

QB
275
. U35
no. 305
1953

U. S. Department of Commerce

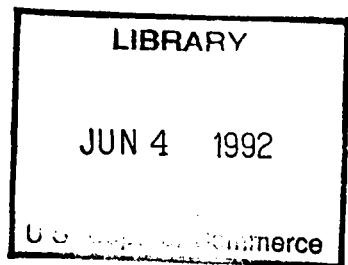
Sinclair Weeks, Secretary

Coast and Geodetic Survey

Robert F. A. Studds, Director

Special Publication No. 305

**PLANE COORDINATE PROJECTION TABLES
DELAWARE**



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1953

National Oceanic and Atmospheric Administration

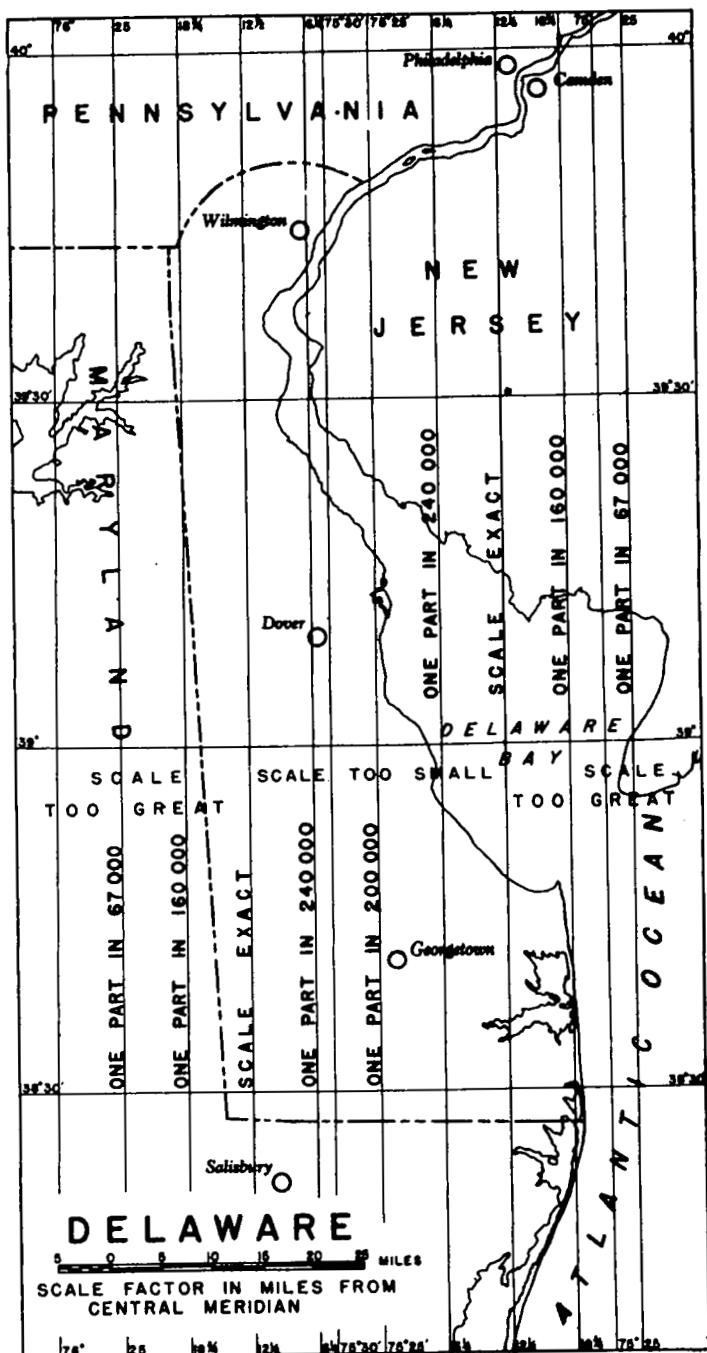
ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

- Discolored pages
- Faded or light ink
- Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the Climate Database Modernization Program, National Climate Data Center (NCDC). To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or www.reference@nodc.noaa.gov.

LASON
Imaging Contractor
12200 Kiln Court
Beltsville, MD 20704-1387
January 1, 2006



Foreword

The plane coordinate system used in this State is based on the transverse Mercator projection using a reduced scale for the central meridian of the zone. The tables in this publication are to be used for the conversion of geographic positions to plane coordinates or plane coordinates to geographic positions. The constants of the projection are listed with the tables.

The methods of computation have been designed for machine calculation. All of the functions that are required are given in this publication.

The formulas and sample computations which follow show the general methods for computing either type of coordinates.

Plane coordinates from geographic positions

$$x = x' + 500,000$$

$$x' = H \cdot \Delta\lambda'' \pm a b$$

$$y = y_0 + v \left(\frac{\Delta\lambda''}{100} \right)^2 \pm c$$

Grid azimuth = geodetic azimuth - $\Delta\alpha$ - second term

$$\Delta\alpha'' = \Delta\lambda'' \sin \phi + g$$

where

y_0 , H , V , and a are based on the latitude
of the geographic position,

and

b , c , and g are based on $\Delta\lambda''$.

$$\Delta\lambda'' = \text{Central Meridian} - \lambda$$

and

$\Delta\alpha''$ is the convergence of the meridian at the station with respect to the Central Meridian.

The second term for the reduction of geodetic to grid azimuths may be neglected for most work. However, for lines five miles or more in length if the same degree of accuracy is desired as is obtained by geographic computations, this term should be evaluated and used.

$$\text{Second term} = \frac{(y_2 - y_1) (2x'_1 + x'_2)}{(6 \rho_o^2 \sin l'') g}$$

Geographic positions from plane coordinates

$$P (x'/10,000)^2 + d = v (\Delta\lambda''/100)^2 + c$$

$$y_o = y - P (x'/10,000)^2 - d$$

Obtain the latitude from the table of y_o .

Use latitude to obtain H from the table.

$$x' = x - 500,000$$

$$\text{approximate } \Delta\lambda'' = x' \div H.$$

Determine a from latitude and b from approximate $\Delta\lambda$ then

$$\Delta\lambda'' = (x' + a b) \div H$$

$$\Delta\alpha'' = Mx'.$$

PLANE COORDINATES ON TRANSVERSE MERCATOR PROJECTION
(Condensed form for calculating-machine computation)

State Delaware Zone — Central meridian $75^{\circ} 25' 00.00''$

Station	<u>Fleming, 1933</u>	<u>Swedesboro (N.J.), 1933</u>			
ϕ	<u>$39^{\circ} 21' 15.214''$</u>	<u>$39^{\circ} 45' 14.765''$</u>			
λ	<u>$75^{\circ} 33' 00.748''$</u>	<u>$75^{\circ} 19' 01.889''$</u>			
$\Delta\lambda = \text{Central mer.} - \lambda$	<u>$-0^{\circ} 08' 00.748''$</u>	<u>$+0^{\circ} 05' 58.111''$</u>			
$\Delta\lambda''$	<u>-480.748</u>	<u>$+358.111$</u>			
$\left(\frac{\Delta\lambda''}{100}\right)^2$	<u>23.112</u>	<u>12.824</u>			
H	<u>78.553 799</u>	<u>78.104 042</u>			
V	<u>1.207 625</u>	<u>1.210 899</u>			
a	<u>-0.797</u>	<u>+0.573</u>	<u>-0.737</u>	<u>+0.429</u>	
$x' = H \cdot \Delta\lambda \pm ab$	<u>-37,764.13</u>	<u>+27,969.60</u>			
$V \left(\frac{\Delta\lambda''}{100}\right)^2 \pm c$	<u>27.91</u>	<u>15.53</u>			
Tabular y	<u>493,200.96</u>	<u>638,855.31</u>			
x	<u>462,235.87</u>	<u>527,969.60</u>			
y	<u>493,228.87</u>	<u>638,870.84</u>			
$\Delta\alpha''$	<u>-304.85</u>	<u>+229.01</u>			
$\Delta\alpha$	<u>-0 05 04.8</u>	<u>+0 03 49.0</u>			
Geod. Az. to Az. Mk.	<u>335 34 08.8</u>	<u>279 50 22.2</u>			
Grid Az. to Az. Mk.	<u>335 39 14</u>	<u>279 46 33</u>			

$$x = x' + 500,000$$

$$y = \text{Tab. } y + V \left(\frac{\Delta\lambda''}{100} \right)^2 \pm c$$

$$\Delta\alpha'' = \Delta\lambda'' \cdot \sin \phi + g$$

$$\text{Grid Az.} = \text{Geod. Az.} - \Delta\alpha$$

H and $V = \text{Tab. } H$ and $\text{Tab. } V$.

When ab is $-$, decrease $H \cdot \Delta\lambda$ numerically.
 $+$ increase

g increases $\Delta\lambda'' \cdot \sin \phi$ numerically.

GEODETIC POSITIONS FROM TRANSVERSE MERCATOR COORDINATES
(CALCULATING MACHINE COMPUTATION)

STATE - ZONE Delaware

Station Fleming, 1933

X	462,235.87	Y	493,228.87
C	- 500,000.00	$P\left(\frac{X'}{10,000}\right)^2 + d$	- 27.91
X'	- 37,764.13	Y_o	493,200.96
P	1.95678	Approx. $\Delta\lambda = X' \div H$	- 481"
d	0.00	$\Delta\lambda = (X' + ab) \div H$	- 480."748
H	78.553 799	$\Delta\lambda$	- 0° 08' 00."748
a b	- 0.797 +0.573	Central Meridian	75 25 00.000
φ	39° 21' 15".214	$\lambda = C.M. - \Delta\lambda$	75° 33' 00."748

Station Swedesboro (N.J.), 1933

X	527,969.60	Y	638,870.84
C	- 500,000.00	$P\left(\frac{X'}{10,000}\right)^2 + d$	- 15.53
X'	+ 27,969.60	Y_o	638,855.31
P	1.98475	Approx. $\Delta\lambda = X' \div H$	+358"
d	0.00	$\Delta\lambda = (X' + ab) \div H$	+358."/111
H	78.104 042	$\Delta\lambda$	+0° 05' 58."/111
a b	- 0.737 +0.429	Central Meridian	75 25 00.000
φ	39° 45' 14".765	$\lambda = C.M. - \Delta\lambda$	75° 19' 01."889

Station

X		Y	
C	-	$P\left(\frac{X'}{10,000}\right)^2 + d$	-
X'		Y_o	"
P		Approx. $\Delta\lambda = X' \div H$	"
d		$\Delta\lambda = (X' + ab) \div H$	"
H		$\Delta\lambda$	° ′ ″
a b		Central Meridian	
φ	° ′ ″	$\lambda = C.M. - \Delta\lambda$	° ′ ″

Station

X		Y	
C	-	$P\left(\frac{X'}{10,000}\right)^2 + d$	-
X'		Y_o	"
P		Approx. $\Delta\lambda = X' \div H$	"
d		$\Delta\lambda = (X' + ab) \div H$	"
H		$\Delta\lambda$	° ′ ″
a b		Central Meridian	
φ	° ′ ″	$\lambda = C.M. - \Delta\lambda$	° ′ ″

When ab is $+$, decrease X' numerically
 $-$, increase X' numerically

Constants for Delaware

Central Meridian	75° 25' 00":000
log R	-21.7
Scale reduction (Central Meridian)	1 : 200,000
$\log\left(\frac{1}{6\rho_0^2}\right)_g$	4.581 0907 -20
$\log\left(\frac{1}{6\rho_0^2 \sin l''}\right)_g$	9.895 5158 -20
$\left(\frac{1}{6\rho_0^2 \sin l''}\right)_g$	0.7862×10^{-10}

**TRANSVERSE MERCATOR PROJECTION
DELAWARE**

Lat.	y _o feet	Δy _o per second	H	ΔH per second	V	ΔV per second	a
38 0 0	0.00	101.153 17	80.048 286	302.01	1.194 789	2.90	-1.000
38 0 1	6 069.19	101.153 50	80.030 165	302.15	1.194 963	2.90	- .998
38 0 2	12 138.40	101.154 00	80.012 036	302.25	1.195 137	2.90	- .995
38 0 3	18 207.64	101.154 17	79.993 901	302.36	1.195 311	2.88	- .993
38 0 4	24 276.89	101.154 50	79.975 759	302.46	1.195 484	2.88	- .990
38 0 5	30 346.16	101.154 67	79.957 611	302.60	1.195 657	2.86	- .988
38 0 6	36 415.44	101.155 00	79.939 455	302.70	1.195 829	2.86	- .985
38 0 7	42 484.74	101.155 33	79.921 293	302.81	1.196 001	2.85	- .983
38 0 8	48 554.06	101.155 67	79.903 124	302.93	1.196 172	2.85	- .980
38 0 9	54 623.40	101.155 83	79.884 948	303.05	1.196 343	2.85	- .978
38 1 0	60 692.75	101.156 17	79.866 765	303.16	1.196 514	2.83	- .975
38 1 1	66 762.12	101.156 50	79.848 575	303.26	1.196 684	2.83	- .973
38 1 2	72 831.51	101.156 83	79.830 379	303.38	1.196 854	2.81	- .970
38 1 3	78 900.92	101.157 00	79.812 176	303.50	1.197 023	2.81	- .968
38 1 4	84 970.34	101.157 33	79.793 966	303.61	1.197 192	2.81	- .965
38 1 5	91 039.78	101.157 67	79.775 749	303.71	1.197 361	2.80	- .963
38 1 6	97 109.24	101.158 00	79.757 526	303.85	1.197 529	2.80	- .960
38 1 7	103 178.72	101.158 17	79.739 295	303.95	1.197 697	2.78	- .958
38 1 8	109 248.21	101.158 50	79.721 058	304.05	1.197 864	2.78	- .955
38 1 9	115 317.72	101.158 83	79.702 815	304.18	1.198 031	2.78	- .953
38 2 0	121 387.25	101.159 17	79.684 564	304.28	1.198 198	2.76	- .950
38 2 1	127 456.80	101.159 33	79.666 307	304.41	1.198 364	2.76	- .948
38 2 2	133 526.36	101.159 67	79.648 042	304.51	1.198 530	2.76	- .945
38 2 3	139 595.94	101.160 00	79.629 771	304.61	1.198 696	2.75	- .943
38 2 4	145 665.54	101.160 33	79.611 494	304.75	1.198 861	2.73	- .940
38 2 5	151 735.16	101.160 50	79.593 209	304.85	1.199 025	2.73	- .938
38 2 6	157 804.79	101.160 83	79.574 918	304.96	1.199 189	2.73	- .935
38 2 7	163 874.44	101.161 17	79.556 620	305.06	1.199 353	2.73	- .933
38 2 8	169 944.11	101.161 50	79.538 316	305.20	1.199 517	2.70	- .930
38 2 9	176 013.80	101.161 83	79.520 004	305.30	1.199 679	2.71	- .928
38 3 0	182 083.50	101.162 00	79.501 686	305.41	1.199 842	2.70	- .925
38 3 1	188 153.22	101.162 33	79.483 361	305.53	1.200 004	2.70	- .923
38 3 2	194 222.96	101.162 50	79.465 029	305.63	1.200 166	2.68	- .920
38 3 3	200 292.71	101.163 00	79.446 691	305.75	1.200 327	2.68	- .918
38 3 4	206 362.49	101.163 17	79.428 346	305.86	1.200 488	2.66	- .915
38 3 5	212 432.28	101.163 50	79.409 994	305.98	1.200 648	2.66	- .913
38 3 6	218 502.09	101.163 67	79.391 635	306.08	1.200 808	2.66	- .910
38 3 7	224 571.91	101.164 17	79.373 270	306.20	1.200 968	2.65	- .908
38 3 8	230 641.76	101.164 33	79.354 898	306.31	1.201 127	2.65	- .905
38 3 9	236 711.62	101.164 67	79.336 519	306.43	1.201 286	2.63	- .903
38 4 0	242 781.50	101.164 83	79.318 133	306.55	1.201 444	2.63	- .900
38 4 1	248 851.39	101.165 00	79.299 740	306.65	1.201 602	2.63	- .898
38 4 2	254 921.31	101.165 33	79.281 341	306.76	1.201 760	2.61	- .895
38 4 3	260 991.24	101.165 50	79.262 935	306.88	1.201 917	2.61	- .893
38 4 4	267 061.19	101.166 00	79.244 522	306.98	1.202 074	2.60	- .890
38 4 5	273 131.15	101.166 50	79.226 103	307.10	1.202 230	2.60	- .888
38 4 6	279 201.14	101.166 67	79.207 677	307.21	1.202 386	2.60	- .885
38 4 7	285 271.14	101.167 00	79.189 244	307.33	1.202 542	2.58	- .883
38 4 8	291 341.16	101.167 33	79.170 804	307.43	1.202 697	2.58	- .880
38 4 9	297 411.20	101.167 50	79.152 358	307.55	1.202 852	2.56	- .878
38 5 0	303 481.25	101.167 83	79.133 905	307.66	1.203 006	2.56	- .875
38 5 1	309 551.32	101.168 17	79.115 445	307.76	1.203 160	2.56	- .873
38 5 2	315 621.41	101.168 50	79.096 979	307.86	1.203 314	2.55	- .870
38 5 3	321 691.52	101.168 67	79.078 506	308.00	1.203 467	2.55	- .868
38 5 4	327 761.64	101.169 00	79.060 026	308.11	1.203 620	2.53	- .865
38 5 5	333 831.78	101.169 33	79.041 539	308.21	1.203 772	2.53	- .863
38 5 6	339 901.94	101.169 67	79.023 046	308.33	1.203 924	2.53	- .860
38 5 7	345 972.12	101.170 83	79.004 546	308.45	1.204 076	2.51	- .858
38 5 8	352 042.31	101.170 33	78.986 039	308.56	1.204 227	2.51	- .855
38 5 9	358 112.53	101.170 50	78.967 525	308.66	1.204 378	2.50	- .853
39 0 0	364 182.76		78.949 005		1.204 528		- .850

**TRANSVERSE MERCATOR PROJECTION
DELAWARE**

Lat.	y _o feet	Δy _o per second	H	ΔH per second	V	ΔV per second	a
39 0 0	364 182.76	101.170 83	78.949 005	308.78	1.204 528	2.50	-.850
39 0 1	370 253.01	101.171 00	78.930 478	308.90	1.204 678	2.48	-.848
39 0 2	376 323.27	101.171 33	78.911 944	309.00	1.204 827	2.48	-.845
39 0 3	382 393.55	101.171 67	78.893 404	309.13	1.204 976	2.48	-.843
39 0 4	388 463.85	101.172 00	78.874 856	309.21	1.205 125	2.46	-.840
39 0 5	394 534.17	101.172 33	78.856 303	309.35	1.205 273	2.46	-.838
39 0 6	400 604.51	101.172 50	78.837 742	309.45	1.205 421	2.45	-.835
39 0 7	406 674.86	101.172 83	78.819 175	309.56	1.205 568	2.45	-.833
39 0 8	412 745.23	101.173 17	78.800 601	309.68	1.205 715	2.45	-.830
39 0 9	418 815.62	101.173 33	78.782 020	309.78	1.205 862	2.43	-.828
39 1 0	424 886.02	101.173 83	78.763 433	309.90	1.206 008	2.43	-.825
39 1 1	430 956.45	101.174 00	78.744 839	310.01	1.206 154	2.41	-.823
39 1 2	437 026.89	101.174 33	78.726 238	310.11	1.206 299	2.41	-.820
39 1 3	443 097.35	101.174 50	78.707 631	310.23	1.206 444	2.40	-.818
39 1 4	449 167.82	101.175 00	78.689 017	310.33	1.206 588	2.41	-.815
39 1 5	455 238.32	101.175 17	78.670 397	310.46	1.206 733	2.38	-.813
39 1 6	461 308.83	101.175 50	78.651 769	310.56	1.206 876	2.40	-.810
39 1 7	467 379.36	101.175 83	78.633 135	310.68	1.207 020	2.36	-.808
39 1 8	473 449.91	101.176 00	78.614 494	310.78	1.207 162	2.38	-.805
39 1 9	479 520.47	101.176 33	78.595 847	310.90	1.207 305	2.36	-.803
39 2 0	485 591.05	101.176 57	78.577 193	311.01	1.207 447	2.36	-.800
39 2 1	491 661.65	101.177 00	78.558 532	311.11	1.207 589	2.35	-.798
39 2 2	497 732.27	101.177 17	78.539 865	311.23	1.207 730	2.35	-.795
39 2 3	503 802.90	101.177 67	78.521 191	311.35	1.207 871	2.35	-.793
39 2 4	509 873.56	101.177 33	78.502 510	311.46	1.208 012	2.33	-.790
39 2 5	515 944.23	101.178 00	78.483 822	311.56	1.208 152	2.31	-.788
39 2 6	522 014.91	101.178 50	78.465 128	311.68	1.208 291	2.33	-.785
39 2 7	528 085.62	101.178 67	78.446 427	311.78	1.208 431	2.31	-.783
39 2 8	534 156.34	101.179 00	78.427 720	311.90	1.208 570	2.30	-.780
39 2 9	540 227.08	101.179 33	78.409 006	312.01	1.208 708	2.30	-.778
39 3 0	546 297.84	101.179 67	78.390 285	312.13	1.208 846	2.30	-.775
39 3 1	552 368.62	101.179 83	78.371 557	312.25	1.208 984	2.28	-.773
39 3 2	558 439.41	101.180 17	78.352 823	312.33	1.209 121	2.26	-.770
39 3 3	564 510.22	101.180 50	78.334 083	312.46	1.209 257	2.28	-.768
39 3 4	570 581.05	101.180 83	78.315 335	312.56	1.209 394	2.26	-.765
39 3 5	576 651.90	101.181 00	78.296 581	312.68	1.209 530	2.25	-.763
39 3 6	582 722.76	101.181 33	78.277 820	312.78	1.209 665	2.25	-.760
39 3 7	588 793.64	101.181 67	78.259 053	312.90	1.209 800	2.25	-.758
39 3 8	594 864.54	101.182 00	78.240 279	313.01	1.209 935	2.23	-.755
39 3 9	600 935.46	101.182 17	78.221 498	313.11	1.210 069	2.23	-.753
39 4 0	607 006.39	101.182 50	78.202 711	313.23	1.210 203	2.23	-.750
39 4 1	613 077.34	101.183 00	78.183 917	313.33	1.210 337	2.21	-.748
39 4 2	619 148.32	101.183 17	78.165 117	313.46	1.210 470	2.21	-.745
39 4 3	625 219.31	101.183 33	78.146 309	313.56	1.210 603	2.20	-.743
39 4 4	631 290.31	101.183 67	78.127 495	313.66	1.210 735	2.20	-.740
39 4 5	637 361.33	101.184 00	78.108 675	313.78	1.210 867	2.18	-.738
39 4 6	643 432.37	101.184 33	78.089 848	313.90	1.210 998	2.18	-.735
39 4 7	649 503.43	101.184 67	78.071 014	314.00	1.211 129	2.18	-.733
39 4 8	655 574.51	101.184 83	78.052 174	314.11	1.211 260	2.16	-.730
39 4 9	661 645.60	101.185 17	78.033 327	314.23	1.211 390	2.16	-.728
39 5 0	667 716.71	101.185 50	78.014 473	314.33	1.211 520	2.15	-.725
39 5 1	673 787.84	101.185 83	77.995 613	314.46	1.211 649	2.15	-.723
39 5 2	679 858.99	101.186 17	77.976 745	314.55	1.211 778	2.15	-.720
39 5 3	685 930.16	101.186 33	77.957 872	314.68	1.211 907	2.13	-.718
39 5 4	692 001.34	101.186 67	77.938 991	314.76	1.212 035	2.13	-.715
39 5 5	698 072.54	101.186 83	77.920 105	314.90	1.212 163	2.11	-.713
39 5 6	704 143.75	101.187 33	77.901 211	315.00	1.212 290	2.11	-.710
39 5 7	710 214.99	101.187 50	77.882 311	315.11	1.212 417	2.10	-.708
39 5 8	716 286.24	101.187 83	77.863 404	315.21	1.212 543	2.10	-.705
39 5 9	722 357.51	101.188 17	77.844 491	315.33	1.212 669	2.10	-.703
40 0 0	728 428.80		77.825 571		1.212 795		-.700

**TRANSVERSE MERCATOR PROJECTION
DELAWARE**

Lat.	y. feet	Δy. per second	H	ΔH per second	V	ΔV per second	a
40 00	728 428.80	101.188 50	77.825 571	315.43	1.212 795	2.08	-.700
40 01	734 500.11	101.188 67	77.806 645	315.56	1.212 920	2.08	-.698
40 02	740 571.43	101.189 00	77.787 711	315.65	1.213 045	2.08	-.695
40 03	746 642.77	101.189 33	77.768 772	315.78	1.213 170	2.06	-.693
40 04	752 714.13	101.189 67	77.749 825	315.86	1.213 294	2.06	-.690
40 05	758 785.51	101.189 83	77.730 873	316.00	1.213 418	2.05	-.688
40 06	764 856.90	101.190 17	77.711 913	316.10	1.213 541	2.05	-.685
40 07	770 928.31	101.190 50	77.692 947	316.21	1.213 664	2.03	-.683
40 08	776 999.74	101.190 83	77.673 974	316.31	1.213 786	2.03	-.680
40 09	783 071.19	101.191 17	77.654 995	316.43	1.213 908	2.03	-.678
40 10	789 142.66		77.636 009		1.214 030		-.675

TRANSVERSE MERCATOR PROJECTION
DELAWARE

$\Delta\lambda''$	b	Δb	c	$\Delta\lambda''$	b	Δb	c
0	0.000	+0.120	0.000	2600	+1.843	-0.038	-0.061
100	+0.120	+0.120	0.000	2700	+1.805	-0.051	-0.062
200	+0.240	+0.120	-0.001	2800	+1.754	-0.063	-0.062
300	+0.360	+0.119	-0.002	2900	+1.691	-0.077	-0.063
400	+0.479	+0.116	-0.003	3000	+1.614	-0.093	-0.062
500	+0.595	+0.115	-0.004	3100	+1.521	-0.107	-0.061
600	+0.710	+0.112	-0.006	3200	+1.414	-0.122	-0.059
700	+0.822	+0.109	-0.008	3300	+1.292	-0.136	-0.056
800	+0.931	+0.106	-0.010	3400	+1.156	-0.152	-0.052
900	+1.037	+0.102	-0.012	3500	+1.004	-0.167	-0.047
1000	+1.139	+0.097	-0.015	3600	+0.837	-0.184	-0.040
1100	+1.236	+0.093	-0.018	3700	+0.653	-0.200	-0.032
1200	+1.329	+0.087	-0.021	3800	+0.453	-0.218	-0.023
1300	+1.416	+0.081	-0.024	3900	+0.235	-0.235	-0.012
1400	+1.497	+0.075	-0.028	4000	0.000	-0.253	0.000
1500	+1.572	+0.068	-0.032	4100	-0.253	-0.272	+0.017
1600	+1.640	+0.061	-0.035	4200	-0.525	-0.291	+0.034
1700	+1.701	+0.053	-0.038	4300	-0.816	-0.311	+0.052
1800	+1.754	+0.045	-0.041	4400	-1.127	-0.331	+0.072
1900	+1.799	+0.036	-0.045	4500	-1.458	-0.351	+0.094
2000	+1.835	+0.027	-0.049	4600	-1.809	-0.372	+0.118
2100	+1.862	+0.017	-0.052	4700	-2.181	-0.394	+0.144
2200	+1.879	+0.007	-0.055	4800	-2.575	-0.415	+0.172
2300	+1.886	-0.002	-0.057	4900	-2.990	-0.438	+0.202
2400	+1.884	-0.015	-0.059	5000	-3.428		+0.234
2500	+1.869	-0.026	-0.060				

$$F = 7.42 \times 10^{-13}$$

TRANSVERSE MERCATOR PROJECTION

TABLE FOR g

$$\Delta\alpha'' = \sin \phi (\Delta\lambda'') + g$$

Latitude	$\Delta\lambda''$						
	0"	1000"	2000"	3000"	4000"	5000"	6000"
24°	0.00	0.00	0.02	0.07	0.17	0.33	0.58
25	0	0	0.02	0.07	0.17	0.34	0.59
26°	0.00	0.00	0.02	0.08	0.18	0.35	0.60
27	0	0	0.02	0.08	0.18	0.35	0.61
28	0	0	0.02	0.08	0.18	0.36	0.62
29	0	0	0.02	0.08	0.19	0.37	0.63
30	0	0	0.02	0.08	0.19	0.37	0.64
31°	0.00	0.00	0.02	0.08	0.19	0.37	0.64
32	0	0	0.02	0.08	0.19	0.38	0.65
33	0	0	0.02	0.08	0.19	0.38	0.65
34	0	0	0.02	0.08	0.19	0.38	0.65
35	0	0	0.02	0.08	0.19	0.38	0.65
36°	0.00	0.00	0.02	0.08	0.19	0.38	0.65
37	0	0	0.02	0.08	0.19	0.38	0.65
38	0	0	0.02	0.08	0.19	0.38	0.65
39	0	0	0.02	0.08	0.19	0.37	0.64
40	0	0	0.02	0.08	0.19	0.37	0.64
41°	0.00	0.00	0.02	0.08	0.19	0.37	0.63
42	0	0	0.02	0.08	0.18	0.36	0.63
43	0	0	0.02	0.08	0.18	0.36	0.62
44	0	0	0.02	0.08	0.18	0.35	0.61
45	0	0	0.02	0.08	0.18	0.35	0.60
46°	0.00	0.00	0.02	0.07	0.17	0.34	0.59
47	0	0	0.02	0.07	0.17	0.33	0.58
48	0	0	0.02	0.07	0.17	0.33	0.56
49	0	0	0.02	0.07	0.16	0.32	0.55
50	0.00	0.00	0.02	0.07	0.16	0.31	0.54

$$g = \left[\frac{C (\sin 1'') \cos^3 \phi}{2A^2} + F \right] (\Delta\lambda'')^3$$

A, C and F are position factors.

Y CORRECTION FOR COMPUTATION OF GEOGRAPHIC
POSITIONS FROM PLANE COORDINATES
TRANSVERSE MERCATOR PROJECTION, DELAWARE

$$P(x'/10,000)^2 + d = V(\Delta Y/100)^2 + c$$

P taken out for y-coordinate
d taken out for x'

V	P	ΔP	x'	d
0	1.86437	1846	0	0.00
100,000	1.88283	1860	50,000	0.00
200,000	1.90143	1873	100,000	0.00
300,000	1.92016	1888	150,000	0.00
400,000	1.93904	1903		
500,000	1.95807	1917		
600,000	1.97724	1933		
700,000	1.99657			

TRANSVERSE MERCATOR PROJECTION

Delaware

$$\Delta\alpha = Mx'$$

y	M	ΔM
0	0.007 6911	762
100,000	0.007 7673	767
200,000	0.007 8440	773
300,000	0.007 9213	779
400,000	0.007 9992	785
500,000	0.008 0777	791
600,000	0.008 1568	797
700,000	0.008 2365	804
800,000	0.008 3169	

TRANSVERSE MERCATOR PROJECTION
DELAWARE

x' (feet)	Scale in units of 7th place of logs	Scale expressed as a ratio
0	-21.7	0.9999950
5,000	-21.6	0.9999950
10,000	-21.2	0.9999951
15,000	-20.6	0.9999953
20,000	-19.7	0.9999955
25,000	-18.6	0.9999957
30,000	-17.2	0.9999960
35,000	-15.6	0.9999964
40,000	-13.8	0.9999968
45,000	-11.6	0.9999973
50,000	- 9.3	0.9999979
55,000	- 6.7	0.9999985
60,000	- 3.8	0.9999991
65,000	- 0.7	0.9999998
70,000	+ 2.6	1.0000006
75,000	+ 6.2	1.0000014
80,000	+10.1	1.0000023
85,000	+14.2	1.0000033
90,000	+18.5	1.0000043
95,000	+23.1	1.0000053
100,000	+27.9	1.0000064
105,000	+33.0	1.0000076
110,000	+38.4	1.0000088
115,000	+44.0	1.0000101
120,000	+49.8	1.0000115
125,000	+55.9	1.0000129
130,000	+62.2	1.0000143
135,000	+68.8	1.0000158
140,000	+75.6	1.0000174
145,000	+82.7	1.0000190
150,000	+90.0	1.0000207

CORRECTIONS TO NATURAL SCALE RATIOS*

(in units of the 7th decimal place)

For Lambert Projection				For Lambert or transverse Mercator Projection			
$\Delta\phi'$ as argument				Δy	or	Δx	Corr'n (Plus)
$\Delta\phi'$	Corr'n (Plus)	$\Delta\phi'$	Corr'n (Plus)				
1	0	31	34		10,000		0
2	0	32	36		20,000		0
3	0	33	38		30,000		1
4	1	34	40		40,000		2
5	1	35	43		50,000		2
6	1	36	45		60,000		3
7	2	37	48		70,000		5
8	2	38	51		80,000		6
9	3	39	53		90,000		8
10	4	40	56		100,000		10
11	4	41	59		110,000		11
12	5	42	62		120,000		14
13	6	43	65		130,000		16
14	7	44	68		140,000		19
15	8	45	71		150,000		21
16	9	46	74		160,000		24
17	10	47	77		170,000		27
18	11	48	81		180,000		31
19	13	49	84		190,000		34
20	14	50	88		200,000		38
21	15	51	91		210,000		42
22	17	52	95		220,000		46
23	19	53	98		230,000		50
24	20	54	102		240,000		55
25	22	55	106		250,000		59
26	24	56	110		260,000		64
27	26	57	114		270,000		69
28	27	58	118		280,000		74
29	29	59	122		290,000		80
30	32	60	126		300,000		86
$\Delta\phi'$ is the difference in latitude in minutes of the ends of the line.					310,000		91
					320,000		97
					330,000		103
					340,000		110
					350,000		116

*Scale ratio interpolated for mean latitude or mean x' of the ends of a line and corrected by the above table is a true mean value accurate to within one in the seventh decimal place.