5149

Form 504
Rev. Dec. 1933

DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY
R. S. PATTON, DIRECTOR

DESCRIPTIVE REPORT

Topographic / *Hydrographic* } *Sheet No.* T - 5149

State VIRGINIA

LOCALITY
Elizabeth River
~~SOUTH BRANCH - ELIZABETH RIVER~~
SOUTHERN BRANCH

1936

CHIEF OF PARTY
S. B. Grenell

U.S. GOVERNMENT PRINTING OFFICE: 1934

5149

Applied to Cht 830 - June 22, 1937. R.L.J.
Applied to Cht - 452 June 14, 1938 - PBC.

Mar 24 - 7. P.M.

Form 537a
Ed. Nov. 1929

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.....

T5149

REGISTER NO. T- 5149

State Virginia

General locality ~~Vicinity of Norfolk~~ Elizabeth River

Locality Southern ~~South~~ Branch, ~~Elizabeth River~~

Scale 1:10,000 Date of survey September, 1935 Compiled Nov. Dec, 1936

Vessel Airphoto Compilation Party # 18

Chief of party S. B. Grenell

Surveyed by Airphotos

Inked by R. A. Earle & S. B. Grenell

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

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

Instructions dated March 18, 19 36

Remarks:

NOTES ON COMPILATION

One copy of this form must accompany each chart from beginning to completion. The last draftsman, whose name appears on this form, is responsible for it and all personnel will endeavor to keep these forms up to date and correctly posted. This form is very important inasmuch as the final Descriptive Report of the Chart compiled is based upon the information contained herein.

SHEET NO. T - 5149

Accession: 719 — 76
" 720 — PHOTO NO. 117 TO PHOTO NO. 129

	BY	START	FINISH
ROUGH RADIAL PLOT	S. B. Grenell		
SCALE FACTOR(.97)	S. B. Grenell		
SCALE FACTOR CHECKED	J. A. Giles		
PROJECTION	Washington office		
PROJECTION CHECKED	S. B. Grenell		
CONTROL PLOTTED	S. B. Grenell		
CONTROL CHECKED	J. A. Giles		
TOPOGRAPHY TRANSFERRED	none		
TOPOGRAPHY CHECKED			
SMOOTH RADIAL LINE PLOT	S. B. Grenell		
RADIAL LINE PLOT CHECKED	S. B. Grenell		
DETAIL INKED	Robert A. Earle S. B. Grenell		

AREA DETAIL INKED 25.8 sq. Statute Miles

LENGTH OF SHORELINE OVER ~~300~~ 200 m. 19.0 Statute Miles

LENGTH OF SHORELINE UNDER ~~300~~ 200 m. 21.4 Statute Miles

GENERAL LOCATION Virginia, Elizabeth River

LOCATION Southern Branch

DATUM STATION St. Juliana 1932 Latitude 36 - 47 - 00.828 (25.5 m.) (adjusted)
DATUM: N. A. 1927 Longitude 76 - 18 - 50.498 (1252.1 m.)

X coordinate: 2,640,136.20 FT.
Y " 171,331.58 FT.

The triangulation of the U. S. Engineers mentioned on the opposite page consisted of a system of quadrilaterals with an excellent closure on Coast Survey first order stations at Great Bridge (2 1/2 meters). This triangulation will be computed on the State grid. This triangulation was not used on this compilation. This information was obtained through conversation of the chief of the photo compilation party with the engineer in charge of the U. S. Engineer triangulation party.

The State grid system will be applied to this compilation before it is printed.

B G Jones

REPORT OF COMPILATION
FOR
AIRPHOTO COMPILATION T-5149

PHOTOGRAPHS: Accession 719; Nos. 76 - 90
" 720 " 117 - 129

CONTROL:

The plot of this compilation was fairly well controlled - especially along the waterways - by the following triangulation schemes:-

First order, 1931; Second order, G. W. Cowie, 1932; third order, J. B. Boutelle, 1912.

Most of the stations were on the latter scheme and there were plenty ofthem, although only part of the original number were recovered. Spoil banks from dredging operations along the Elizabeth River and Deep Creek have covered many of the stations. The U. S. Engineers have recently recovered all stations still in good condition and have included them in a triangulation scheme which they have recently completed from Norfolk to Great Bridge. See offsheet page

FIELD INSPECTION:

A launch was borrowed from the Commanding Officer ofthe MIKAWE and field inspection and recovery of control along the waterways was made from this craft. The areas back from the waterways and the first order control stations were inspected from a truck. All of the field inspection was made by the Chief of Party and the one draftsman on the party.

After the shoreline and all detail bordering the waterways was inked in, a second field inspection was made from a launch, directly upon the compilation, and all docks and structures shown on chart #452 were checked. Notes have been made on a copy of chart # 452 which will be forwarded with the compilation. ~~The copy of~~ This section of chart 452 is attached at the back of this report.

SCALE PLOT:

There are two flights covering this compilation, as noted at the beginning ofthis report. Photographs Nos. 76 - 90 overlap compilation5471 to the eastward and are approximately the same scale as the flights on that compilation. The flight on the western edge of this compilation, however, is considerably smaller in scale, but, due to the fact that there is very little control along the junction between 5149 and 5471, it was decided to plot both sheets on the same scale in order that they might be joined andthe overlapping photographs intersected on both sheets.

RADIAL LINE PLOT:

The plot was run through in the usual manner with the two sheets joined togather - thus making it possible to use all control and coordinate the two flights. The plots

Note This compilation is considered more accurate than noted on the offset page. A better estimate is an accuracy of location of 0.5 to ± 1.0 mm except on the extreme edge of the where these values may be exceeded. Some of the photographs were badly tilted but ~~that~~ the control is ample.

BGG

of the overlapping flights were adjusted several time s until fine, clear intersections were secured for radial points common to both flights and all available control held. The western flight - photos 117-129 - was well controlled and gave a perfect tie-in with the adjoining flight - photos 76 - 90.

ADJUSTMENT OF PHOTOGRAPHS: All of the photographs on the flights were tilted, and in addition, the scale varied through some sections of the flights. This was particularily true of photos 117 to 125 which were considerably smaller than the scale of the projection. This made it very difficult to adjust the intricate detail and a proper adjustment was securedonly by interlacing for additional control points.

INTERPRETATION OF DETAIL: The northern half of the compilation is covered with a mass of intricate detail; cultivation, road and street systems, groups of buildings, railway sidings, etc. In addition to the trouble of adjusting this detail - as noted in the preceding paragraph - the prints are badly blurred from the center ofthe wing outward, andin some sections, clouds and cloud shadows obscure detail. The stereoscope was used wherever possible and every effort was made to get a proper interpretation of all detail inked.

COMPLETENESS AND ACCURACY: It was originally intended to carry the inked detail to longitude 76 - 21 on the west,but, when it was found that the photos were so badly blurred and out of scale in this area, detail was stopped at the line of the highway just east of 76 - 21. All detail inked in is complete as far as can be determined from the photographs. Due to the fact that the radial plot worked through so smoothly, I believe that the probable error does not exceed 2 m.m. for well defined detail; this, in spite of the excess adjustment necessary due to the variable scale of the photographs. See note on opposite page.

JUNCTION: The junction with T-5471 is complete.

COMPARISON: There are no contemporary surveys. Comparison was made with Chart 452 as noted ina preceding paragraph.

LANDMARKS: List was submitted when this sheet was sent in for preliminary printing in November, 1936.

Coast Pilot Notes: None submitted.

BRIDGE DATA: Bridge data should be taken from the publication "Bridges Over Navigable Waters of U. S. - 1934". I do not have this publication at hand. I have checked with the local U. S. Engineer office and the list as given is correct to date.

Respectfully submitted,

S. B. Grenell,
Chief of Party # 18

	Remarks	Decisions
1		
2	Not shown on Compilation	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19	"Money Pt" on USGS Quad Norfolk Buell on " " Newport News	
20		
21		A USGB decision
22	U. S. D. C. N. 11/4/38 makes Jones Creek the	
23	Principal tributary of Southern Branch and Gilligan Cr. entering it from southwest	
24		
25		
26		
27		

M 234

GEOGRAPHIC NAMES

Survey No. T-5149

Name on Survey	A On Chart No. 452, 1227	B On previous survey No. T-3249, 3250	C On U.S. quadrangle Maps	D From local information	E On local Maps USCP	F P.O. Guide or Map	G Rand McNally Atlas	H H.R. Doc. 182 U.S. Light List 73 Cong. - 2nd Sess.	K B.P.	
Elizabeth River - Southern Branch ✓	✓	✓	✓		✓					1
~~Herring~~ Canal	✓								26531	2
Paul Cr ✓	✓								Paul's cr 14902	3
Sykes Cr ✓	✓								26530	4
Stewart Cr ✓	✓								Stewart's cr 14901	5
Sampson Cr ✓	✓								Sampsons Cr. 14901	6
New Mill Cr ✓	✓							✓	14901	7
Camden Mill ✓	✓								26531	8
Millville ✓	✓		✓						26531	9
Mains Cr ✓	✓		✓					✓		10
Hodges Cr ✓	✓							✓	14906	11
Deep Cr ✓	✓ appd	✓	✓					✓	✓	12
Newton Cr ✓	✓		✓					✓	Mill-Dam cr 14905	13
Gilmerton ✓	✓		✓				✓	✓		14
Milldam Cr ✓	✓		✓					✓		15
Money Point (Settlement)	✓						✓			16
Money Point ✓			✓					✓		17
St. Julian Cr ✓	✓	✓	✓					✓		18
Buell ✓	✓		✓			✓	✓			19
Blows Cr ✓	✓		Blow cr					✓		20
Paradise Cr ✓	✓ appd	✓	✓							21
Jones Cr ✓	✓		Gilligan cr					✓		22
Gilligan Cr ✓	✓							✓		23
Dismal Swamp Canal ✓	✓		✓							24
Gilmerton - Deep Creek Canal ✓	✓									25
Deep Creek (settlement) ✓ 1227										26
			Names underlined in red approved by GHE on 3/15/37							27

M 234

Scaling sheet - Keep in report Envelope

Geographic Positions of Landmarks for Charts

Scaled from Compilation T-5149

OBJECT	LOCATION	(SCALE OF COMP.) LAT.	LONG.	D.M.	D.P.	(TRUE SCALE) D.M.	D.P.
TANK (elevated)	Richmond Cedar Works	36 - 43		810.0		836.5	
			76 - 15	1272.0		1313.4	
TANK (elevated)	Armour & Co.	36 - 46		1301.0		1342.6	
			76 - 17	1143.0		1179.8	
TANK (elevated)		36 - 46		1416.0		1462.0	
	International Agricultural Corp.		76 - 17	1238.0		1278.8	
TANK (elevated)	Eastern Fertilizer Co.	36 - 46		1448.0		1494.6	
			76 - 18	98.0		101.2	
TANK (elevated)	Norfolk Creosoting Co.	36 - 47		358.0		369.0	
			76 - 18	110.0		113.6	
TANK (elevated)		36 - 47		618.0		638.4	
			76 - 17	1197.0		1236.0	
TANK (elevated)	Robertson Fertilizer Co.	36 - 47		757.0		782.0	
			76 - 17	954.0		984.5	
* TANK (elevated)		36 - 47		859.0		887.1	
			76 - 17	781.0		806.0	
TANK (elevated)		36 - 47		1002.0		1034.2	
			76 - 17	787.0		812.6	
TANK (elevated)		36 - 47		1527.0		1576.2	
			76 - 17	368.0		379.9	
STACK (very prominent)	Texas Co.	36 - 47		1458.0		1505.0	
			76 - 17	607.0		626.3	

NOTE: Back-lash scaled and computed as check for all positions. Datum: N.A. 1927

Conversion factor, scaled to true D.M. & D.P. is 1.0326 (approx).

* Triang. J.B.Boutelle, 1912; N.A. 1927 datum: Lat. 36-47 - 886.8; Long. 76-17- 807.1

Form 567
Rev. March 1935

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY

DUPLICATE
Original forwarded in November, 1936

LANDMARKS FOR CHARTS

To be charted
~~TO BE CHARTED~~
~~TO BE DELETED~~ } STRIKE OUT ONE

Fort Norfolk, Norfolk, Va. Nov. 16, 1936

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.

S. B. Grenell
Chief of Party.

GENERAL LOCALITY ELIZABETH RIVER, VA. SOUTHERN BRANCH

NAME AND DESCRIPTION	POSITION LATITUDE ° ′	LATITUDE D. M. METERS	LONGITUDE ° ′	LONGITUDE D. P. METERS	DATUM	METHOD OF LOCATION	DATE OF LOCATION	HARBOR CHART	INSHORE CHART	OFFSHORE CHART	CHARTS AFFECTED
TANK (elevated)	36 43	838.5	76 15	1313.4	N.A. 1927	Air photo	1936	*			452 ✓ 830
TANK (elevated)	36 46	1342.6	76 17	1179.8	"	"	"				" ✓ "
TANK (elevated)	36 46	1402.0	76 17	1278.8	"	"	"				" ✓ "
TANK (elevated)	36 46	1494.6	76 18	101.2	"	"	"				" ✓ "
TANK (elevated)	36 47	369.0	76 16	113.6	"	"	"				" ✓ "
TANK (elevated)	36 47	638.4	76 17	1236.0	"	"	"				" ✓ "
TANK (elevated)	36 47	782.0	76 17	984.6	"	"	"				" ✓ "
TANK (elevated)	36 47	887.1	76 17	806.0	"	"	"				" ✓ "
TANK (elevated)	36 47	1034.2	76 17	812.6	"	"	"				" ✓ "
TANK (elevated)	36 47	1576.2	76 17	379.9	"	"	"				" ✓ "
STACK	36 47	1505.0	76 17	626.3	"	"	"				" ✓ "
Tri. "RICHMOND" TANK (elevated)	36 43	718.2	76 15	1348.0	"	Triang.	1932				" ✓ "
Tri. "ST. JULIENS" TANK - AERO BEACON (elevated)	36 47	25.6	76 16	1252.1	"	"	"				" ✓ "

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.

U. S. GOVERNMENT PRINTING OFFICE

REVIEW OF AIR PHOTO COMPILATION T-5149
Scale 1:10,000

Data Record:

1. Triangulation to 1932.
2. Photographs ~~to~~ September 1935 and October 1935
3. Field inspection to November 1936.

The field inspection noted no appreciable changes from the date of the photographs and detail on this compilation can be considered as of the date of the photographs.

There are no graphic control sheets or contemporary hydrographic surveys in the area covered by this compilation.

Comparison with Topographic Surveys

T-1387c (1873), 1:20,000
T-3249 (1912), 1:10,000
T-3250 (1912), 1:10,000

There have been numerous changes in structural features due to construction, filling and excavating. The high water line has been altered considerably along the shores of the Southern Branch of Elizabeth River and canals have been both constructed and abandoned.

The compilation is complete and adequate to supersede the above topographic surveys for charting.

Comparison with Chart 452, scale 1:20,000

After completion of drawing of this compilation, a final field inspection of the water front detail was made to insure the completeness of the compilation. See page one of the descriptive report, T-5149.

The attached section of chart 452 shows in red ink notes made by the field party regarding changes in detail and detail to be removed from the chart.

The clearance of the elevated transmission line which crosses the Southern Branch is unknown and is omitted from the compilation.

General

All geographic names were added to the compilation in this office. Several groups of piling were added in this office after inspection of the charts, old topographic or hydrographic surveys, and the photographs proved their existence. The transmission line

symbol was completed and several railroad spurs and connections were added in this office.

The field inspection reports that the numerous drainage ditches in this area are essential for cultivation and are characteristic of this locality. The land is low and cultivation is possible only in the areas which are a few feet higher than the surrounding swamp and which can be drained into the swamp. These ditches are often covered by brush and hedges and are not apparent on the photographs but the Chief of Party states that these brush and hedge lines are invariably over a drainage ditch.

March 15, 1937.

H. H. Schleiter

B. G. Jones

REVIEW OF AIR PHOTO COMPILATION NO.

Chief of Party: S. B. Grenell Compiled by: R. A. Earle, S. B. Grenell

Project: Park #18 Instructions dated: 3/18/36

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)

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)

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." M-87

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)

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)~~ None

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)
See paragraph on BRIDGES in descriptive report.
Data added in Wash. office.

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)
Added in office.

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;

S. R. Powell
Chief of Party

19. Remarks after review in office:

Reviewed in office by: H. H. Schleiter 3/15/37 B. J. Gomas

Examined and approved:

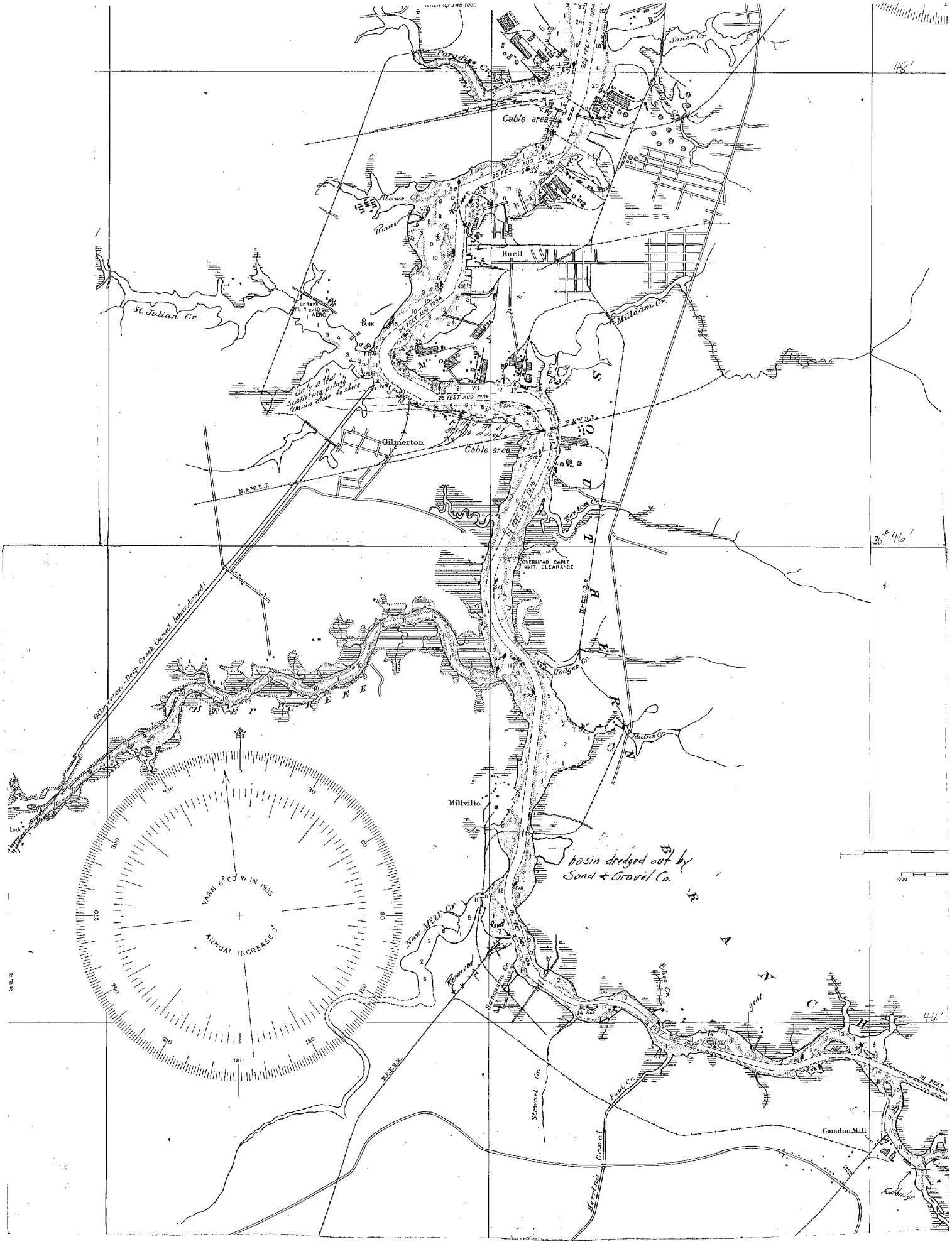
E. K. Green
Chief, Section of Field Records

Fred. L. Peacock
Chief, Section of Field Work

L. O. Colbert
Chief, Division of Charts

H. A. Rue
Chief, Division of Hydrography and Topography.

The work shown has apparently deteriorated and chips & fly very easily. The completion has been retouched where most needed but will probably need additional retouching before printing. S. R. Powell


Paradise Cr.
James Cr.
Cable area
Rowe Cr.
Rivers
Pines
Burell
St. Julian Cr.
Tank
Millam Cr.
Only a few scattering pilings remain above the shore
Gilmerton
Cable area
N.A.W.R.R.
Newton Cr.
OVERHEAD CABLE 150FT. CLEARANCE
Hodges Cr.
Mains Cr.
Millville
basin dredged out by Sand & Gravel Co.
New Mill Cr.
Stewart Cr.
Paul Cr.
Camden Mill
Harrison Canal
VARN 6° 00' W IN 1935
ANNUAL INCREASE 3'
48'
36° 46'
44'

M-350

T-5149

PLANE COORDINATE GRID SYSTEM

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 H. D. REED, JR.

Positions checked by _____

Grid inked ~~on machine~~ by hand by Wittman

~~Intersections inked~~ grid checked by B.G.J.

Points used for plotting grid:

x 2,630,000 FT. y 175,000 FT.	x 2,645,000 y 165,000
x 2,630,000 y 165,000	x 2,645,000 y 150,000
x 2,630,000 y 150,000	x 2,655,000 y 175,000
x 2,645,000 y 175,000	x 2,655,000 y 165,000

K = 2,655,000
Y = 150,000

Triangulation stations used for checking grid:

1. St. Julian, 1932 (K= , Y=)	5. _____
2. _____	6. _____
3. _____	7. _____
4. _____	8. _____

T-5149

Geodetic positions from Lambert coordinates

State Va. South Station A

x	2,630,000	$R_b + A$	27,811,312.71
C		y	175,000
x' (= x − C)	+630,000	$R_b + A - y$	27,636,312.71
tan θ	log 3.67221037	R	
θ	0° 18′ 21″.2		
	"	y	175,000
$\frac{\theta}{\ell}$ (= Δλ)	log 3.88907547	y″	− 7,179.84
		y′	167,820.16
λ (central mer.)	78° 30′ "		✓
− Δλ	+ 2 09 05.9639	φ (by interpolation)	36° 47′ 39.3943
λ	76 20 54.0361 ✓		

Station B

x	2,630,000	$R_b + A$	27,811,312.71
C		y	165,000
x' (= x − C)	+630,000	$R_b + A - y$	27,646,312.71
tan θ		R	
θ	° ′ ″		
	″	y	165,000
$\frac{\theta}{\ell}$ (= Δλ)		y″	− 7,177.24
		y′	157,822.76
λ (central mer.)	78° 30′ "		✓
− Δλ	+ 2 09 03.1631	✓φ (by interpolation)	36° 46′ 00.5396
λ	76 20 56.8369		

$$\tan\theta = \frac{x - C}{R_b + A - y}$$

$$\Delta\lambda = \frac{\theta}{\ell}$$

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

$$R = (R_b + A - y)\sec\theta$$

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

$$y' = y - y''$$

C is constant added to x′ in computation of coordinates

R_b is map radius of lowest parallel

A is value of y′ for R_b; in most cases it is zero

φ is interpolated from table of y′

(M-28)

T-5149

Geodetic positions from Lambert coordinates

State Va. South Station C

x	2,630,000	$R_b + A$	
C		y	150,000
$x' (= x - C)$	+630,000	$R_b + A - y$	27,661,312.71
tan θ		R	
θ	° ′ ″		
	″	y	150,000
$\frac{\theta}{\ell} (= \Delta\lambda)$		y″	− 7,173.35
		y′	142,826.65
λ (central mer.)	78° 30′ ″		
$-\Delta\lambda$	+ 2 08 58.9657	φ (by interpolation)	36° 43′ 32.2575
λ	76 21 01.0343		

Station D

x	2,645,000	$R_b + A$	
C		y	175,000
$x' (= x - C)$	+645,000	$R_b + A - y$	27,636,312.71
tan θ		R	
θ	° ′ ″		
	″	y	175,000
$\frac{\theta}{\ell} (= \Delta\lambda)$		y″	− 7,525.76
		y′	167,474.24
λ (central mer.)	78° 30′ ″		
$-\Delta\lambda$	2 12 10.3254	φ (by interpolation)	36° 47′ 35.9739
λ	76 17 49.6746		

$$\tan\theta = \frac{x - C}{R_b + A - y}$$

$$\Delta\lambda = \frac{\theta}{\ell}$$

$\lambda = \lambda$ (central mer.) $- \Delta\lambda$

$R = (R_b + A - y) \sec\theta$

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

$y' = y - y''$

C is constant added to x′ in computation of coordinates

R_b is map radius of lowest parallel

A is value of y′ for R_b; in most cases it is zero

φ is interpolated from table of y′

(M-26)

T-5149

Geodetic positions from Lambert coordinates

State Va. South Station E

x	2,645,000	$R_b + A$	
C		y	165 000
x' (= x−C)	+645,000	$R_b + A - y$	27,646,312.71
tan θ		R	
θ	° ′ ″		
	″	y	165,000
$\frac{\theta}{\ell}$ (= Δλ)		y''	− 7523.04
		y'	157,476.96
λ (central mer.)	78° 30′ ″		
− Δλ	2 12 07.4582 ✓	φ (by interpolation)	36° 45′ 57.1203 ✓
λ	76 17 52.5418		

Station J

x	2,645,000	$R_b + A$	
C		y	150,000
x' (= x−C)	+645,000	$R_b + A - y$	27,661,312.71
tan θ		R	
θ	° ′ ″		
	″	y	150,000
$\frac{\theta}{\ell}$ (= Δλ)		y''	− 7518.96
		y'	142,481.04
λ (central mer.)	78° 30′ ″		
− Δλ	2 12 03.1606 ✓	φ (by interpolation)	36° 43′ 28.8401 ✓
λ	76 17 56.8394		

$$\tan\theta = \frac{x - C}{R_b + A - y}$$

$$\Delta\lambda = \frac{\theta}{\ell}$$

$\lambda = \lambda$ (central mer.) $- \Delta\lambda$

$R = (R_b + A - y) \sec\theta$

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

$y' = y - y''$

C is constant added to x' in computation of coordinates

R_b is map radius of lowest parallel

A is value of y' for R_b; in most cases it is zero

φ is interpolated from table of y'

(M-28)

T-5149

Geodetic positions from Lambert coordinates

State Va. South Station G

x	2,655,000	$R_b + A$	
C		y	175,000
x' (= x − C)	+655,000	$R_b + A - y$	27,636,312.71
tan θ		R	
θ	° ′ ″		
	″	y	175,000
$\frac{\theta}{\ell}$ (= Δλ)		y''	− 7,760.89
		y'	167,239.11
λ (central mer.)	78° 30′ ″		
− Δλ	2 14 13.2307	✓ φ (by interpolation)	36° 47′ 33.6489″ ✓
λ	76 15 46.7693		

Station H

x	2,655,000	$R_b + A$	
C		y	165,000
x' (= x − C)	+655,000	$R_b + A - y$	27,646,312.71
tan θ		R	
θ	° ′ ″		
	″	y	165,000
$\frac{\theta}{\ell}$ (= Δλ)		y''	− 7,758.08
		y'	157,241.92
λ (central mer.)	78° 30′ ″		
− Δλ	− 2 14 10.3189	✓ φ (by interpolation)	36° 45′ 54.7962″ ✓
λ	76 15 49.6811 ✓		

$$\tan\theta = \frac{x - C}{R_b + A - y}$$

$$\Delta\lambda = \frac{\theta}{\ell}$$

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

$$R = (R_b + A - y)\sec\theta$$

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

$$y' = y - y''$$

C is constant added to x′ in computation of coordinates

R_b is map radius of lowest parallel

A is value of y′ for R_b; in most cases it is zero

φ is interpolated from table of y′

(M-28)

Geodetic positions from Lambert coordinates T-5149

State Va. South Station I

x	2,655,000	$R_b + A$	27,811,312.71
C		y	150,000
x' (= x − C)	+655,000	$R_b + A - y$	27,661,312.71
tan θ		R	
θ	log θ 3.688712 49 / 9.783134 90		
		y	150,000
$\frac{\theta}{\ell}$ (= Δλ)	3.90557759	y''	− 7,753.88
		y'	142,246.12
λ (central mer.)	78° 30′ ″		
− Δλ	+ 2 14 05.9548	φ (by interpolation)	36° 43′ 26.5172
λ	76 15 54.0452		

Station

x		$R_b + A$	
C		y	
x' (= x − C)		$R_b + A - y$	
tan θ		R	
θ	° ′ ″ / ″		
		y	
$\frac{\theta}{\ell}$ (= Δλ)		y''	−
		y'	
λ (central mer.)	° ′ ″		
− Δλ		φ (by interpolation)	° ′ ″
λ			

$\tan\theta = \frac{x - C}{R_b + A - y}$

$\Delta\lambda = \frac{\theta}{\ell}$

$\lambda = \lambda$ (central mer.) $- \Delta\lambda$

$R = (R_b + A - y) \sec\theta$

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

$y' = y - y''$

C is constant added to x' in computation of coordinates

R_b is map radius of lowest parallel

A is value of y' for R_b; in most cases it is zero

φ is interpolated from table of y'

(M-28)

T - 5149

Plane coordinates on Lambert projection

State Va. South Station A

ϕ = 36° 47' 39".3943 λ = 76° 20' 54".0361

Tabular difference of R for 1" of ϕ = 101.13233

R (for min. of ϕ)		27,647,476.59	y' (for min. of ϕ)		163,836.12
Cor. for sec. of ϕ		− 3 984.04	Cor. for sec. of ϕ		+ 3 984.04
R		27,643,492.55	y'		167,820.16
			y'' (=2R sin² $\frac{\theta}{2}$)		+ 7 179.84 ✓
θ (for min. of λ)		+ 1° 18' 54".0136	y		175,000.00
Cor. for sec. of λ		− 32.7759			
θ		+ 1 18 21.2177	$\frac{\theta}{2}$		°39 10.6
θ''	For machine computation	4701."2177		For machine computation	
			log θ''		3.67221037
log θ''		3.67221037	colog 2		9.69897000
S for θ		4.68553727	S for $\frac{\theta}{2}$		4.68556546
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.05674583
log R		7.44159291		R sin $\frac{\theta}{2}$	
log x'		5.79934055	log sin² $\frac{\theta}{2}$	R sin² $\frac{\theta}{2}$	6.11349166
x'	R sin θ	+ 630,000	log R		7.44159291
		2,000,000.00	log 2		0.30103000
x		2,630,000 ✓	log y''		3.85611457

x = 2,000,000.00 + R sin θ

y = y' + 2R sin² $\frac{\theta}{2}$

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

(R 340)

T-5149

Plane coordinates on Lambert projection

State Va. South Station B

ϕ = 36° 46′ 0″0.5396 λ = 76° 20′ 56″.8369

Tabular difference of R for 1″ of ϕ = 101.13217

R (for min. of ϕ)		27,653,544.52	y′ (for min. of ϕ)		157,768.19
Cor. for sec. of ϕ		− 54.57	Cor. for sec. of ϕ		+ 54.57
R		27,653,489.95	y′		157,822.76
			y″ (=2R sin² $\frac{\theta}{2}$)		+ 7177.24
θ (for min. of λ)		+ 1 ° 18′ 54″.0136	y		165,000.00
Cor. for sec. of λ		− 34.4957			
θ		+ 1 18 19.5179	$\frac{\theta}{2}$		° 39 ′ 09″.5
θ''	For machine computation	4699.5179		For machine computation	
			log θ''		3.67205331
log θ''		3.67205331	colog 2		9.69897000
S for θ		4.68553729	S for $\frac{\theta}{2}$		4.68556547
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.05658878
log R		7.44174995		R sin $\frac{\theta}{2}$	
log x′		5.79934055	log sin² $\frac{\theta}{2}$	R sin² $\frac{\theta}{2}$	6.11317756
x′	R sin θ	630,000	log R		7.44174995
		2,000,000.00	log 2		0.30103000
x		2,630,000	log y″		3.85595751

x = 2,000,000.00 + R sin θ

y = y′ + 2R sin² $\frac{\theta}{2}$

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

(R 340)

T-5149

Plane coordinates on Lambert projection

State Va South Station C

ϕ = 36° 43' 32.2575" λ = 76° 21' 01.0343"

Tabular difference of R for 1" of ϕ = 101.13233

R (for min. of ϕ)		27,671,748.34	y' (for min. of ϕ)		139,564.37
Cor. for sec. of ϕ		− 3 262.28	Cor. for sec. of ϕ		+ 3262.28
R		27,668,486.06	y'		142,826.65
			y'' (=2R $\sin^2 \frac{\theta}{2}$)		+ 7,173.35
θ (for min. of λ)		+ 1° 18' 17.5981	y		150,000.00
Cor. for sec. of λ		− .6277			
θ		1 18 16.9704	$\frac{\theta}{2}$		° 39' 08.48
θ''	For machine computation	+ 4696.9704		For machine computation	
			log θ''		3.67181782
log θ''		3.67181782	colog 2		9.69897000
S for θ		4.68553733	S for $\frac{\theta}{2}$		4.68556549
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.05635331
log R		7.44198540		R sin $\frac{\theta}{2}$	
log x'		5.79934055	log $\sin^2 \frac{\theta}{2}$	R $\sin^2 \frac{\theta}{2}$	6.11270662
x'	R sin θ	+ 630,000.00	log R		7.44198540
		2,000,000.00	log 2		0.30103000
x		2,630,000	log y''		3.85572202

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

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

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

(R 340)

T-5149

Plane coordinates on Lambert projection

State Va South Station D

ϕ = 36° 47′ 35.9739 λ = 76° 17′ 49.6746

Tabular difference of R for 1″ of ϕ = 101.13233

R (for min. of ϕ)		27,647,476.59	y′ (for min. of ϕ)		163,836.12
Cor. for sec. of ϕ		− 3638.12	Cor. for sec. of ϕ		+ 3638.12
R		27,643,838.47	y′		167,474.24
			y″ (=2R $\sin^2 \frac{\theta}{2}$)		+ 7525.76
θ (for min. of λ)		+ 1° 20′ 43.260	y		175,000.00
Cor. for sec. of λ		− 30.1487			
θ		1 20 13.1114	$\frac{\theta}{2}$		° 40′ 06.56
θ''	For machine computation	4813."1114		For machine computation	
			log θ''		3.68242591
log θ''		3.68242591	colog 2		9.69897000
S for θ		4.68553546	S for $\frac{\theta}{2}$		4.68556501
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.06696092
log R		7.44159834		R sin $\frac{\theta}{2}$	
log x′		5.80955971	log $\sin^2 \frac{\theta}{2}$	R $\sin^2 \frac{\theta}{2}$	6.13392184
x′	R sin θ	645,000	log R		7.44159834
		2,000,000.00	log 2		0.30103000
x		2,645,000	log y″		3.87655018

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

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

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

(R 340)

T-5149

Plane coordinates on Lambert projection

State Va South Station E

ϕ = 36° 45' 57.1203 λ = 76° 17' 52.5418

Tabular difference of R for 1" of ϕ = 101.13233

R (for min. of ϕ)		27,659,612.46	y' (for min. of ϕ)		151,700.25
Cor. for sec. of ϕ		− 5776.71	Cor. for sec. of ϕ		+ 5776.71
R		27,653,835.75	y'		157,476.96
			y'' (=2R $\sin^2 \frac{\theta}{2}$)		+ 7,523.04
θ (for min. of λ)		+ 1° 20' 43.2601	y		165,000.00
Cor. for sec. of λ		− 31.8889			
θ		+ 1 20 11.3712	$\frac{\theta}{2}$		° 40' 05.68
θ''	For machine computation	4811."3712		For machine computation	
			log θ''		3.68226886
log θ''		3.68226886	colog 2		9.69897000
S for θ		4.68553548	S for $\frac{\theta}{2}$		4.68556502
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.06680388
log R		7.44175538		R sin $\frac{\theta}{2}$	
log x'		5.80955972	log $\sin^2 \frac{\theta}{2}$	R $\sin^2 \frac{\theta}{2}$	6.13360776
x'	R sin θ	645,000.01	log R		7.44175538
		2,000,000.00	log 2		0.30103000
x		2,645,000.01	log y''		3.87639314

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

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

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

T-5149

Plane coordinates on Lambert projection

State Va. South Station 7

$\phi = 36^\circ\ 43'\ 28.8401$ $\lambda = 76^\circ\ 17'\ 56.8394$

Tabular difference of R for 1" of ϕ = 101.13233

R (for min. of ϕ)		27,671,748.34	y' (for min. of ϕ)		139,564.37
Cor. for sec. of ϕ		− 2916.67	Cor. for sec. of ϕ		+ 2916.67
R		27,668,831.67	y'		142,481.04
			y'' (=2R $\sin^2 \frac{\theta}{2}$)		+ 7,518.96
θ (for min. of λ)		+ 1° 20' 43".2601	y		150,000.00
Cor. for sec. of λ		− 34.4972			
θ		1 20 08.7629	$\frac{\theta}{2}$		° ' "
θ''	For machine computation	4808".7629		For machine computation	
			log θ''		3.68203336
log θ''		3.68203336	colog 2		9.69897000
S for θ		4.68553552	S for $\frac{\theta}{2}$		4.68556503
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.06656839
log R		7.44199082		R sin $\frac{\theta}{2}$	
log x'		5.80955970	log $\sin^2 \frac{\theta}{2}$	R $\sin^2 \frac{\theta}{2}$	6.13313678
x'	R sin θ	644,999.99	log R		7.44199082
		2,000,000.00	log 2		0.30103000
x		2,644,999.99	log y''		3.87615760

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

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

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

T-5149

Plane coordinates on Lambert projection

State Va South Station G.

ϕ = 36° 47′ 33.6489 λ = 76° 15′ 46.7693

Tabular difference of R for 1″ of ϕ = 101.13233

R (for min. of ϕ)		27,647,476.59	y′ (for min. of ϕ)		163,836.12
Cor. for sec. of ϕ		− 3 402.99	Cor. for sec. of ϕ		+ 3 402.99
R		27,644,073.60	y′		167,239.11
			y″ (=2R $\sin^2 \frac{\theta}{2}$)		+ 7,760.89
θ (for min. of λ)		+ 1° 21′ 56.0911	y		175,000.00
Cor. for sec. of λ		− 28.3854			
θ		1 21 27.7057	$\frac{\theta}{2}$		° ′ ″
θ''	For machine computation	4887.7057		For machine computation	
			log θ''		3.68910505
log θ''		3.68910505	colog 2		9.69897000
S for θ		4.68553422	S for $\frac{\theta}{2}$		4.68556470
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.07363975
log R		7.44160204		R sin $\frac{\theta}{2}$	
log x′		5.81624131	log $\sin^2 \frac{\theta}{2}$	R $\sin^2 \frac{\theta}{2}$	6.14727950
x′	R sin θ	655,000.02	log R		7.44160204
		2,000,000.00	log 2		0.30103000
x		2,655,000.02	log y″		3.88991154

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

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

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

(R 340)

T-5149

Plane coordinates on Lambert projection

State Va. South Station 14

ϕ = 36° 45′ 54.7962 λ = 76° 15′ 49.6811

Tabular difference of R for 1″ of ϕ = 101.13233

R (for min. of ϕ)		27,659,612.46	y′ (for min. of ϕ)		151,700.25
Cor. for sec. of ϕ		− 5541.67	Cor. for sec. of ϕ		+ 5541.67
R		27,654,070.79	y′		157,241.92
			y″ (=2R sin² $\frac{\theta}{2}$)		+ 7758.08
θ (for min. of λ)		+ 1° 21′ 56.0911	y		165,000.00
Cor. for sec. of λ		− 30.1527			
θ		+ 1 21 25.9384	$\frac{\theta}{2}$		° ′ ″
θ''	For machine computation	4885.9384		For machine computation	
log θ''		3.68894798	log θ''		3.68894798
S for θ		4.68553425	colog 2		9.69897000
log sin θ	sin θ		S for $\frac{\theta}{2}$		4.68556471
log R		7.44175907	log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.07348269
log x′		5.81624130		R sin $\frac{\theta}{2}$	
x′	R sin θ	+ 655,000	log sin² $\frac{\theta}{2}$	R sin² $\frac{\theta}{2}$	6.14696538
		2,000,000.00	log R		7.44175907
x		2,655,000	log 2		0.30103000
			log y″		3.88975445

x = 2,000,000.00 + R sin θ

y = y′ + 2R sin² $\frac{\theta}{2}$

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

(R 340)

T-5149

Plane coordinates on Lambert projection

State Va. S. Station I

$\phi = 36^\circ 43' 26.5172$ $\lambda = 76^\circ 15' 54.0452$

Tabular difference of R for 1" of ϕ = 101.13233

R (for min. of ϕ)		27,671,748.34	y' (for min. of ϕ)		139,564.37
Cor. for sec. of ϕ		− 2 681.75	Cor. for sec. of ϕ		+ 2,681.75
R		27,669,066.59	y'		142,246.12
			y" (=2R $\sin^2 \frac{\theta}{2}$)		+ 7,753.88
θ (for min. of λ)		+ 1° 21' 56.0911	y		150,000.00
Cor. for sec. of λ		− 32.8014			
θ		+ 1 21 23.2897	$\frac{\theta}{2}$		° 40 41.64
θ"	For machine computation	4883".2897		For machine computation	
			log θ"		3.68871249
log θ"		3.68871249	colog 2		9.69897000
S for θ		4.68553429	S for $\frac{\theta}{2}$		4.68556472
log sin θ	sin θ		log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	8.07324721
log R		7.44199451		R sin $\frac{\theta}{2}$	
log x'		5.81624129	log $\sin^2 \frac{\theta}{2}$	R $\sin^2 \frac{\theta}{2}$	6.14649442
x'	R sin θ	654,999.98	log R		7.44199451
		2,000,000.00	log 2		0.30103000
x		2,654,999.98	log y"		3.88951893

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

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

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

(R 340)