	4.418
	B	Anadara ovalis	1	4.651
	B	Tellina sp.	26	2.47
	D	Alpheus heterochelis	1	0.208
	D	Libinia emarginata	1	9.561
	D	Pinnixia sp.	2	0.098
	D	Xanthidae	1	1.239
	D	Palaemonetes sp.	1	0.608
	G	Mitrella lunata	2	0.02
	G	Anachis avara	4	1.244
	G	Crepidula plana	1	1.141
	P	Nereis succinea	1	0.018
	P	Maldanidae	fragments	--
	P	Notomastus sp.	2	0.01
	P	Diopatra cuprea	fragment	2.4
	P	Glycera sp.	2	0.082
	P	Sabellidae	1	0.039
Plot B, Rep 3	B	Ensis spp.	18	5.077
	B	Tagelus spp.	1	2.434
	B	Tellina sp.	2	0.191
	B	Anadara ovalis	1	19.348
	D	Libinia sp.	1	0.189
	D	Cancer sp.	1	5.78
	O	Cerebratulus lacteus	fragments	8.03
	P	Maldanidae	fragment	--
	P	Nereis spp.	3	0.082
	P	Arabellidae	3	1.015

	P	Phylodocidae ? (no heads)	fragments	0.99
	P	Glycera sp.	2	0.358
Plot C, Rep 1	D	Alpheus heterochelis	2	0.451
	D	Palaemonetes sp.	1	0.106
	D	Xanthidae	2	1.256
	D	Cancer sp.	1	2.731
	O	Chaetopleura apiculata	1	0.138
	O	Arbacia punctulata	1	6.579
	P	unidentified scale worm	fragments	--
Plot C, Rep 2	A	Ampelisca sp.	4	0.034
	B	Anadara transversa	1	5.56
	B	Ensis spp.	1	0.037
	B	Anadara ovalis	2	43.175
	B	Noetia ponderosa	1	8.824
	D	Alpheus heterochelis	1	0.684
	D	Libinia spp.	1	3.005
	D	Xanthidae	4	1.859
	G	Eupleura caudata	1	0.104
	G	Odostomia impressa	1	0.016
	G	unidentified gastropod	1	--
	G	Anachis avara	3	0.24
	O	Chaetopleura apiculata	4	0.418
	O	Gobiidae	1	0.013
	O	unidentified tunicate	2	--
	P	Hesionidae	2	0.008
	P	Glycera sp.	2	0.146
	P	Nereis spp.	39	6.48
	P	Glycera sp.	1	0.039
	P	unidentified scale worm	fragments	0.428

	P	Arabellidae	fragments	0.137
Plot C. Rep 3	A	Ampelisca sp.	1	0.05
	A	Corophium sp.	1	--
	B	Noetia pondersosa	1	1.68
	B	Anadara ovalis	1	0.286
	D	Alpheus heterochelis	2	0.67
	D	Pagurus annulipes	1	0.323
	D	Cancer sp.	2	9.356
	D	Xanthidae	18	19.347
	D	Libinia emarginata	1	13.712
	D	Pagurus pollicaris	1	4.15
	O	Ectopleura caudata	1	shell only
	O	Chaetopleura apiculata	12	2.4
	O	Astrangia astreiformis ?	fragment	--
	P	Lumbrineridae	12 + frags	0.255
	P	Hesionidae	6	0.122
	P	Arabellidae	1	0.058
Plot D. Rep 2	A	Ampelisca sp.	3	0.034
	B	Mulinia lateralis	1	0.149
	B	Ensis spp	9	0.54
	B	Tellina sp.	24	2.392
	D	Pinnixia sp.	2	0.058
	D	Cancer sp.	2	0.036
	D	tiny hermit crabs in shells	4	--
	D	Xanthidae	2	1.125
	D	Alpheus heterochelis	1	0.611
	G	Anachis avara	13	3.16
	G	Nassarius vibex	2	1.904
	O	Erichsonella sp	2	0.077

	O	Phoronis sp.	2	0.023
	O	Nemertea	1	0.114
	O	Chaetopleura apiculata	1	0.538
	O	unidentified anemone	1	0.063
	P	Diopatra cuprea	fragment	--
	P	Glycera sp.	2	0.141
	P	Arabellidae	3	0.276
Plot D, Rep 3	A	Ampelisca sp.	6	0.012
	B	Tagelus spp.	1	0.035
	B	Anadara transversa	1	0.475
	B	Ensis spp.	2	0.159
	B	Mulinia lateralis	1	0.124
	B	unknown bivalve	2	--
	B	Tellina sp.	18	1.389
	B	Anadara ovalis	1	45.24
	B	Mercenaria mercenaria	2	1.218
	D	Xanthidae	2	0.497
	D	Pinnixia sp.	1	0.029
	G	Nassarius vibex	1	0.999
	G	Anachis avara	2	0.432
	G	Acteocina canaliculata	1	--
	O	Erichsonella attenuata	2	0.108
	O	Thyone briareus	1	22.12
	O	Phoronis sp.	fragments	0.049
	P	unidentified scale worm	fragments	--
	P	Nereis spp.	fragments	0.709
	P	Arabellidae	4	0.183

Appendix II. Benthic invertebrates (number of individuals and biomass) from Spider Crab Bay, (A) before and (B) after dredging. [Major taxa: A=amphipod, B=bivalve, D=decapod, G=gastropod, P=polychaete, O=other.]

(B)

Station	Major Taxa	Species	Number	Wet weight (g)
Plot A, Rep 1	B	Tagelus spp.	11	1.233
	B	Anomia simplex	5	4.628
	B	unidentified bivalve	2	--
	B	Ensis spp.	1	0.123
	D	Pagurus pollicaris	1	2.822
	D	Alpheus heterochelis	2	0.708
	D	Libinia spp.	2	24.304
	D	Xanthidae	11	3.177
	G	Anachis avara	2	0.446
	G	Crepidula fornicata	9	4.174
	O	Arbacia punctulata	1	13.09
	P	Glycera sp.	1	0.085
	P	Arabellidae	fragments	--
	P	Hesionidae	15	0.539
	P	Nereis spp.	21	10.305
	P	Lumbrineridae	14	0.419
	P	unidentified scale worm	fragments	0.422
Plot A, Rep 2	A	Amphipoda	fragments	--
	B	Tagelus spp.	6	0.557
	B	Mulinia lateralis	1	0.073
	B	Anadara transversa	1	0.553
	B	unidentified bivalve	1	--
	B	Ensis spp.	2	2.16
	B	Mercenaria mercenaria	1	0.027

	D	<i>Alpheus heterochelis</i>	1	0.079
	D	<i>Pinnixa</i> sp.	1	0.039
	G	<i>Crepidula fornicata</i>	1	0.26
	G	<i>Anachis avara</i>	2	0.71
	O	unidentified anemone	1	--
	O	<i>Chaetopleura apiculata</i>	1	1.58
	O	<i>Thyone briareus</i>	2	97.55
	O	<i>Phoronis</i> sp.	frags in tubes	0.3
	O	Gobiidae	2	0.346
	P	unidentified scale worm	fragments	0.431
	P	Arabellidae	fragments	0.236
	P	Lumbrineridae	1	0.008
Plot A, Rep 3	A	<i>Ampelisca</i> sp.	1	0.005
	A	Caprellidae	1	--
	B	<i>Tagelus</i> spp.	4	0.267
	B	<i>Anadara ovalis</i>	1	3.81
	D	Xanthidae	3	0.222
	D	<i>Alpheus heterochelis</i>	2	1.041
	G	<i>Crepidula convexa</i>	1	0.18
	G	<i>Anachis avara</i>	6	1.727
	G	<i>Nassarius vibex</i>	1	1.278
	O	Gobiidae	2	0.131
	O	unidentified anemone	1	--
	P	unidentified scale worm	fragments	0.059
	P	<i>Hydroides hexagina</i>	2	0.032
	P	<i>Pectinaria</i> sp.	fragment	--
	P	Arabellidae	fragments	0.685
	P	<i>Nereis</i> spp.	5	0.418
	P	<i>Glycera</i> sp.	2	0.232
	P	Lumbrineridae	fragments	0.089

	P	Cirratulidae	1	0.1
	P	Diopatra cuprea	1	0.16
Plot B, Rep 1	B	Macoma balthica	1	0.218
	B	Mulinia lateralis	1	0.075
	B	unidentified bivalve	1	--
	B	Ensis spp.	3	1.451
	D	Pagurus longicarpus	1	0.077
	D	Xanthidae	1	0.059
	G	Crepidula fornicata	1	0.752
	G	Crepidula convexa	1	0.244
	O	Phoronis sp.	frags in tubes	0.189
	O	Gobiidae	1	0.231
	P	Nereis succinea	3	0.531
	P	Maldanidae	2	0.143
	P	Glycera sp.	1	0.793
Plot B, Rep 2	D	unidentified hermit crab	1	0.035
	D	Upogebia affinis	1	0.106
	G	Crepidula convexa	1	0.094
	G	Nassarius vibex	1	0.996
	G	Anachis avara	1	0.335
	G	Polinices duplicatus	1	0.762
	O	Erichsonella sp.	1	0.033
	O	Phoronis sp.	frags in tubes	1.328
	O	Ceriantheopsis americanus	fragments	--
	O	Gobiidae	1	2.69
	P	Maldanidae	fragments	--
	P	Arabellidae	fragments	--
	P	Glycera sp.	1	0.063

Plot B, Rep 3	B	Ensis spp.	1	0.243
	B	Mercenaria mercenaria	1	275.5
	O	Phoronis sp.	1	0.005
	P	Arabellidae	1	0.081
Plot C, Rep 1	A	Corophium sp.	1	0.027
	B	Anomia simplex	2	12.633
	B	Xanthidae	5	2.726
	B	Macoma balthica	2	0.487
	B	Tagelus spp.	12	2.524
	B	unidentified bivalve	2	--
	B	Mercenaria mercenaria	4	700.28
	B	Noetia ponderosa	1	25.251
	B	Anadara ovalis	1	25.641
	D	Alpheus heterochelis	9	0.563
	D	Libinia emarginata	1	32.074
	D	Cancer spp.	1	2.172
	G	Crepidula fornicata	2	1.709
	G	Eupleura caudata	4	4.63
	O	Gobiidae	4	0.742
	O	Chaetopleura apiculata	1	0.229
	O	Thyone briareus	1	57.92
	P	Capitelidae	1	--
	P	Arabellidae	fragments	1.099
	P	Glycera sp.	fragments	0.148
	P	Nereis spp.	fragments	0.073
Plot C, Rep 2	B	Macoma balthica	7	4.409
	B	Anomia simplex	2	6.128
	B	Noetia ponderosa	2	23.793
	B	Tagelus spp.	1	0.091

	D	<i>Pagurus pollicaris</i>	1	3.357
	D	<i>Pinnixia</i> sp.	1	0.007
	D	<i>Libinia</i> spp.	1	3.27
	D	Xanthidae	26	17.341
	D	<i>Alpheus heterochelis</i>	46	9.295
	D	<i>Cancer irrorata</i>	3	8.426
	G	<i>Crepidula fornicata</i>	1	0.796
	G	<i>Crepidula plana</i>	11	1.135
	G	<i>Odostomia impressa</i>	3	0.085
	G	<i>Mitrella lunata</i>	1	0.009
	O	<i>Chaetopleura apiculata</i>	2	0.306
	O	<i>Arbacia punctulata</i>	1	0.961
	O	<i>Astrangia danae</i>	1 colony	11
	O	Gobiidae	6	0.934
	P	<i>Glycera</i> sp.	1	0.039
	P	Arabellidae	fragments	2.588
	P	unidentified scale worm	fragments	1.431
	P	Lumbrineridae	7	0.111
Plot C, Rep 3	B	<i>Macoma balthica</i>	2	1.034
	B	<i>Anomia simplex</i>	1	17.978
	B	<i>Mercenaria mercenaria</i>	1	190.65
	B	<i>Nucula proxima</i>	2	0.18
	D	<i>Alpheus heterochelis</i>	57	7.33
	D	<i>Heterocrypta granulata</i>	1	0.09
	D	<i>Pagurus longicarpus</i>	1	1.275
	D	Xanthidae	20	15.41
	D	<i>Cancer irroratus</i>	8	28.221
	G	<i>Crepidula fornicata</i>	1	0.615
	G	<i>Eupleura caudata</i>	1	0.965
	G	<i>Crepidula convexa</i>	2	0.236

	G	<i>Anachis ayara</i>	1	0.303
	G	<i>Odostomia impressa</i>	1	0.033
	G	<i>Anachis transversa</i>	1	8.846
	O	<i>Thyone briareus</i>	1	32.293
	O	<i>Chaetopleura apiculata</i>	1	0.179
	O	Gobiidae	2	0.412
	P	Lumbrineridae	2	0.04
	P	Hesionidae	4	2.08
	P	<i>Nereis</i> spp.	33	9.966
	P	unidentified scale worm	7	1.58
	P	Maldanidae	1	0.307
	P	Arabellidae	fragments	1.238
Plot C, Rep 4	B	<i>Tagelus</i> spp.	1	--
	B	unidentified bivalves	3	--
	B	<i>Mercenaria mercenaria</i>	1	108.67
	D	<i>Heterocrypta granulata</i>	1	0.139
	D	<i>Cancer</i> spp.	1	1.59
	D	Xanthidae	12	8.965
	D	<i>Alpheus heterochelis</i>	23	2.567
	D	<i>Libinia</i> spp.	1	2.382
	G	<i>Crepidula convexa</i>	1	0.14
	O	Gobiidae	3	0.35
	P	<i>Nereis</i> spp.	3	1.069
	P	Arabellidae	1	0.144
	P	unidentified scale worm	1	0.211
Plot D, Rep 1	B	<i>Tagelus</i> spp.	1	0.45
	B	<i>Mercenaria mercenaria</i>	2	0.119
	B	<i>Ensis</i> spp.	2	0.079
	B	<i>Mercenaria mercenaria</i>	1	27.602

	B	<i>Tellina</i> sp.	8	0.502
	D	unidentified mud shrimp	fragment	--
	D	Xanthidae	2	0.81
	O	unidentified anemone	1	0.313
Plot D, Rep 2	B	<i>Tagelus</i> spp.	4	0.402
	G	<i>Crepidula convexa</i>	1	0.158
	O	<i>Phoronis</i> sp.	4	--
	P	<i>Nereis</i> spp.	1	0.028
	P	Maldanidae	fragments	0.113
	P	Arabellidae	5	0.77
	P	<i>Upogebia affinis</i>	4	3.03
Plot D, Rep 3	B	<i>Mulinia lateralis</i>	1	0.144
	B	<i>Tagelus</i> spp.	11	2.278
	B	<i>Mercenaria mercenaria</i>	2	54.09
	B	<i>Ensis</i> spp.	3	3.35
	D	Xanthidae	3	0.667
	G	<i>Crepidula fornicata</i>	2	0.26
	G	<i>Busycon canaliculatum</i>	1	0.794
	O	Gobiidae	1	0.13
	P	Arabellidae	fragments	2.887
	P	Hesionidae	5	0.105
	P	Drillonereidae	fragments	--
	P	Maldanidae	2	0.034
	P	<i>Glycera</i> sp.	1	0.207
	P	<i>Nereis</i> spp.	3	1.589
	P	<i>Upogebia affinis</i>	2	0.708
	P	unidentified scale worm	fragments	0.665
	P	<i>Diopatra cuprea</i>	2	1.267
	P	Lumbrineridae	9	0.41

**Appendix III - Clam dredge permits for the seaside of the Eastern Shore,  
September 1994- December 1995.**

Dredger or Agent	Owner	Boat	Plat # (if available)
Fitchett, T.K.	Smith, David Ira	Vicky Lynn(8204L)	61.26
Lescalette, Ronnie	Farlow, Eddie	Vicky Lynn(8204L)	-
Fitchett, T.K.	Smith, David L.	Vicky Lynn	Burton's Bay
Fitchett, T.K.	Mears, Billy	Vicky Lynn	-
Fitchett, T.K.	Farlow, Eddie	Vicky Lynn	-
Fitchett, Thomas K.	Spence, George	Vicky Lynn	-
Fitchett, Thomas K.	Spence, George	Vicky Lynn	-
Smith, David	Farlow, Eddie	Vicky	Burton's Bay
Terry, H.M.	Terry, H.M.	Tug Hames	All Terry Ground
Terry, H.M.	Terry, H.M.	Tug Hames	-
Roberschet, David	Bell, B.L. & Sons	Three Brothers	-
Farlow, Eddie	Farlow, Eddie	Thelma	Burton's Bay
Farlow, John E.	Spence, G.O.	Thelma	-
Farlow, Eddie	Terry, H.M. Co.	Thelma	Paraby Ground
Farlow, Eddie	Spence, George	Thelma	-
Farlow, Eddie	Terry, K.	Thelma	-
Farlow, Eddie	Farlow, Eddie	Thelma	-
Farlow, Eddie	Farlow, Eddie	Thelma	Hog Island Bay
Farlow, Eddie	Robbins, Sam L.	Thelma	-
Farlow, Eddie	Robbins, Sammy	Thelma	-
Farlow, Eddie	Farlow, Eddie	Thelma	Burton's Bay
Farlow, Eddie	Farlow, Eddie	Thelma	69.7
Robins, Sammy	Parks, William T.	Sea Robbin	-
Robbins, Johnnie	Kilmon, Andy	Sea Robbin	-
Robbins, Sammy	Kilmon, Andy	Sea Robbin	-
Robbins, Johnnie	Parks, William T.	Sea Robbin	-
Robbins, Johnnie	Parks, Bill	Sea Robbin	John Mears Rock
Robbins, Johnnie	Curtis, Clifton	Sea Robbin	-
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	250
Robbins, John	Terry, H.M. Co.	Sea Robbin	-
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	-
Robbins, J.	Terry, K.	Sea Robbin	Humps Drain
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	-
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	-
Robbins, John L.	Robbins, John L.	Sea Robbin	250
Robbins, Johnny	Kilmon, Andy	Sea Robbin	-
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	77
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	-
Robbins, Johnnie	Robbins, Johnnie	Sea Robbin	250

Dredger or Agent	Owner	Boat	Plat # (if available)
Robbins, Johnnie	Robbins, Samuel	Sea Robbin	-
Brady, Walter Lee	Brady, Annie	Sea Gull	16432/149.76
Brady, Walter Lee	Brady, Walter Lee	Sea Gull	16338/16820
Brady, Walter	Brady, Walter	Sea Gull	South Bay
Brady, Walter	Brady, Walter	Sea Gull	100
Brady, Walter	Brady, Walter	Sea Gull	100
Brady, Walter	Brady, Walter	Sea Gull	149
Smith, David, Jr.	Terry & Co. (Pete)	Sabatage (3084AL)	-
Smith, David, Jr.	Spence, George	Sabatage (3084AL)	-
Smith, David, Jr.	Robbins, Sammy	Sabatage (3084AL)	-
Smith, David Ira	Smith, David Ira	Sabatage (3084AL)	-
Smith, David, Jr.	Robbins, Sammy	Sabatage (3084AL)	-
Smith, David I., Jr.	Terry, H. M. Co.	Sabatage (3084AL)	-
Smith, David, Jr.	Spencer, George	Sabatage (3084AL)	-
Smith, David Ira, Jr.	Mears, Billy	Sabatage (3084AL)	-
Blanchard, Joseph	Parks, William T.	Phobe-Jo	-
Smith, David I., Sr.	Terry, H. M. Co.	Penny	Brant Hill
Smith, David I., Sr.	Smith, David I., Sr.	Penny	Burtons Bay
Smith, David	Lewis, Randy	Penny	-
Smith, David Ira, Sr.	Smith, David Ira, Sr.	Penny	207.38
Smith, David L., Jr.	Smith, David I., Sr.	Penny	-
Smith, David	Farlow, Eddie	Penny	-
Smith, David I., Sr.	Farlow, Eddie	Penny	-
Smith, David I.	Terry, K. S. Co.	Penny	-
Smith, David I., Sr.	Smith, David I., Sr.	Penny	Burtons Bay
Smith, David	Smith, David	Penny	10.33
Hamblin, John Larry	Hamblin, John Larry	Peggy Sue	-
Hamblin, Larry	Hamblin, Larry	Peggy Sue	Hog Island Bay
Hamblin, Larry	Hamblin, Larry	Peggy Sue	Hog Island Bay
Spady, Randy	McCready, Winfred	Miss Beth	10526 to 10530
Hancock, C. B.	Parks, William T.	Maria-Lynn	-
Parks, William T.	Parks, William T.	Lynn	74.2
Parks, Billy	Robbins, Johnnie	Lynn	-
Parks, William T.	Parks, William T.	Lynn	248.11
Park, William	Robbins, Samuel	Lynn	-
Parks, Billy	Robbins, Johnnie	Lynn	-
Parks, Bill	Terry, H. M. Co.	Lynn	North Ch/Brant Will
Parks, Bill	Curtis, Clifton Lynn	-	-
Parks, William T.	Robbins, Sanuel	Lynn	-
Parks, William (Bill)	Parks, William (Bill)	Lynn	74.20
Parks, William T.	Parks, William T.	Lynn	248.11

Dredger or Agent	Owner	Boat	Plat # (if available)
Parks, William T.	Parks, William T.	Lynn	249.11
Parks, Billy	Kilmon, Andy	Lynn	-
Parks, Bill	Terry, H. M. Co.	Lynn	-
Parks, Billy	Kilmon, Andy	Lynn	-
Parks, B.	Terry, K.	Kathy	-
Curtis, James	Curtis, James	Joasha (1705)	-
Curtis, James	Curtis, James	Joasha (1705)	45
Drewer, H. V. & Son	Drewer, H. V. & Son	Harvey Drewer	36/Seal Creek
Curtis, James	Curtis, James	Francis (7914)	-
Curtis, James	Curtis, James	Francis (7914)	13841/35.21
Curtis, James	Curtis, James	Frances	7914/22.81
Mears, Billy	Curtis, James	Frances	36
Mears, Billy	Bell, B. L. & Sons	Denise	Swash Bay
Edwards, Douglas	Bell, B. L. & Sons	Denise	Gull Marsh/441.73
Hamblin, Larry	Justis, Benny	Christina	Map 245-2760
Hamblin, Larry	Hamblin, Larry	Capt. Jim	-
Hall, Billy	Hamblin, Larry	Capt. Jim	Hog Island Bay
Spady, Leonard R.	Hall, George E.	Billy Crystal	-
Spady, Leonard R.	McCready, J. Steve	Betty	16624
Spady, Leonard R.	Spady, Leonard R.	Betty	-
Parks, William T.	Bell, B. L. & Sons	Betty	250
Justis, Wayne C.	Robbins, John L.	Becky Lynn	-
Justis, Wayne	Justis, Wayne C.	Becky	-
Justis, Wayne C.	Justis, Wayne	Becky	60
Bowen, Robert L.	Justis, Wayne C.	Becky	60
Parks, Bobbie L.	Bowen, Robert L.	Becky	65/Metompkin
Schultz, David	Justis, Clay	Annie B. (9106)	All Bowen Ground
Bowen, Robert L.	Bell, B. L. & Sons	Ann	-
Booker, Grayson	Bowen, Robert L.	9470B	-
Booker, Grayson	Scott, M. S., Jr.	910L	-
Parks, John Dale	Parsons, George F.	8433P	-
Parks, John Dale	Justis, Benny	8433P	-
Bundick, Robert	Parks, John Dale	6320HH	-
Bundick, John	Bundick, Robert	6320HH	-
Pruitt, Morris	Bundick, John	5745EE	50/Metompkin
Pruitt, Morris	Pruitt, Morris	5745EE	3.51
Curtis, Clifton	Pruitt, Morris	4352ZZ	21.8
Marshall, William	Curtis, Clifton	4325ZZ	-
Porter, Don	Marshall, William	3153KK	-
Bell, Tim	Drewer, H. V. & Son	3093R	-
	Bell, B. L. & Sons	1151TT	-
		4855	-

Dredger or Agent	Owner	Boat	Plat # (if available)
Roberschets, Dave	Bell, B. L.		Drum Hole
Reid, Jeffrey	Reid, Jeffrey		16804
William, Ray	Scott, M.		-
Dise, John	Parker, Alvin S., Sr.		-
Reid, Jeffrey	Reid, Jeffrey		15735

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