

5467

Form 504
Rev. Dec. 1933
DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY
R. S. PATTON, Director

DESCRIPTIVE REPORT

Air Photo
~~Topographic~~
~~Hydrographic~~

Sheet No. T- 5467

State New York

LOCALITY

Staten Island

Kill Van Kull

Mariners Harbor and
Vicinity

1937

(Photographs taken in 1935)

CHIEF OF PARTY

J. C. Partington Jr. H. & G. E.

3
Applied to Chart 285 Dec 22 1937 Chas R. Bunker

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY

REG. NO.

TOPOGRAPHIC TITLE SHEET

The Topographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

Field No. T-5467

REGISTER NO. T-5467

T5467

State New York

General locality Staten Island

Locality Mariners Harbor and Vicinity
Kill Van Kull

Scale 1:5000 Date of ^{Photographs} ~~survey~~ June 26, 1935

Vessel Photo Compilation Party # 25

Chief of party J.C. Partington

Surveyed by Field Inspection ---- J. Rippstein
Compilation ----- E.R. Gollon

Inked by J.C. Partington

Heights in feet above ----- to ground to tops of trees

Contour, Approximate contour, Form line interval ----- feet

Instructions dated March 14, 1934

Remarks: -----

STATISTICS

AIR PHOTO COMPILATION? REGISTER NO. T-5467

Photographs No.	date	time	tide at Shooters Island			
			high		low	
			time	hts.	time	hts.

V 241-250(87ON-8)	6-26-35	8:20a	4:22a	4.3'	10:36a	0.0
			4:58p	5.4'	11:27p	0.0

tide 1.4 ft. above l.w. at time of photos.

Scale Factor ----- R.C.Bolstad ----- previously determined

Projection ----- Ruling Machine ----- No date

Projection Checked ----- F.R. Gollon ----- " "

Control Plotted ----- F.R. Gollon ----- " "

Control Checked ----- H.W. Sleiter ----- " "

Radial line Plot ----- F.R. Gollon ----- " "

Radial Line Plot Checked -- B.G. Jones ----- " "

Detail Inked ----- J.C. Partington ----- June 15 - July 10, 1937

Preliminary Review ----- J.C. Partington ----- July 12 - July 14, 1937

Area (land area) ----- 4.0 square statute miles

Area (shoals in water) ----- 0.0 " " "

Shoreline (more than 200 m. from opposite shore) ----- 13.8 statute miles

Shoreline (creeks) ----- 11.8 " "

Streets, roads, trails, railroads, etc. ----- 53.3 " "

General location ----- Staten Island -----

Locality ----- *Mariners Harbor and Vicinity*
~~Kill Van Kull~~ -----

Datum ----- North American 1927 -----

Station ----- Public School 22, 1931 (N.Y.)

Latitude	40 37' 30.300"	934.6 meters (adjusted)
Longitude	74 09' 06.100"	143.4 " ✓ J. L. P.

N.J. Grid { $x = 2,142,952.55 \text{ FT.}$
 $y = 653,069.28 \text{ FT.}$

L.I. Grid { $x = 1,957,889.67 \text{ FT.}$ ✓
 $y = 745,606.62 \text{ FT.}$

Compiler's Report
for
Air Photo Topographic Sheet, Register No. T-5467

GENERAL INFORMATION.

The field inspection for the area covered by this sheet is part of a special report covering the northern section of Staten Island and was submitted by R.C. Bolstad in 1935. *Filed in Desc. Report T5467 Field inspection August, 1935.*

This sheet was originally started in the Washington Office. In June 1937 the work on this sheet was resumed by Party # 25 in Baltimore, Md.

This sheet has been compiled from single lens photographs listed on page # 2 of this report. These photographs were taken by the U.S. Army Corp at Mitchell Field, Long Island, N.Y., with a special camera developed by the Fairchild Camera Corporation, 62-10 Woodside Ave., Woodside, New York City and with the cooperation of the Air Corp. This camera is known as the "K-7C" by the Army and as "K7A" by the Fairchild Corporation.

The Army plane was piloted by Lieut. Cullen at an altitude very close to 15,000 feet; the photographer was Sergeant Cates. A 24 inch cone (focal length 24") was used which placed the original negatives on a scale of 1:7500. Contact prints were furnished the field party for inspection purposes and the original negatives were used to enlarge a set of office prints to a scale of 1:5000. These office prints were furnished this party and were used to compile this sheet.

CONTROL.

The radial plot was controlled by R.W. Woodworth's 1930-1933 triangulation except for a few 1908 and 1913 stations.

The North American 1927 Datum was used in plotting all of the triangulation stations shown on this sheet.
Rec. H&T stations, previously located by plane table or U.S.G. were not used in controlling the plot.

Recovery notes for triangulation stations OLD PLACE, 1908 and DOWNEY SHIPYARDS TANK (N.Y.) 1931 are submitted with this report. The field inspection party reports both of these stations lost. *(1) Downey Shipyard Tank 1931 recovery card not submitted with this report as noted above. Altho no notes on field photos saying it is lost, the tank does not appear on the photos to exist. COMPILATION. It was reported to Geodesy and Nautical Chart Section as lost, on strength of above note.*
(2) Old Place, 1908. Recovery note states it is probably lost. Reported to Geodesy.

The radial plot was completed in the Washington Office before the sheet was turned over to this party. A few additional radial points were located to facilitate detailing.

(b) Method.

According to notes sent to this party the radial plot was run by celluloid templates. The radial points on the extreme western portion of the sheet are weak since they were determined from only two photographs.

The photographs were all very close to scale.

(b) Method (continued)

No unusual adjustment of the plot was necessary aside from that mentioned on page 3.

(c) Interpretation. *see P. 5 for list of bridges over navigable waters.*

No attempt has been made to show street car tracks on this sheet. Double railroad tracks have been generalized and are shown as a single track with a note "two tracks" on the overlay. Railroad yards have also been generalized and show approximately every third track.

The double full line has been used to show all first class roads and streets (curb to curb); the single dashed line to show trails and the double dashed line to show second class roads.

An attempt has been made to show all buildings of any importance along the waterfront and a few of the more important buildings inland. The stereoscope has been used freely in determining the shapes of the buildings.

Where there were definite limits of patches of marsh grass outside of the high water line they were shown on the compilation by the tidal marsh symbol ~~bounded by a dashed line~~. In nearly all cases the field inspection made no mention as to the extent the marsh was covered at the various stages of the tide. *Dashed line removed around marsh.*

Wrecks are shown on the compilation in true size and shape with a full line, except where they appear submerged at high water or partly submerged; in such cases they are shown by a dashed line. According to field inspection notes many of these wrecks are rapidly being dismantled for fire wood. *wrecks above L.W. outlined with dashed line. "H.W." solid line. Shoals and areas foul with wrecks and debris limited by dashed line.*

In several cases wrecks and piling appearing on topographic sheet # T-6125 were not field inspected by the photo field inspection party. An attempt was made to take the positions from the photographs; where they could not be identified they were transferred from the topographic sheet and position adjusted to fit the surrounding topography on the compilation. *(it was not necessary to transfer any wrecks from T-6125 to T-5467)*

The overlay has been prepared in accordance with The Director's letter of June 28, 1937. *Large pipe lines shown by single light solid line with legend.*

(d) Recoverable Topographic Stations (Card Form 524)

Geographic positions of USE stations were computed from coordinates furnished by the USE Dept. and are shown in the appendix. The position of these stations were plotted, after the radial plot was run as they could not be identified on the photographs. *(see review for discussion of location of rec. H&T stations)*

9 Form 524 filed under T-5467.

25 " " " " T-6125; *(in area of T-5467 but not shown on T-5467)*

(Rec. H&T stations were not transferred from T-6125 to T-5467, or relocated)
All rec. H&T stations in area of this sheet were checked by photo plot upon review.

(d) Recoverable Topographic Stations (continued)

There is submitted with this report Card Forms 524 for ~~eleven~~ ^{nine} USE stations.

(e) Information from other sources.

- (1) Control from sources as stated on page 3 of this report.
- (2) Recoverable Topographic Stations as shown computation sheets in the appendix.
- (3) Names from sources as listed on Form M234 in the appendix.
- (4) Detail transferred from topographic sheet # T-6125 (so labeled on the overlay) (labels removed upon review)
- (5) Clearances of bridges from USE 1935 Bridge Book.

Except as mention above all other information shown on the compilation was taken from field inspection notes and the photographs.

(f) Names.

Geographic names shown on this compilation are listed on Form M234 in the appendix.

The names of streets may be obtained from the Map of the City of New York, Board of Estimate and Apportionment. ^{New} Filed in Room 1209, B.P. 25094, filed in vaults, is probably a better source of street names.

(g) Junctions.

This sheet makes a junction with sheet T-5466 along longitude 47° 08' 00" and with sheet T-5110 along latitude 40° 37' 30". The sheet is bounded on the west by Arthur Kill, and on the north by Kill Van Kull. ^{Also joins T-5468 on NE (Bayonne Bridge) and T-5106 (B.F.O.R.R. + Goethals Bridge)} All junctions are satisfactory.

(h) Comparison with other Surveys.

Topographic Sheet T-6125

A comparison between topographic sheet T-6125 and the compilation was made, ~~over the portion of the sheet east of longitude 74° 10' 00"~~ and was found to be in close agreement.

The wreckage appearing on topographic sheet T-6125 between docks about 300 meters south of the south-east corner of Shooters Island was not transferred to the compilation since there are several barges afloat at this point and they were not field inspected as wrecks. Sheet T-6125 has labeled them as sunken wrecks. ^{Partly revised upon review. T-5467 shows condition at time of field inspection (Aug '35)} Wrecks under rapid change in this area. Chart 285

Due to the difference in scale between this chart and the compilation only a visual comparison was made. The following differences are noted: ^(see next page)

Bridges:	Bayonne Bridge (fixed steel arch)	Hor. Cl. = 1640 ft.	} from 1935 Ed. of U.S.E. List of Bridges
		Vert. Cl. = 150 ft. M.H.W.	
	Baltimore & Ohio R.R. (swing draw)	Hor. Cl. = East: 202 ft; West: 212 ft.	
		Vert. Cl. = 31 ft. M.H.W. (draw closed)	
	Goethals Bridge (fixed)	Hor. Cl. = 664 ft.	
		Vert. Cl. = 135 ft. at M.H.W. (as indicated)	

Chart 285 (continued)

- (1) Many additional wrecks appear on the compilation that are not shown on the chart.
- (2) The large buildings on Shooters Island have been removed and according to field inspection notes the few smaller ones shown on the photographs are being dismantled.
- (3) According to field inspection notes there is no longer a cable crossing to Shooters Island as charted (see 1:7500 print, photo V 244)
- (4) A bulkhead now extends across the small bight in the shoreline at longitude 74 10.7'.
- (5) Floating drydocks are shown on the compilation and are not shown on the chart.
- (6) Considerable changes have occurred in the many creeks and ponds on the western portion of the compilation from that shown on the chart.

see chart attached at end of this report for additional differences.

LANDMARKS.

The landmarks shown on chart 285 are all in existence and should be charted, except triangulation station "Downey Shipyard Tank (N.Y.) 1931" which has been torn down and should not be charted. No additional landmarks are submitted for this area. *Location of Pier Light (Shooters Island) submitted on Form 567, upon review. Had not been located by triangulation, recent topography or hydrography.*

RECOMMENDATION FOR FUTURE SURVEYS.

This sheet is believed to be complete in all detail of importance for charting and no additional surveys are required.

The probable error is not greater than 3 meters in position of well defined objects along the waterfront east of longitude 74 11.0'. The probable error of the shore line west of longitude 74 11.0' and for other detail on the entire sheet is not greater than 5 meters.

Respectfully submitted,

J.C. Partington
J.C. Partington
Jr. H. & G.E.

Approved:

J.C. Partington
J.C. Partington
Chief-of-Party

Notes in Red by T.M.P. upon Review, Nov. 30, 1937

REVIEW OF AIR PHOTOGRAPHIC SURVEY T-5467

Data Record

Triangulation, 1913 and 1931-32
Recoverable stations of less than third order accuracy to 1935
Photographs taken June 1935
Field inspection August 1935
Planetable graphic control surveys, October 1934

The field inspection was for the interpretation of the photographs. Except for (1) piles and rocks taken from planetable survey T-6125 (1934), (2) recoverable hydrographic and topographic stations computed from the U. S. Engineers' surveys and checked by the radial plot, and (3) minor changes in hulks aground which occurred between date of flying and of field inspection, the detail of T-5467 is of the date of the photographs.

Comparison with Recent Graphic Control Surveys

T-6125 (1934), 1:10,000

(1) Recoverable hydrographic and topographic station NEAR (d) is same as triangulation station St. Mary's Catholic Church Spire, 1913. Noted on Form 524 and T-6125.

(2) The location of the recoverable hydrographic and topographic stations by planetable did not agree well with the check obtained by the radial plot of the photographs. "U.S.E.D. 281, S.I.T. (d)" differed by 12 m. and station "B" differed by 17 m. These two stations have been rejected; Form 524 discarded and a note placed on T-6125 sheet and report, regarding the rejection.

Form 524 for each of the recoverable hydrographic and topographic stations located by planetable survey T-6125, in the area covered by T-5467, has been removed from the regular file and cross referenced. These Forms 524 are now filed in the Air Photo Unit and are available only for use on scales of 1:10,000 or smaller. This separation has been made because a number of these stations differed from the radial plot location by 5 m. The stations have not been shown on T-5467 on this account, and it is not desired to have the public later plot these stations on published copies of T-5467, from the Form 524 positions.

The source of the discrepancy could not be found and a correction made because (1) the error may be in the planetable survey because certain large errors, as noted elsewhere, were found in that survey, and besides, 5 m. is not too large an error to ~~accept~~^{expect} on the 1:10,000 scale at which this survey was made; (2) the error, on the other hand, may be in the air photo map which was not as well controlled as desirable.

Filed in report envelope T-5467

(2) cont'd.

If it is necessary to use these stations on scales larger than 1:10,000, the coordinate positions should be obtained from the U.S. Engineers and the geographic positions computed therefrom.

The only Forms 524 of this group which have been left in the regular file are:

(a) NEAR (d) which is also a triangulation station.
(b) TOE, MUS, DIKE ANGLE, the geographic positions for which were computed from the U.S.E. locations and found to agree well with the planetable location, (2.6 m. greatest difference). The U.S.E. position has been noted on Form 524 for these stations. These stations have not been shown on T-5467 but the dike, on which they are located, has been corrected on T-5467 to agree.

(3) In large slip, southeast corner, Shooters Island, T-6125 shows an area filled with hulks and barges aground. Only part of this area appears to be foul at the date of photographs. The other barges appear to be moored. This is verified by field inspection notes.

(4) In several instances, T-6125 has outlined an area by a dashed line that is foul with wrecks, where T-5467 has shown the individual wrecks.

(5) The sunken wreck symbol is incorrectly used on T-6125. In the area covered by T-5467, all of the wrecks are awash or above high water. None is below low water.

(6) Numerous minor differences in representation of detail. All carefully studied and T-5467 correct or made correct.

(7) There is an average difference of 5 m. in the position of most detail, between T-6125 and T-5467. The largest difference is 12 m., which is in waterfront due south of the southeast end of Shooters Island. Errors in position, up to 5 m., over a large area, may be due to weak radial plot. But errors greater than 5 m., and particularly for a small section, are undoubtedly due to errors in the planetable survey. T-5467 is considered the more accurate.

General

(1) T-5467 is on a scale of 1:5,000 whereas T-6125 is on a scale of 1:10,000.

(2) T-5467 has been carefully compared with T-6125, the photographs, and recent hydrographic sheets. In general, the field inspection is adequate and the photographs show the detail clearly. T-5467 has been corrected against the above sources of information and in case of any differences between T-6125 and T-5467, the latter should now be taken as correct.

(3) All detail on T-6125 within the area of T-5467 is now shown on the compilation, except:

- (a) Detail proved in error or no longer existing.
- (b) Temporary topographic stations.
- (c) Recoverable, described topographic stations. (The reason for not transferring these is given in paragraph (2) under comparison with T-6125.)
- (d) Magnetic declination.

Comparison with Previous Topographic Surveys

T- 9 (1836)	1:10,000
T- 530 (1855)	"
T- 533 (1855)	"
T- 751 (1857-75)	"
T-1719 (1885-6)	"
T-1720 (1886)	"
# T-2545 (1901-2)	1:5,000
T-3431 (1913)	1:10,000
T-3540 (1915)	"

Because of the many changes to be expected in an area of this character since the previous topographic surveys were made, only a general comparison was made.

T-5467 is adequate to supersede the portions of former topographic surveys which it covers.

Comparison with Recent Hydrographic Surveys

H-5608 (1934), 1:10,000

(1) The shoreline of the above survey was taken from the recent graphic control surveys and therefore differs from T-5467 in the same respects as discussed under T-6125 comparison. The

differences are minor and no corrections were made on the hydrographic surveys which have been completed and applied to the charts.

(2) A number of wrecks which are awash at some stage of the tide, or above high water, have been shown incorrectly by a sunken wreck symbol on ~~H~~^H-5608. *has verified by inspection of photos.*

(3) The wreck shown 55 m. northwest of the east end of the large dike in Newark Bay appears on the photographs, but it carries a field inspection note that it was not to be seen at the time of field inspection. *(inferred that it was gone) It was therefore not shown on T-5467. However, the field inspection note was not positive, and because of this element of doubt, it is considered best to chart this wreck as located on H-5608.*

(4) The wreck shown 35 m. north of the east end of the dike cannot be seen on the photographs but there is a field inspection note saying that a wreck above ^{high} water was there at the time of field inspection. Because of its doubtful location on the field photographs, it was not shown on T-5467. *This wreck no doubt exists, but it could not be located from the photos & was therefore not shown on T-5467. It is not customary to transfer features of this nature to a topographic sheet from a hydrographic sheet.*

(5) There is no conflict between the soundings on H-5608 and the detail on T-5467.

Comparison with U. S. Engineers' surveys

Blueprints #28840, 28841 (1933), 1:5,000

The date of the topography is not given, but the agreement with T-5467 is good. The differences (mainly hulks aground since date of U.S.E. survey) were minor, but these were checked and T-5467 found correct. There is no conflict between the soundings on the above blueprints and the detail on T-5467.

Comparison with Charts

Chart 285 (Ed. 7/31/37), 1:15,000

A detailed comparison was made between this chart and T-5467. The important changes to be made on the chart are noted on a section of the chart attached to this report. (Floating drydocks are shown on T-5467. Although it does not seem to be current practice to chart these, there appeared to be no reason for removing them from this survey. They all carry legends.)

Chart 369 (Ed. 4/17/37), 1:40,000

A general comparison only was made. The same corrections as noted above for chart 285 apply to this chart.

Remarks

Recoverable hydrographic and topographic stations

9 Form 524, filed under T-5467

25 Form 524, filed under T-6125, fall within area of T-5467 ²¹ but are not shown on T-5467, as explained in paragraph (2) ^{insert} under comparison with T-6125.

Stations Gulf Shed U.S.E. (d) and City Mon. No. 416 (U.S.E.) (d) were removed from T-5467 upon review because the positions as described, and as obtained by radial plot, did not agree with the positions as computed from U.S.E. Coordinates. *(U.S.E. position did not agree with U.S.E. description for these 2 stations).*

The radial plot position does not disagree with the U.S.E. computed position more than 4 m. for any station remaining on T-5467. The U.S.E. computed position is the one shown on the sheet and on Form 524.

Changes to T-5467 upon review

(1) The high water line from lat. $40^{\circ} 38.6'$, long. $74^{\circ} 11.2'$ to the southwest limit of sheet, (approx. $1 \frac{1}{2}$ miles), was moved offshore an average of 20 meters. This was done in contradiction to the field inspection marking of the high water line, on the strength of the indication of an error afforded by a comparison with 4 previous surveys. The exact demarcation of the revised high water line was obtained by careful study of the photographs under the stereoscope.

(2) Two recoverable topographic stations removed as noted in preceding paragraph.

(3) Dock and railroad tracks near topographic station B. & O. 27 B, 1933, U.S.E.(d), changed 4 m.

(4) The street known as Post Lane was added.

(5) Wreck shown 55 m. northwest of the east end of Newark Bay dike removed to comply with field inspection note. (See paragraphs (3) and (4) under H-5608 comparison.)

(6) The levees and several canals were added around Gulf Refining Company plant.

(7) Revision of legends pertaining to wrecks; addition of legends for bridge clearances, and notation of the number of tracks on railroads.

Several
(8) Long spur-tracks at Proctor & Gamble plant added.

(9) Other changes include numerous minor changes in waterfront detail, addition of certain houses, prominent pipe lines, trestle ruins, trails, roads, canals.

(10) Whole dike in Newark Bay moved north approx. 5 m. to agree with U.S.E. and plant table location.

The photographs furnished the location of all changes made.

Accuracy

It appears that the statement of accuracy given in the report would be more nearly correct if the line dividing the 3 m. accuracy and the 5 m. accuracy were moved to long. $74^{\circ} 09'$.

Additional Work

This survey is complete and adequate for chart compilation, except for the location of submerged pipe lines and cable crossings.

It is suggested that when the next survey is made in this vicinity, the following items, not thoroughly established by this survey, receive attention:

(1) Non-existence of cable crossing at lat. $40^{\circ} 38.3'$, long. $74^{\circ} 09.2'$.

(2) Location of wrecks near east end of Newark Bay dike. (Refer to paragraphs (3) and (4) under comparison with H-5608, this review.)

(3) Demarcation of marsh high water line on east shore of Arthur Kill from Howland Hook south. (Refer to paragraph (1) under Remarks, this review.)

November 30, 1937.

T. M. Price
T. M. Price

Remarks

Decisions

1	* Called "Arthur Kills"	
2		USGB decision
3		
4		
5		see T-6125
6	Name of railroad station	
7	Name of railroad station	
8		see T-6125
9	Name of railroad station (R.R stop in Port Richmond)	
10		
11		
12		see T-6125
13		USGB decision
14		
15	on Map of Port of N.Y. Authority	
16	" " " " " " "	
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		

GEOGRAPHIC NAMES

Survey No. T-5467

Name on Survey	A On Chart No. 285	B On previous survey No. T 6126	C On U. S. Quadrangle Maps	D From local field information	E N.Y. Board of Estima. On local Maps & Apportionment Map	F P. O. Guide or Map	G Rand McNally Atlas	H U. S. Light List	
<u>Arthur Kill</u>	appd x				x				1
<u>Shooters Island</u>	x				x				2
<u>Old Place Creek</u>	appd x				x			✓	3
<u>Old Place</u>	appd x		✓						4
<u>Mariners Harbor</u>	appd x			x	x			✓	5
<u>Arlington</u>	appd x			x	x			✓	6
<u>Elm Park</u>	appd x			x	x			✓	7
<u>Port Richmond</u>	appd x				x	✓	✓	✓	8
<u>Tower Hill</u> Howland Hook			✓	x	x		✓	✓	9
<u>Howland Hook</u>			x	x					10
<u>Graniteville</u>			✓	x					11
<u>Newark Bay</u>	appd x				x				12
<u>Kill Van Kull</u>	x	x			x				13
<u>Staten Island</u>	✓								14
<u>Port Ivory</u>									15
<u>Gulfport</u>									16
									17
									18
									19
									20
									21
									22
									23
									24
									25
									26
									27

Names underlined in red approved

by JHE on 10/14/37

DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY

LANDMARKS FOR CHARTS

~~TO BE CHARTED~~
~~TO BE DELETED~~

STRIKE OUT ONE

Baltimore, Maryland

~~July 14, 1937~~ 93

I recommend that the following objects which have (*have not*) been inspected from seaward to determine their value as landmarks, be charted on (*deleted from*) the charts indicated.

The positions given have been checked after listing.

[illegible]

This form shall be prepared in accordance with 1934 Field Memorandum, "LANDMARKS FOR CHARTS." The data should be considered for the charts of the area and not by individual field survey sheets. Information under each column heading should be given.

Computation of Geographic Coordinates From Plane Coordinates

Chart No.

Origin of coordinates: Bogart 1885

Lat. 40° 36' (223.9 m.) Coordinate value of origin N. or S. 20350 feet = 6202.69 m.
Long. 74° 06' (1367.5 m.) referred to the Zero E. or W. 20250 feet = 6172.21 m.

Name of station: U.S. Mon. No. 26 (U.S.E.)

Coordinates: N. or S. 9532.61 feet = 2905.51 m.
E. or W. 40954.00 feet = 12482.82 m.

Latitude N. - S. coordinates

N. or S. feet = 3297.2 m.

+ or - seconds in meters = 223.9 m.

N. or S. of 40° 36' = 3521.1 m.

From table + or - 1 = 1850.7 m.

Lat. (uncorrected) 40° 37' 1670.4 m.

Curvature = 2.6 m.

*Latitude 40° 37' 1667.8 m.

Longitude E. - W. coordinates

E. or W. feet = 6310.6 m.

+ or - seconds in meters = 1366.8 m.

E. or W. of 74° 06' = 7677.4 m.

From table + or - 5 = 7050.2 m.

Longitude 74° 11' 627.2 m.

Name of station: City Mon. # 1806 (U.S.E.)

Coordinates: N. or S. 6212.62 feet = 1902.76 m.
E. or W. 37819.00 feet = 11527.25 m.

Latitude N. - S. coordinates

N. or S. feet = 4299.9 m.

+ or - seconds in meters = 223.9 m.

N. or S. of 40° 36' = 4523.8 m.

From table + or - 2 = 3701.5 m.

Lat. (uncorrected) 40° 38' 822.3 m.

Curvature = 1.9 m.

*Latitude 40° 38' 820.4 m.

Longitude E. - W. coordinates

E. or W. feet = 5355.0 m.

+ or - seconds in meters = 1366.5 m.

E. or W. of 74° 06' = 6721.5 m.

From table + or - 4 = 5639.4 m.

Longitude 74° 10' 1082.1 m.

Name of station: City Mon. # 416 (U.S.E.)

Coordinates: N. or S. 6181.19 feet = 1884.03 m.
E. or W. 35190.79 feet = 10726.17 m.

This position is 57 meters NE of point described on form 524 and located in field on photos as No. 416. Therefore station removed from T-5467. T.M.P.37

Latitude N. - S. coordinates

N. or S. feet = 4318.7 m.

+ or - seconds in meters = 223.9 m.

N. or S. of 40° 36' = 4542.6 m.

From table + or - 2 = 3701.5 m.

Lat. (uncorrected) 40° 38' 841.1 m.

Curvature = 1.4 m.

*Latitude 40° 38' 839.7 m.

Longitude E. - W. coordinates

E. or W. feet = 4554.0 m.

+ or - seconds in meters = 1366.5 m.

E. or W. of 74° 06' = 5920.5 m.

From table + or - 4 = 5639.4 m.

Longitude 74° 10' 281.1 m.

Computed by J.C. Partington June 9 1937

*Use in taking out longitude values.

File with history slip of largest scale chart covering this area.

(R-325)

Computation of Geographic Coordinates From Plane Coordinates

Chart No.

Origin of coordinates: Bogart 1885

Lat. $40^{\circ} 36'$ (223.9 m.) Coordinate value of origin N. or S. 20350 feet = 6202.69 m.
Long. $74^{\circ} 06'$ (1367.5 m.) referred to the Zero E. or W. 20250 feet = 6172.21 m.

Name of station: Hecker (U.S.E.)

Coordinates: N. or S. 6670.68 feet = 2033.23 m.
E. or W. 32217.23 feet = 9819.83 m.

Latitude N. - S. coordinates

N. or S. feet = 4169.5 m.
+ or - seconds in meters = 223.9 m.
N. or S. of $40^{\circ} 36' = 4393.4$ m.
From table + or - 2' = 3701.5 m.
Lat. (uncorrected) $40^{\circ} 38' = 691.9$ m.
Curvature = 0.9 m.
*Latitude $40^{\circ} 38' = 691.0$ m.

Longitude E. - W. coordinates

E. or W. feet = 3647.6 m.
+ or - seconds in meters = 1366.57 m.
E. or W. of $74^{\circ} 06' = 5014.13$ m.
From table + or - 3' = 4229.67 m.
Longitude $74^{\circ} 09' = 784.56$ m.

Name of station: City Mon. # 2141 (U.S.E.)

Coordinates: N. or S. 7026.86 feet = 2141.79 m.
E. or W. 27843.86 feet = 8486.82 m.

Latitude N. - S. coordinates

N. or S. feet = 4060.9 m.
+ or - seconds in meters = 223.9 m.
N. or S. of $40^{\circ} 36' = 4284.8$ m.
From table + or - 2' = 3701.5 m.
Lat. (uncorrected) $40^{\circ} 38' = 583.3$ m.
Curvature = 0.4 m.
*Latitude $40^{\circ} 38' = 582.9$ m.

Longitude E. - W. coordinates

E. or W. feet = 2314.6 m.
+ or - seconds in meters = 1366.78 m.
E. or W. of $74^{\circ} 06' = 3681.34$ m.
From table + or - 2' = 2819.9 m.
Longitude $74^{\circ} 08' = 861.45$ m.

Name of station: City Mon. # 2142 (U.S.E.)

Coordinates: N. or S. 6625.60 feet = 2019.49 m.
E. or W. 27071.35 feet = 8251.36 m.

Latitude N. - S. coordinates

N. or S. feet = 4183.2 m.
+ or - seconds in meters = 223.9 m.
N. or S. of $40^{\circ} 36' = 4407.1$ m.
From table + or - 2' = 3701.5 m.
Lat. (uncorrected) $40^{\circ} 38' = 705.6$ m.
Curvature = 0.3 m.
*Latitude $40^{\circ} 38' = 705.3$ m.

Longitude E. - W. coordinates

E. or W. feet = 2079.2 m.
+ or - seconds in meters = 1366.7 m.
E. or W. of $74^{\circ} 06' = 3445.9$ m.
From table + or - 2' = 2819.9 m.
Longitude $74^{\circ} 08' = 626.0$ m.

Computed by J.C. Partington June 10 1937

*Use in taking out longitude values.

File with history slip of largest scale chart covering this area.

(R-325)

Gulf port photos
Mr. Storm

Gulf

Computation of Geographic Coordinates From Plane Coordinates

Chart No. 1

Origin of coordinates: Bogart (1885)

Lat. 40° 36' (223.9 m.) Coordinate value of origin N. or S. 20350 feet = 6202.69 M.
Long. 74° 06' (1367.5 m.) referred to the Zero E. or W. 20250 feet = 6172.21 M.

Name of station: Gulf Shed (U.S.E.)

Coordinates: N. or S. 9201.02 feet = 2804.48 m.
E. or W. 43409.70 feet = 13231.30 m.

*not used:
U.S.E. description, and radial
plot do not fit this coordinate.*

Latitude N. - S. coordinates
N. or S. feet = 3398.2 m.
+ or - seconds in meters = 223.9 m.
N. or S. of 40° 36' = 3622.1 m.
From table + or - 1' = 1850.7 m.
Lat. (uncorrected) 40° 37' 1771.4 m.
Curvature = 3.2 m.
*Latitude 40° 37' 1768.2 m.

Longitude E. - W. coordinates
E. or W. feet = 7059.1 m.
+ or - seconds in meters = 1366.8 m.
E. or W. of 74° 06' = 8425.9 m.
From table + or - 5' = 7050.23 m.
Longitude 74° 11' 1375.7 m.

Name of station: U.S. Mon. New Point (U.S.E.)

Coordinates: N. or S. 9407.07 feet = 2867.28 m.
E. or W. 43317.16 feet = 13203.10 m.

Latitude N. - S. coordinates
N. or S. feet = 3335.4 m.
+ or - seconds in meters = 223.9 m.
N. or S. of 40° 36' = 3559.3 m.
From table + or - 1' = 1850.7 m.
Lat. (uncorrected) 40° 37' 1708.6 m.
Curvature = 3.2 m.
*Latitude 40° 37' 1705.4 m.

Longitude E. - W. coordinates
E. or W. feet = 7030.9 m.
+ or - seconds in meters = 1366.8 m.
E. or W. of 74° 06' = 8397.7 m.
From table + or - 5' = 7050.23 m.
Longitude 74° 11' 1347.5 m.

Name of station: Sta. B & O 27B, 1933 (U.S.E.)

Coordinates: N. or S. 5759.70 feet = 1755.56 m.
E. or W. 40611.65 feet = 12378.46 m.

Latitude N. - S. coordinates
N. or S. feet = 4447.1 m.
+ or - seconds in meters = 223.9 m.
N. or S. of 40° 36' = 4671.0 m.
From table + or - 2' = 3701.5 m.
Lat. (uncorrected) 40° 38' 969.5 m.
Curvature = 2.5 m.
*Latitude 40° 38' 967.0 m.

Longitude E. - W. coordinates
E. or W. feet = 6206.2 m.
+ or - seconds in meters = 1366.5 m.
E. or W. of 74° 06' = 7572.7 m.
From table + or - 5' = 7049.3 m.
Longitude 74° 11' 523.4 m.

Computed by J. C. Partington June 8 1937

*Use in taking out longitude values.

File with history slip of largest scale chart covering this area.

(N-325)

Computation of Geographic Coordinates From Plane Coordinates

Chart No. 1885

Origin of coordinates: Bogart 1885

Lat. 40° 36' (223.9 m.) Coordinate value of origin N. or S. 20350 feet = 6202.69 m.
Long. 74° 06' (1367.5 m.) referred to the Zero E. or W. 20250 feet = 6172.21 m.

Name of station: City Mon. (Richmond Terrace, east of Nicholas Ave.) (U.S.E.)

Coordinates: N. or S. 6645.40 feet = 2025.52 m.
E. or W. 26618.05 feet = 8113.20 m.

Latitude N. - S. coordinates
N. or S. feet = 4177.2 m.
+ or - seconds in meters = 223.9 m.
N. or S. of 40° 36' = 4401.1 m.
From table + or - 2' = 3701.5 m.
Lat. (uncorrected) 40° 38' 699.6 m.
Curvature = 0.3 m.
*Latitude 40° 38' 699.3 m.

Longitude E. - W. coordinates
E. or W. feet = 1941.0 m.
+ or - seconds in meters = 1366.7 m.
E. or W. of 74° 06' = 3307.7 m.
From table + or - 2' = 2819.98 m.
Longitude 74° 08' 487.89 m.

Name of station: City Mon. (Richmond Terrace, west of Sharpe Ave.) (U.S.E.)

Coordinates: N. or S. 6452.02 feet = 1966.58 m.
E. or W. 26121.28 feet = 7961.78 m.

Latitude N. - S. coordinates
N. or S. feet = 4236.1 m.
+ or - seconds in meters = 223.9 m.
N. or S. of 40° 36' = 4460.0 m.
From table + or - 2' = 3701.5 m.
Lat. (uncorrected) 40° 38' 758.5 m.
Curvature = 0.2 m.
*Latitude 40° 38' 758.3 m.

Longitude E. - W. coordinates
E. or W. feet = 1789.6 m.
+ or - seconds in meters = 1366.7 m.
E. or W. of 74° 06' = 3156.3 m.
From table + or - 2' = 2819.98 m.
Longitude 74° 08' 336.45 m.

Name of station: _____

Coordinates: N. or S. feet = _____ m.
E. or W. feet = _____ m.

Latitude N. - S. coordinates
N. or S. feet = _____ m.
+ or - seconds in meters = _____ m.
N. or S. of _____ = _____ m.
From table + or - _____ = _____ m.
Lat. (uncorrected) _____ = _____ m.
Curvature = _____ m.
*Latitude _____ = _____ m.

Longitude E. - W. coordinates
E. or W. feet = _____ m.
+ or - seconds in meters = _____ m.
E. or W. of _____ = _____ m.
From table + or - _____ = _____ m.
Longitude _____ = _____ m.

Computed by J. C. Partington 1938

*Use in taking out longitude values.

File with history slip of largest scale chart covering this area.

(R-325)

REVIEW OF AIR PHOTO COMPILATION NO. T-5467

Chief of Party: *J.C. Partington*Compiled by: *See Statistics*Project: *HT-175*Instructions dated: *March 14, 1934*

- ✓ 1. The charts of this area have been examined and topographic information necessary to bring the charts up to date is shown on this compilation. (Par. 16a, b, c, d, e, g and i; 26; and 64)
- ✓ 2. Change in position, or non-existence of wharfs, lights, and other topographic detail of particular importance to navigation which affect the chart, is discussed in the descriptive report. (Par. 26; and 66 g, n)
- ✓ 3. Ground surveys by plane table, sextant, or theodolite have been used to supplement the photographic plot where necessary to obtain complete information, and all such surveys are discussed in the descriptive report. (Par. 65; and 66 d, e)
No ground surveys used to supplement plot.
Some detail taken from plane table survey T 6125
- ✓ 4. Blue-prints and maps from other sources which were transmitted by the field party contain sufficient control for their application to the charts. (Par. 28)
No blue-prints or maps transmitted.
- ✓ 5. Differences between this compilation and contemporary plane table and hydrographic surveys have been examined and rectified in the field before forwarding the compilations to the office and are discussed in the descriptive report. ✓
- ✓ 6. The control and adjustment of the photo plot are discussed in the descriptive report. Unusual or large adjustments are discussed in detail and limits of the area affected are stated. (Par. 12b; 44; and 66 c, h, i)
- ✓ 7. High water line on marshy ~~and mangrove~~ coast is clear and adequate for chart compilation. (Par. 16a, 43, and 44)

NOTE: Strike out paragraphs, words or phrases not applicable and modify those requiring it. Paragraph numbers refer to those in the Topographic Manual. Refer also to the pamphlet "Notes on the Compilation of Planimetric Line Maps from Five Lens Air Photographs."

8. The representation of ~~low water lines~~, reefs, coral reefs and rocks, and ~~legends~~ pertaining to them is satisfactory. (Par. 36, 37, 38, 39, 40, 41).
*low water line not shown
dashed line used to indicate shoal and foul areas.*
9. Recoverable objects have been located and described on Form 524 in accordance with circular 30, 1933, circular letter of March 3, 1933, and circular 31, 1934. (Par. 29, 30, and 57)
10. A list of landmarks was furnished on Form 567 and instructions in the Director's letter of July 16, 1934, Landmarks for Charts, complied with. (Par. 16d, e; and 60)
11. All bridges shown on the compilation are accompanied by a note stating whether fixed or draw, clearance, and width of draw if a draw bridge. Additional information of importance to navigation is given in the descriptive report. (Par. 16c)✓
Only those over navigable streams carry notes.
12. Geographic names are shown on the overlay tracing. The accepted local usage of new names has been determined and they are listed in the report, together with a general statement as to source of information and a specific statement when advisable. Complete discussion of place names differing from the charts and from the U. S. G. S. Quadrangles is given in the descriptive report, together with reasons for recommendations made. (Par. 64, and 66k)✓
13. The geographic datum of the compilation is *N.A. 1927* and the reference station is correctly noted.✓
14. Junctions with adjoining compilations have been examined and are in agreement. (Par. 66j)✓
15. The drafting is satisfactory and particular attention has been given the following:
 1. Standard symbols authorized by the Board of Surveys and Maps have been used throughout except as noted in the report. ✓
 2. The degrees and minutes of Latitude and Longitude are correctly marked. ✓

3. All station points are exactly marked by fine black dots. ✓
4. Closely spaced lines are drawn sharp and clear for printing. ✓
5. Topographic symbols for similar features are of uniform weight. ✓
6. All drawing has been retouched where partially rubbed off. ✓
7. Buildings are drawn with clear straight lines and square corners where such is the case on the ground. ✓

(Par. 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48)

16. No additional surveying is recommended at this time. ✓

17. Remarks:

18. Examined and approved;

J. C. Partington
Chief of Party

19. Remarks after review in office:

Much more time was required in making additions and corrections, to this map drawing than upon review, than on any other received for this locality, from this party. T.M.P.

Reviewed in office by: *T.M. Price*
Nov. 29, 1937

Examined and approved:

E. H. Green
Chief, Section of Field Records

L. O. Dolbut
Chief, Division of Charts

Fred. L. Pearson
Chief, Section of Field Work

G. F. Rude
Chief, Division of Hydrography and Topography.

PLANE COORDINATE GRID SYSTEM *N.Y. (Long 1. Zone)*

Positions of grid intersections used for fitting the grid to this compilation were computed by Division of Geodesy and the computation forms are included in this report.

Positions plotted by Ask

Positions checked by _____

Grid inked on machine by Reed

Intersections inked by Reed

Points used for plotting grid:

$\frac{x}{y}$ _____

$\frac{x}{y}$ _____

$\frac{x}{y}$ _____

$\frac{x}{y}$ _____

*5 points. 4 corners
and center used.
Computations lost.*

$\frac{x}{y}$ _____

$\frac{x}{y}$ _____

$\frac{x}{y}$ _____

$\frac{x}{y}$ _____

Triangulation stations used for checking grid:

1. see computation 5. _____

2. on next page 6. _____

3. _____ 7. _____

4. _____ 8. _____

Plane coordinates on Lambert projection

State L. Island Station Public School 22 (N.Y.)

$\phi = 40^{\circ} 37' 30.300$ $\lambda = 74^{\circ} 09' 06.100$

Tabular difference of R for 1" of $\phi = 101.20017$

R (for min. of ϕ)		<u>24,320,041.51</u>	y' (for min. of ϕ)		<u>142,503.79</u>
Cor. for sec. of ϕ		<u>- 3,066.37</u>	Cor. for sec. of ϕ	+	<u>3,066.37</u>
R		<u>24,316,975.14</u>	y'		<u>145,570.16</u>
			$y'' (= 2R \sin^2 \frac{\phi}{2})$	+	<u>36.46</u>
θ (for min. of λ)		<u>- 5' 53.20433</u>	y		<u>145,606.62</u>
Cor. for sec. of λ		<u>- 3.98990</u>			
θ		<u>- 5 57.19423</u>	$\frac{\theta}{2}$		<u>2' 58.597115</u>
θ''	For machine computation	"		For machine computation	
			$\log \theta''$		
$\log \theta''$			$\csc 2$		<u>9.69897000</u>
S for θ			S for $\frac{\theta}{2}$		
$\log \sin \theta$	$\sin \theta$	<u>.0017317256</u>	$\log \sin \frac{\theta}{2}$	$\sin \frac{\theta}{2}$	<u>.0008658631</u>
$\log R$				$R \sin \frac{\theta}{2}$	<u>21,055.17</u>
$\log x'$			$\log \sin^2 \frac{\theta}{2}$	$R \sin^2 \frac{\theta}{2}$	<u>18.231</u>
x'	$R \sin \theta$	<u>- 42,110.33</u>	$\log R$		
		<u>2,000,000.00</u>	$\log 2$		<u>0.30103000</u>
x		<u>1,957,889.67</u>	$\log y''$		

$$x = 2,000,000.00 + R \sin \theta$$

$$y = y' + 2R \sin^2 \frac{\theta}{2}$$

y' = the value of y on the central meridian for the latitude of the station

S = log of ratio for reducing arc expressed in seconds to sine

(see log tables)

R, y' , and θ are given in special tables

PLANE COORDINATE GRID SYSTEM *N.J. Grid*

Positions of grid intersections used for fitting the grid to this compilation were computed by Division of Geodesy and the computation forms are included in this report.

Positions plotted by *Ask*

Positions checked by _____

Grid inked on machine by *Reed*

Intersections inked by *Reed*

Points used for plotting grid:

$\frac{x}{y}$ _____	<i>5 grid points used. 4 corners and center computations lost</i>	$\frac{x}{y}$ _____
$\frac{x}{y}$ _____		$\frac{x}{y}$ _____
$\frac{x}{y}$ _____		$\frac{x}{y}$ _____
$\frac{x}{y}$ _____		$\frac{x}{y}$ _____

Triangulation stations used for checking grid:

- | | |
|------------------------------------|----------|
| 1. <u><i>See Comp. on next</i></u> | 5. _____ |
| 2. <u><i>page</i></u> | 6. _____ |
| 3. _____ | 7. _____ |
| 4. _____ | 8. _____ |

PLANE COORDINATES ON TRANSVERSE MERCATOR PROJECTION

State *N.Y.*

Station *Public School 22 (N.Y.)*

λ (Central meridian)

74° 40'

ϕ *40° 37' 30.300"*

λ

74 09 06.100

$\Delta\lambda$ (Central meridian- λ)

30 53.900

$\Delta\lambda$ (in sec.)

+ 1853.900

log $\Delta\lambda$	<i>3.26808630</i>	log S_m^2	<i>9.278430</i>
Cor. arc to sine	<i>- 585</i>	log C^*	<i>1.337883</i>
log $\Delta\lambda_1$	<i>3.26808045</i>	log $\Delta\phi$	<i>0.616313</i>
log cos ϕ	<i>9.88023396</i>	ϕ	<i>40° 37' 30.300</i>
colog A	<i>1.49089744</i>	$\Delta\phi$	<i>+ 4.1335</i>
log S_1	<i>4.63921185</i>	ϕ'	<i>34.4335</i>
Cor. sine to arc	<i>+ 337</i>		
log S_m	<i>4.63921522</i>		
log 3937/1200	<i>0.51598417</i>	Tabular difference of y for 1" of ϕ'	<i>101.19733</i>
log R	<i>- 1086</i>	y (for min. of ϕ')	<i>649,584.70</i>
log S_g	<i>5.15518853</i>	y (for seconds of ϕ')	<i>+ 3484.58</i>
log S_g^3	<i>15.4655656</i>	y	<i>653,069.28</i>
log $1/6\rho_0^2R^2$	<i>4.5810213</i>		
log $(S_g^3/6\rho_0^2)_g$	<i>0.0465869</i>		
S_g	<i>142,951.438</i>	log sin $\frac{\phi+\phi'}{2}$	
$(S_g^3/6\rho_0^2)_g$	<i>1.113</i>	log $\Delta\lambda$	
x'	<i>+ 142,952.551</i>	log $\Delta\alpha_1$	
	<i>2,000,000.00</i>	log $(\Delta\lambda)^3$	
x	<i>2,142,952.55</i>	log F	
		log b	
		$\Delta\alpha_1$	
		b	
		$\Delta\alpha$	
		$\Delta\alpha$	

* Take out C first for ϕ and correct for approximate ϕ' .

(R 349)

$$x = 2,000,000.00 + x'$$

$$x' = S_g + \left(\frac{S_g^3}{6 \rho_0^2} \right)_g$$

$$S_g = \frac{3937}{1200} S_m R$$

$$\log S_m = \log S_1 + \text{cor. sine to arc}$$

$$S_1 = \frac{\Delta \lambda_1 \cos \phi}{A}$$

$$\log \Delta \lambda_1 = \log \Delta \lambda - \text{cor. arc to sine}$$

$$\left(\frac{S_g^3}{6 \rho_0^2} \right)_g = \frac{S_g^3}{6 \rho_0^2 R^2}$$

$$\phi' = \phi + \Delta \phi$$

$$\Delta \phi = C S_m^2$$

$$\Delta \alpha = \Delta \lambda \sin \frac{\phi + \phi'}{2} + F(\Delta \lambda)^3$$

S_m = distance in meters from point to central meridian

S_1 = distance in meters from point to central meridian reduced to sine

S_g = grid distance in feet from point to central meridian

R = scale reduction factor

Values of y in minutes and tabular difference for one second, scale reduction

factors, $\text{colog } A$, and $\log C$ are given in auxiliary tables.

Used for Check.

Geodetic positions from transverse Mercator coordinates

State N.J. Station Public School 22 (N.Y.)

x	2,142,952.55	log S _g	5.15518853
C	2	log (1200/3937)	9.48401583
x' (=x-C)	142,952.551	log (1/R)	1086
x' ³ /(6ρ ₀ ²) _g	- 1.113	log S _m	4.63921522
S _g	142,951.438	cor. arc to sine	- 337
		log S ₁	4.63921185
log S _m ²	9.278430	log A	8.50910256
log C	1.337885	log sec φ	0.11976604
log Δφ	0.616315	log Δλ ₁	3.26808045
		cor. sine to arc	+ 585
y	653,069.28	log Δλ	3.26808630
φ' (by interpolation)	40° 37' 34.4335	Δλ	+ 1853.9"000
Δφ	- 4.1335	λ (central mer.)	74° 40' "
φ	40 37 30.3000	Δλ	30 53.9000
		λ	74 09 06.1000

Station _____

x		log S _g	
C		log (1200/3937)	9.48401583
x' (=x-C)		log (1/R)	
x' ³ /(6ρ ₀ ²) _g	-	log S _m	
S _g		cor. arc to sine	-
		log S ₁	
log S _m ²		log A	
log C		log sec φ	
log Δφ		log Δλ ₁	
		cor. sine to arc	+
y		log Δλ	
φ' (by interpolation)	° ' "	Δλ	"
Δφ	-	λ (central mer.)	° ' "
φ		Δλ	
		λ	

Explanation of form:

$$x' = x - C$$

$$S_g = x' - \frac{x'^3}{(6\rho_o^2)_g}$$

$$S_m = \frac{1}{R} \left(\frac{1200}{3937} \right) S_g$$

R = scale reduction factor

ϕ' is interpolated from table of y

$$\Delta\phi = C S_m^2$$

$$\phi = \phi' - \Delta\phi$$

$$\Delta\lambda_1 = S_1 A \sec \phi$$

$$\log S_1 = \log S_m - \text{cor. arc to sine}$$

$$\log \Delta\lambda = \log \Delta\lambda_1 + \text{cor. arc to sine}$$

$$\lambda = \lambda(\text{central mer.}) - \Delta\lambda$$