



Town of Duck, NC 2013 Hydrographic and Topographic Beach Survey Report

Prepared for:

Town of Duck

Prepared by:

**Coastal Planning & Engineering of North Carolina, Inc., No. C-2331
4038 Masonboro Loop Road
Wilmington, NC 28409**

November 2013



TABLE OF CONTENTS

Abstract
Survey Methodologies
Map Preparation
Ground Digital Photography
Survey Maps
Survey Report Notes and Certification

LIST OF APPENDICES

Appendix No.

- 1 Monument Information Report
- 2 Profile XYZ data
- 3 Profile Plots
- 4 Ground Digital Photography
- 5 Field Book Pages



ABSTRACT

Coastal Planning & Engineering of North Carolina, Inc. (CPE-NC) was contracted by the Town of Duck to provide a hydrographic and topographic survey for the support of a beach nourishment project consisting of thirty-eight (38) profile stations ranging from Salt House Road in the community of Pine Island to 9th Avenue in the Town of Southern Shores. CPE-NC surveyors conducted the beach and hydrographic survey September 10, 2013 through September 16, 2013.

The physical monitoring of Duck included Hydrographic and Topographic surveys of the beach and offshore areas. The monitoring data is necessary to observe and assess beach conditions to aid in the design of the beach nourishment project. Once a project is constructed, monitoring surveys are necessary to continually observe the performance of the nourishment project as well as assess effects of said project on adjacent shorelines.

The scientific monitoring processes provide information necessary to plan, design, and optimize initial beach nourishment projects and future renourishment projects. The information gathered may potentially reduce the need for, and cost of, unnecessary work as well as potentially reducing any environmental impact that may have occurred or been expected.



SURVEY METHODOLOGIES

The beach profile surveys were conducted in accordance with the Minimum Performance Standards for the U.S. Army Corps of Engineers (USACE), Engineering and Design Hydrographic Surveying Manual (EM 1110-2-1003).

This survey is in accordance with Chapter 56.1606 of the North Carolina Administrative Code (NCAC) specifications established by The North Carolina Engineering and Land Surveying Act (GS89C). All work was conducted under the direct supervision and responsible charge of a Professional Land Surveyor (PLS) who is registered in the State of North Carolina. In addition, all hydrographic surveying was conducted under the direct supervision of an American Congress of Surveying and Mapping (ACSM) Certified Hydrographer (CH). A signed and sealed certification is provided at the end of this Hydrographic and Topographic Survey Report. Eight (8) maps are presented, one (1) project location map and seven (7) plan view maps. The plan view maps show reduced true position elevation data collected during the survey. The location of all published control, as well as control found and used for survey purposes, is presented in the Monument Information Report provided in **Appendix 1**.

Vertical data was collected in the North American Vertical Datum of 1988 (NAVD88). All Horizontal data is provided in the North Carolina State Plane Coordinate System, North American Datum of 1983/2011 (NAD 83/2011). Profile data is presented in xyz format relative to NAVD88 in **Appendix 2**. Profile plots are provided in **Appendix 3**. Ground digital photography obtained during the survey is provided in **Appendix 4**. Copies of all field book pages are provided in **Appendix 5**.

The field survey and data collection activities encompassed four (4) phases. Brief descriptions of each survey phase, including methodologies and quality control/quality assurance procedures, are described below.

Phase One: Control Reconnaissance/Establishment/Verification

Prior to the start of the survey, reconnaissance of the monuments was conducted to confirm that survey control was in place and undisturbed. Real Time Kinematic Global Positioning System (RTK GPS) was used to locate and confirm survey control for this project. The horizontal and vertical accuracy of control data meets the accuracy requirements as set forth in the Engineering and Design Hydrographic Surveying Manual (EM 1110-2-1003). In order to achieve required accuracy, the Hydrographic and Topographic surveys were controlled using 1st order monuments, specifically Caffey and Y254 from the National Geodetic Survey (NGS). Horizontal and vertical positioning checks were conducted at the beginning and end of each day using at least two 1st order monuments in the project area. The RTK GPS utilizes statistical methods to ensure accuracy of RTK GPS data remains within the 95% confidence interval. The control check shots were acquired using a minimum of five (5) epochs which results in a high accuracy location. Results from 1st order control checks are displayed showing northing, easting, monument elevation, inverses, horizontal and vertical root mean square error, location description and photographs as indicated in the Monument Information Report (Appendix 1).



Phase Two: Beach Profiles

Upon completion of the control reconnaissance survey, beach/upland and nearshore operations were initiated. Cross-sections of the beach in the project area were surveyed using extended rod RTK GPS rovers, standard RTK GPS rovers, and differential leveling techniques. Extended rod RTK GPS rovers were used to augment RTK GPS survey capability into the nearshore. The current systems allow surveyors from CPE-NC to collect the entire beach profile with RTK GPS technology. Incorporation of RTK GPS into monitoring surveys greatly reduces the potential for human error during data collection and reduction. Furthermore, RTK GPS provides accuracies of eight (8) millimeters + one (1) part per million with true horizontal positioning to the survey data point regardless of sea state.

Profiles commenced from the onshore control point and extend seaward overlapping the offshore data. Nearshore portions of the profiles were surveyed by two (2) surveyors with an Extended Rod Trimble R8 RTK GPS rover who entered the water wearing Personal Floatation Devices (PFD). Trimble TSC3 data collectors are equipped with Bluetooth technology allowing wireless communication with the GPS receiver. The rover system allows surveyors from CPE-NC to reach a maximum water depth of eleven (11) feet. The nearshore survey extended seaward to a point overlapping the offshore portion of the profiles by at least fifty (50) feet.

The upland portion of the survey commenced at the waterline and extended 150 feet landward of the vegetation line or until an obstacle was encountered. The upland portions of the profiles were surveyed using an RTK GPS. Elevations were taken at approximately twenty-five (25) foot intervals along each profile line and at all grade breaks. To maintain online accuracy surveyors utilized the RTK GPS feature *stakeout point*. *Stakeout point* allows surveyors to maintain the profile azimuth without relying on survey lathe or conventional compass bearings allowing surveyors to maintain a three (3) foot profile line variance.

Phase Three: Nearshore/Offshore Profiles

The Nearshore/Offshore profiles were conducted at each required profile station. The profiles were obtained from the surf zone seaward to an elevation no less than negative twenty-five (-25) feet NAVD88. The landward limits of the nearshore profiles were based on a minimum overlap of fifty (50) feet beyond the seaward extent of beach profiles. Soundings were collected at a maximum of twenty-five (25) foot intervals with an Odom Hydrotrac, sufficient to provide an accurate depiction of the seafloor.

Nearshore/offshore profiles were collected using an Odom Hydrotrac single frequency sounder with digitizer on CPE-NC's twenty-eight (28) foot Parker survey vessel with a centrally located hull-mounted transducer. Data was digitally stored using HYPACK Software. A Trimble R8 RTK GPS was used onboard the survey vessel to provide instantaneous tide and heave corrections. Manual tide readings were taken while conducting the onshore portion of the profile to verify onboard tide readings. In order to maintain the vessel navigation along the profile lines, HYPACK navigation software was used. This software provided horizontal position to the



sounding data allowing real-time review of the data in plan view or cross-section format. HYPACK also provided navigation to the helm to minimize deviation from the online azimuth.

Horizontal and vertical positioning checks were conducted at the beginning and end of each as described in phase one (1) of the survey. The sounder was calibrated via bar-checks and a sound velocity probe at the beginning and end of the day. The DIGIBAR PRO sound velocity meter offers a fast additional calibration for sound velocity as compared to the traditional bar-check. Bar-checks were performed from a depth of five (5) feet to a depth of at least twenty-five (25) feet. Analog data showing the results of the bar-check calibration was displayed on the sounder charts at five (5) foot increments during descent of the bar. Prior to start of each survey day the last profile line of the previous day was rerun to verify accuracy of the hydrographic data. Offshore data was collected within one (1) week of onshore data collection for each line.

Nearshore and offshore data from profile stations D-20 through D23 were omitted due to the request from the Army Corps of Engineers Field Research Facility located in Duck, NC.

Phase Four: Data Reduction/Submittals

Upon completion of the field work, data was edited and reduced with HYPACK, Trimble Business Center, and CPE-NC's internal software programs. The offshore raw digital data was viewed in HYPACK and a comma delimited file was created and exported to ArcGIS 10.1 for the availability to produce plan view plots. The offshore RTK GPS tide data that was collected was compared to the manually collected RTK GPS nearshore tide data, as well as observed and predicted tides for data verification purposes. The onshore and offshore data were merged and a representative cross-section was derived for each profile line. The cross-sections were developed using internal CPE-NC plotting programs.

The final plots were reviewed with comparisons to previous years. The 2011 data used for comparison originated from 2009 upland data (landward of dune crest) obtained through LiDAR, 2011 upland data (dune crest to Mean High Water) obtained through LiDAR provided by the U.S. Army Corps of Engineers Field Research Facility (USACE FRF), and 2011 nearshore and offshore data (seaward of Mean High Water) obtained through bathymetric survey methods conducted by the USACE FRF. The September 2013 nearshore and offshore data used for comparison along profiles D-19 through D-23 (as shown in black on profile plots in Appendix 3) originated from a bathymetric survey conducted by the USACE FRF. The final approved cross-section data was prepared in the required formats for submittal (Appendix 2). Digital data is provided in the State required vertical datum NAVD88.



MAP PREPARATION:

Upon completion of the surveys and data reduction, the survey maps were prepared in ArcGIS 10.1. In order to avoid congestion, the survey maps do not show all of collected elevations but enough to give an accurate depiction of the cross sections. The survey maps display profile data and control monument locations plotted against National Agriculture Imagery Program (NAIP) 2012 aerial photographs.

GROUND DIGITAL PHOTOGRAPHY:

Surveyors from CPE-NC collected three (3) digital photos at a mid-beach location at each profile location. The three (3) photos included one (1) in each shore-parallel direction and one (1) landward toward the dune or upland area.



NOTES:

1. ALL DISTANCES AS SHOWN ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED.
2. COMBINED SCALE FACTOR: 0.999990415.

Matchline Sheet 3 of 8

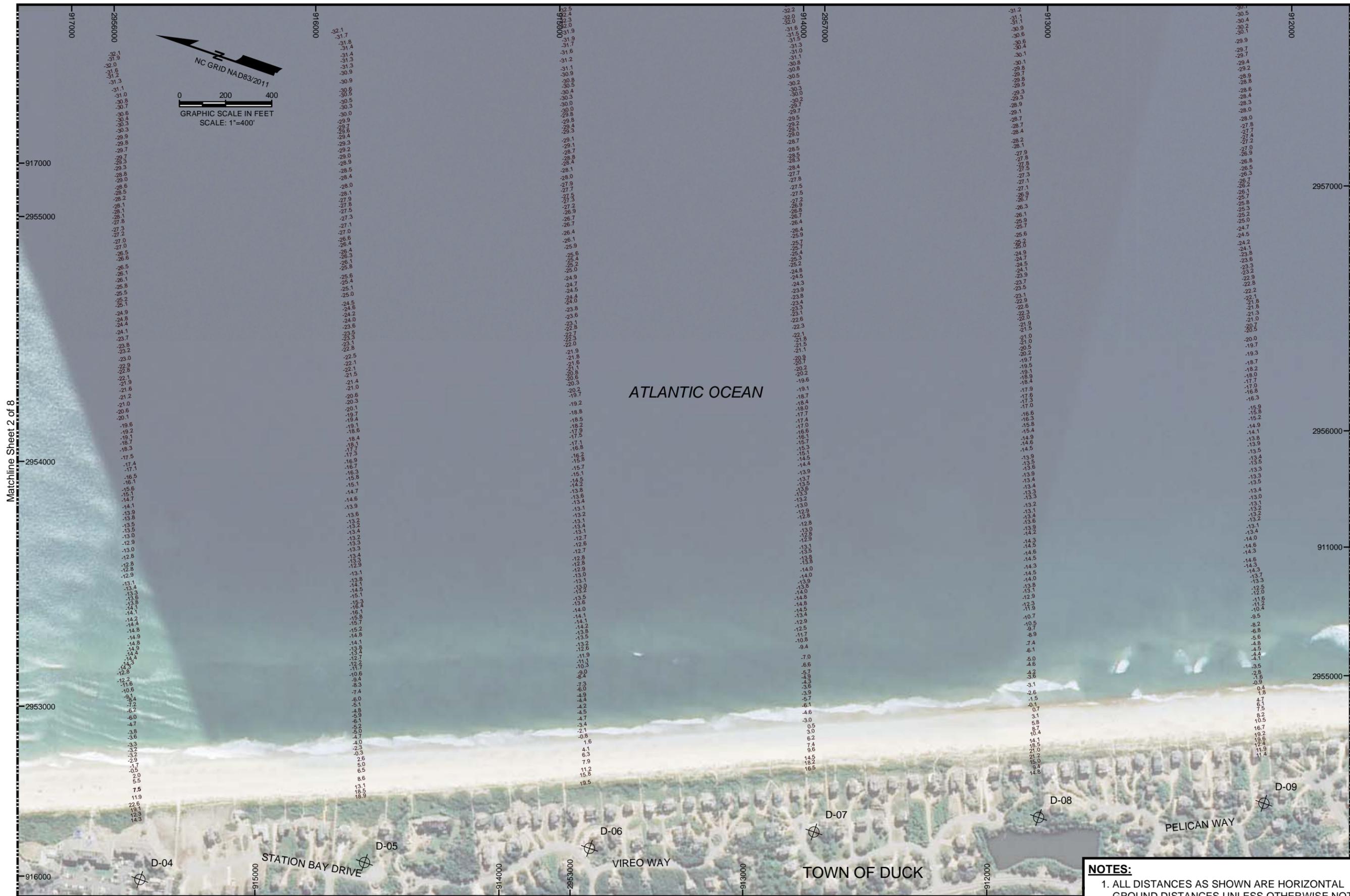
**COASTAL PLANNING & ENGINEERING
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COL #C2331

Reference File:	Designed by:	Checked by:	Description
	J. Sullivan	J. Andrews	
	R. Gooding	A. Deaton	
	November 2013	J. Sullivan	
	AS NOTED	15444	

TOWN OF DUCK, NORTH CAROLINA
2013 HYDROGRAPHIC AND
TOPOGRAPHIC SURVEY

DRAWING NO.
PV-1
SHEET 2 OF 8



Matchline Sheet 2 of 8

Matchline Sheet 4 of 8

NOTES:

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OF NORTH CAROLINA, INC.**

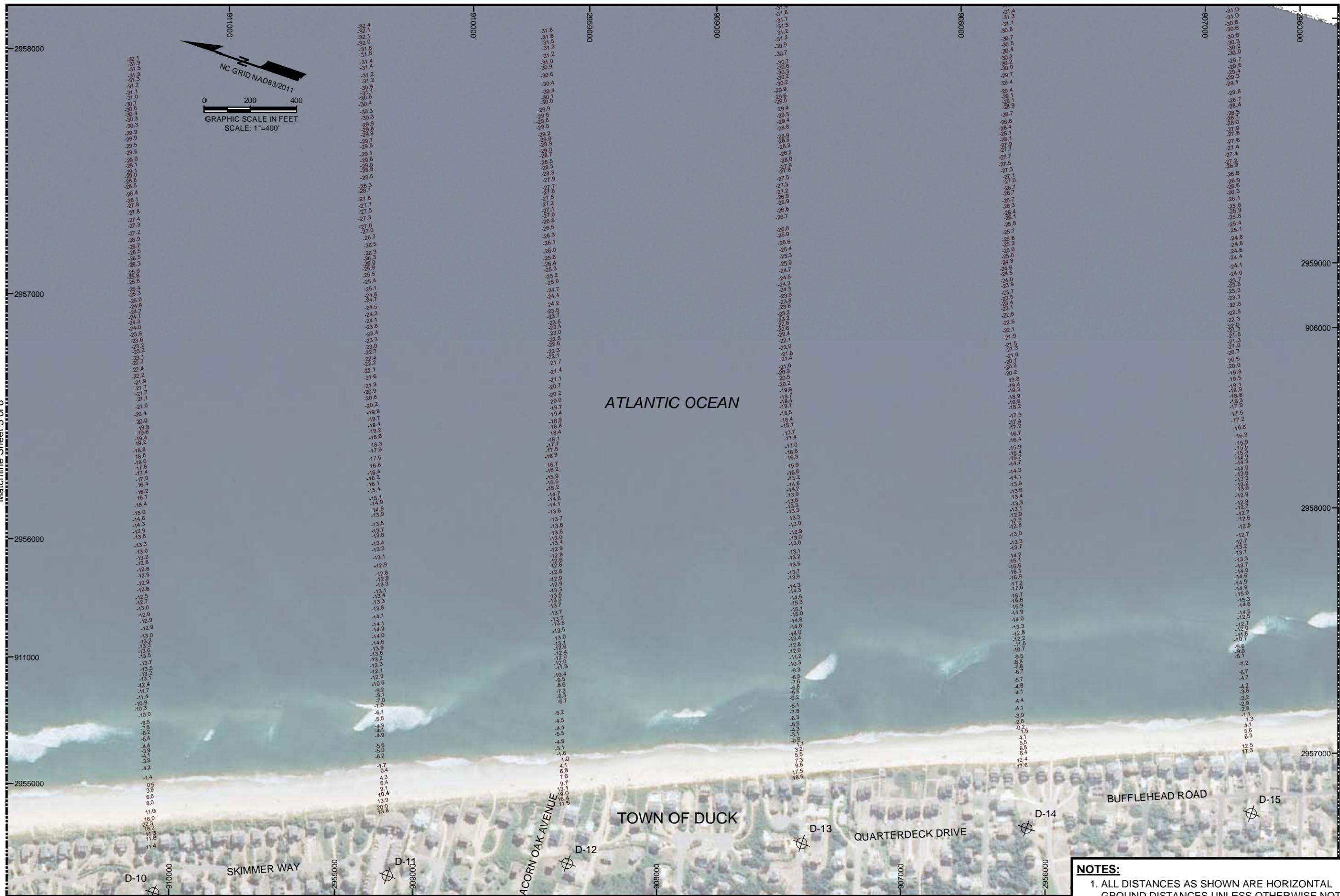
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Checked by:	Designed by:	Reference Files:
J. Andrews	J. Sullivan	
Reviewed by:	Drawn by:	
A. Deaton	R. Gooding	
Submitted by:	Date:	
J. Sullivan	November 2013	
Comm. No.:	Proj. Scale:	
150440	AS NOTED	

TOWN OF DUCK, NORTH CAROLINA
2013 HYDROGRAPHIC AND
TOPOGRAPHIC SURVEY

DRAWING NO.
PV-2
SHEET 3 OF 8

Matchline Sheet 3 of 8



Matchline Sheet 5 of 8

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J. Andrews	J. Sullivan	
Reviewed by:	Drawn by:	
A. DeWitt	R. Gooding	
Submitted by:	Date:	
J. Sullivan	November 2013	
Comm. No.:	Proj. Scale:	
15544	AS NOTED	

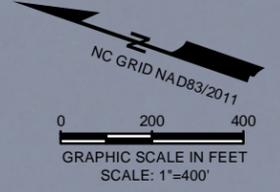
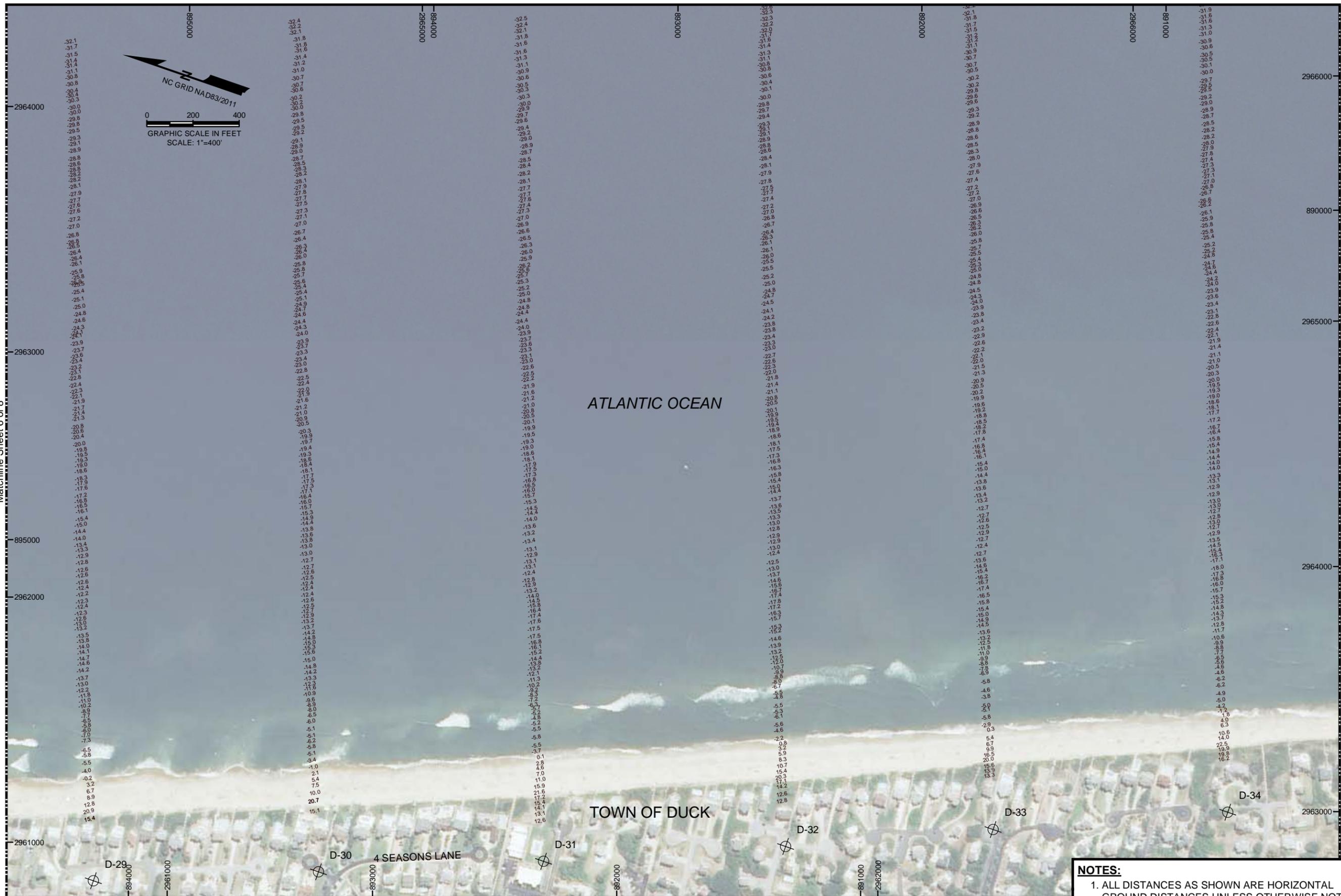
TOWN OF DUCK, NORTH CAROLINA
2013 HYDROGRAPHIC AND
TOPOGRAPHIC SURVEY

DRAWING NO.
PV-3
SHEET 4 OF 8

NOTES:

- ALL DISTANCES AS SHOWN ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED.
- COMBINED SCALE FACTOR: 0.999990415.

Matchline Sheet 6 of 8



Matchline Sheet 8 of 8

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Reference File:	Checked by:	Date	Description
Designed by: J. Sullivan	J. Andrews		
Drawn by: C. Gooding	A. Deaton		
Date: November 2013	Submitted by: J. Sullivan		
Plot Scale: AS NOTED	Comm. No.:	150440	

TOWN OF DUCK, NORTH CAROLINA
2013 HYDROGRAPHIC AND
TOPOGRAPHIC SURVEY

DRAWING NO.
PV-6
SHEET 7 OF 8

- NOTES:**
1. ALL DISTANCES AS SHOWN ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED.
 2. COMBINED SCALE FACTOR: 0.999990415.



SURVEY REPORT NOTES AND CERTIFICATION

Survey Title: Town of Duck, NC 2013 Hydrographic and Topographic Survey
Prepared Date: November 2013
Prepared For: Town of Duck
Prepared By: Coastal Planning & Engineering of North Carolina, Inc.
Dates of Survey: September 10, 2013 through September 16, 2013
Survey Location: Town of Duck (PI-17 through SS-02)

Notes:

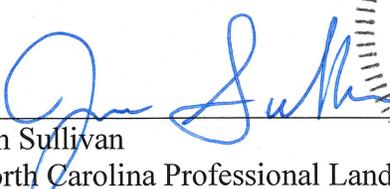
1. The survey is neither valid nor complete without both the survey report and described survey maps. Digital data files encompassing the following have also been provided in the following formats listed.
 - *Monument Information Report (Appendix 1)*
 - *ASCII file (profile xyz data). Digital only (Appendix 2)*
 - *Profile Plots (Appendix 3)*
 - *Ground Digital Photography (Appendix 4)*
 - *Project field book pages. Digital only (Appendix 5)*
2. Survey map and report or the copies thereof are not valid without the original signature and seal of a Professional Licensed Surveyor.
3. The information on this map represents the results of the survey on the dates indicated and can only be considered as indicating the general conditions existing at the time.
4. Additions or deletions to survey maps or report by other than signing party or parties is prohibited without written consent of the signing party or parties.
5. The coordinates shown are in US survey feet based on the vertical and horizontal data that was collected and presented relative to the North American Vertical Datum of 1988 (NAVD88) and the North Carolina State Plane Coordinate System, North American Datum of 1983/2011 (NAD83/2011).

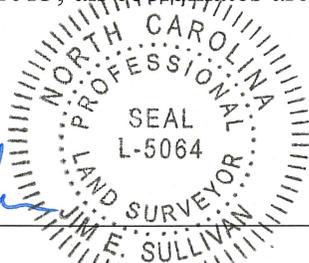


6. Vertical measurements are based on first order monuments Caffey, 865 1370 C Tidal, 865 1370 D Tidal, 865 1370 K Tidal, C255, and Y254 per published NGS coordinates.
7. Bearings are based on a bearing of South 22°10'37" East between NGS monuments Caffey and Y254 per published NGS coordinates.
8. Underground and subaqueous improvements and/or utilities were not located as part of this survey and should be field verified prior to any dredging or construction activities.
9. Refer to CPE-NC field book No. 481 for the onshore portion and CPE-NC Navbook No. 41 for the offshore survey.
10. Aids to navigation were not located during this survey.
11. Soundings were collected using an Odom Hydrotrac, Single Frequency, survey grade sounder. The sounder was calibrated prior to the start of the survey following manufacturers recommended procedures.
12. This survey was conducted for the Town of Duck for use as a Hydrographic and Topographic survey.

Certification:

I, Jim Sullivan, certify that this project was completed under my direct and responsible charge from an actual survey made under my supervision; that this Hydrographic and Topographic survey was performed at the 95 percent confidence level (2 sigma) to meet Federal Geographic Data Committee Standards; that the horizontal accuracy is 0.010, that the vertical accuracy is 0.042 and that the original data was obtained on September 10, 2013; that the survey was completed on September 16, 2013; all coordinates are based on NAD83/2011; and all elevations are based on NAVD88.


Jim Sullivan
North Carolina Professional Land Surveyor No. L-5064
Coastal Planning & Engineering of North Carolina, Inc., No. C-2331
2481 Northwest Boca Raton Blvd., Boca Raton, FL 33431



11-27-2013
Date



APPENDIX OVERVIEW

1) Monument Information Report

Data collected during the surveys is entered in a spreadsheet format and compared to data provided by NGS. This comparison shows differences in northings, eastings and elevation of NGS published control, what was collected in the field, and what was used during profile reduction.

2) Profile XYZ data (digital only)

Offshore survey data was converted into CPE-NC files. Onshore data was reduced by standard means of reduction and also entered into CPE-NC format and merged with the offshore data. CPE-NC format is used for in-house plotting, volume computations and other engineering analyses. The CPE-NC formatted data was converted into xyz format. The xyz data is provided in the datum collected NAVD88 as per state standards.

3) Profile Plots

Profile plots of this survey data compared with historical profile data.

4) Ground Digital Photography

CPE-NC surveyors collected three (3) digital photos at a mid-beach location at each profile location. The three (3) photos included one (1) in each shore-parallel direction and one (1) landward toward the monument. In addition, wherever possible a digital photo was taken of the control identification or stamping on the monument.

5) Field Book Pages (digital only)

This appendix includes copies of the field book pages used for the survey. Refer to CPE-NC field book No. 433 for the onshore portion. Navigation field book No. 41 for the offshore survey.

APPENDIX 1

MONUMENT INFORMATION REPORT

TOWN OF DUCK STATION INFORMATION**SEPTEMBER 2013****DATUMS: NAD83/2001 & NAVD88**

STATION	NORTHING	EASTING	ELEVATION	AZIMUTH	NOTE
PI-17	920098.86	2950657.32	N/A	70	Reference Point
PI-18	919175.36	2951025.99	N/A	70	Reference Point
D-01	918267.75	2951387.52	N/A	70	Reference Point
D-02	917384.44	2951733.76	N/A	70	Reference Point
D-03	916429.37	2952102.95	N/A	70	Reference Point
D-04	915495.29	2952464.03	N/A	70	Reference Point
D-05	914597.97	2952849.30	N/A	70	Reference Point
D-06	913696.93	2953224.38	N/A	70	Reference Point
D-07	912798.76	2953607.33	N/A	70	Reference Point
D-08	911897.95	2953983.04	N/A	70	Reference Point
D-09	910994.82	2954356.65	N/A	70	Reference Point
D-10	910066.74	2954759.12	N/A	70	Reference Point
D-11	909133.14	2955158.05	N/A	70	Reference Point
D-12	908412.53	2955461.41	N/A	70	Reference Point
D-13	907478.35	2955874.29	N/A	70	Reference Point
D-14	906578.33	2956252.15	N/A	70	Reference Point
D-15	905677.78	2956628.57	N/A	70	Reference Point
D-16	904767.65	2956978.72	N/A	70	Reference Point
D-17	903863.92	2957333.66	N/A	70	Reference Point
D-18	902886.47	2957718.79	N/A	70	Reference Point
D-19	902331.03	2957932.45	N/A	70	Reference Point
D-20	901760.74	2958139.73	N/A	70	Reference Point
D-21	900958.69	2958472.08	N/A	70	Reference Point
D-22	900228.83	2958754.03	N/A	70	Reference Point
D-23	899515.64	2958992.70	N/A	70	Reference Point
D-24	898739.78	2959267.16	N/A	70	Reference Point
D-25	897824.26	2959601.68	N/A	70	Reference Point
D-26	896902.26	2959928.60	N/A	70	Reference Point
D-27	895981.88	2960250.61	N/A	70	Reference Point
D-28	895072.97	2960604.07	N/A	70	Reference Point
D-29	894166.25	2960963.56	N/A	70	Reference Point
D-30	893257.57	2961317.69	N/A	70	Reference Point
D-31	892350.69	2961676.73	N/A	70	Reference Point
D-32	891379.42	2962078.13	N/A	70	Reference Point
D-33	890553.16	2962439.37	N/A	70	Reference Point
D-34	889616.07	2962839.65	N/A	70	Reference Point
SS-01	888697.67	2963230.41	N/A	70	Reference Point
SS-02	887775.76	2963618.96	N/A	70	Reference Point



CONTROL MONUMENT USED BY CPE-NC for The Town of Duck September 2013	
DATUMS: NAD83/2001 - NAVD88	
Designation	CAFFEY
Stamping	CAFFEY 1935
Northing	915308.87
Easting	2952084.11
Horizontal Root Mean Square Error	0.117
Elevation	1.99
Vertical Root Mean Square Error	0.039
Description	A U.S. Coast & Geodetic Survey disk in concrete located in thick vegetation approximately 140 feet West of Duck Road and 40 feet South of a parking lot for 1566 Duck Road



Monument: CAFFEY



Location Verification: CAFFEY

Mean of Inverse Shots - Published Versus CPE Found				
Monument	No. of Shots	ΔN	ΔE	ΔZ
CAFFEY	8	0.05	-0.05	0.03



VERTICAL CHECK ONLY

CONTROL MONUMENT USED BY CPE-NC for The Town of Duck September 2013	
DATUMS: NAD83 - NAVD88	
Designation	865 1370 D TIDAL
Stamping	865 1370 D 1977
Northing	900450.64
Easting	2957190.64
Horizontal Root Mean Square Error	2.044
Elevation	18.46
Vertical Root Mean Square Error	0.015
Description	A National Ocean Survey disk protected by an open pipe approximately 6 inches above ground and located on the Army Corp of Engineer's Field Research Facility property (1261 Duck Road) approximately 100 feet East of Duck Road and 100 feet North of the access road.



Monument: 865 1370 D TIDAL



Location Verification: 865 1370 D TIDAL

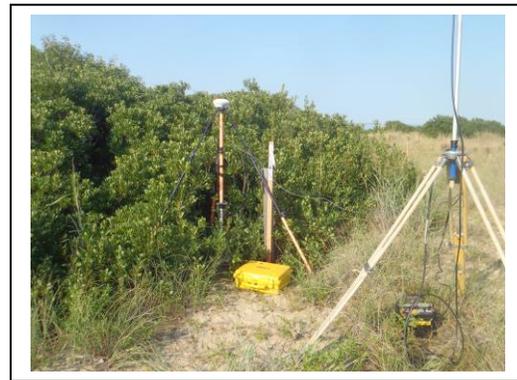
Mean of Inverse Shots - Published Versus CPE Found				
Monument	No. of Shots	ΔN	ΔE	ΔZ
865 1370 D TIDAL	2	-	-	0.01



CONTROL MONUMENT USED BY CPE-NC for The Town of Duck September 2013	
DATUMS: NAD83/2001 - NAVD88	
Designation	865 1370 C TIDAL
Stamping	865 1370 1977
Northing	900621.51
Easting	2957662.02
Horizontal Root Mean Square Error	0.084
Elevation	18.46
Vertical Root Mean Square Error	0.032
Description	A National Ocean Survey disk protected by an open pipe approximately 6 inches above ground and located on the Army Corp of Engineer's Field Research Facility property (1261 Duck Road) approximately 600 feet East of Duck Road, 300 feet West of the gazebo, and 100 feet North of the access road.



Monument: 865 1370 C TIDAL



Location Verification: 865 1370 C TIDAL

Mean of Inverse Shots - Published Versus CPE Found				
Monument	No. of Shots	ΔN	ΔE	ΔZ
865 1370 C TIDAL	24	-0.03	0.03	0.02



CONTROL MONUMENT USED BY CPE-NC for The Town of Duck September 2013	
DATUMS: NAD83/2001 - NAVD88	
Designation	C255
Stamping	C255 1981
Northing	900856.11
Easting	2958600.06
Horizontal Root Mean Square Error	0.119
Elevation	16.89
Vertical Root Mean Square Error	0.059
Description	A National Geodetic Survey pin inside a protective casing with lid approximately 3 inches below ground and located between the two steps on the West side of the Army Corp of Engineer's Field Research Facility (1261 Duck Road), approximately 355 feet East of the main parking lot gate, 15 feet South of the Northerly steps, 15 feet North of the Southerly steps, and 2.7 feet West of the flag pole.



Monument: C255



Location Verification: C255

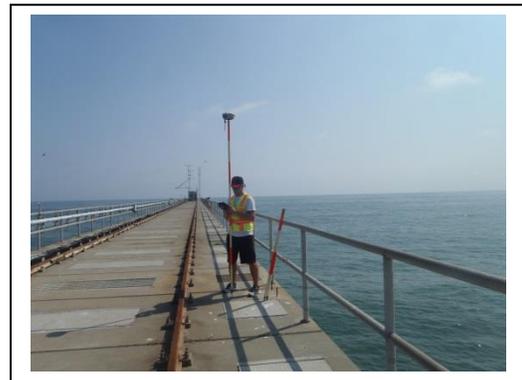
Mean of Inverse Shots - Published Versus CPE Found				
Monument	No. of Shots	ΔN	ΔE	ΔZ
C255	18	0.02	0.00	0.04



CONTROL MONUMENT USED BY CPE-NC for The Town of Duck September 2013	
DATUMS: NAD83/2001 - NAVD88	
Designation	865 1370 K Tidal
Stamping	1370 K 1980
Northing	901318.46
Easting	2959889.05
Horizontal Root Mean Square Error	0.016
Elevation	24.45
Vertical Root Mean Square Error	0.022
Description	A National Ocean Survey disk located on a concrete research pier for the Army Corp of Engineer's Field Research Facility (1261 Duck Road), approximately 1250 feet East of the main Field Research Facility building and 3 feet North of the South edge of the pier.



Monument: 865 1370 K Tidal



Location Verification: 865 1370 K Tidal

Mean of Inverse Shots - Published Versus CPE Found				
Monument	No. of Shots	ΔN	ΔE	ΔZ
865 1370 K Tidal	2	-	-	0.02



CONTROL MONUMENT USED BY CPE-NC for The Town of Duck September 2013	
DATUMS: NAD83/2001 - NAVD88	
Designation	Y254
Stamping	Y254 1981
Northing	880716.27
Easting	2966184.93
Horizontal Root Mean Square Error	0.065
Elevation	12.15
Vertical Root Mean Square Error	0.028
Description	A National Geodetic Survey pin inside a protective casing with lid approximately 3 inches below ground and located along the North side of Duck Road/Highway 12 (180 Duck Road) approximately 30 feet South of a driveway, 31.5 feet East of the centerline of Duck Road, and 3.5 feet West a power pole labeled "01830".



Monument: Y254



Location Verification: Y254

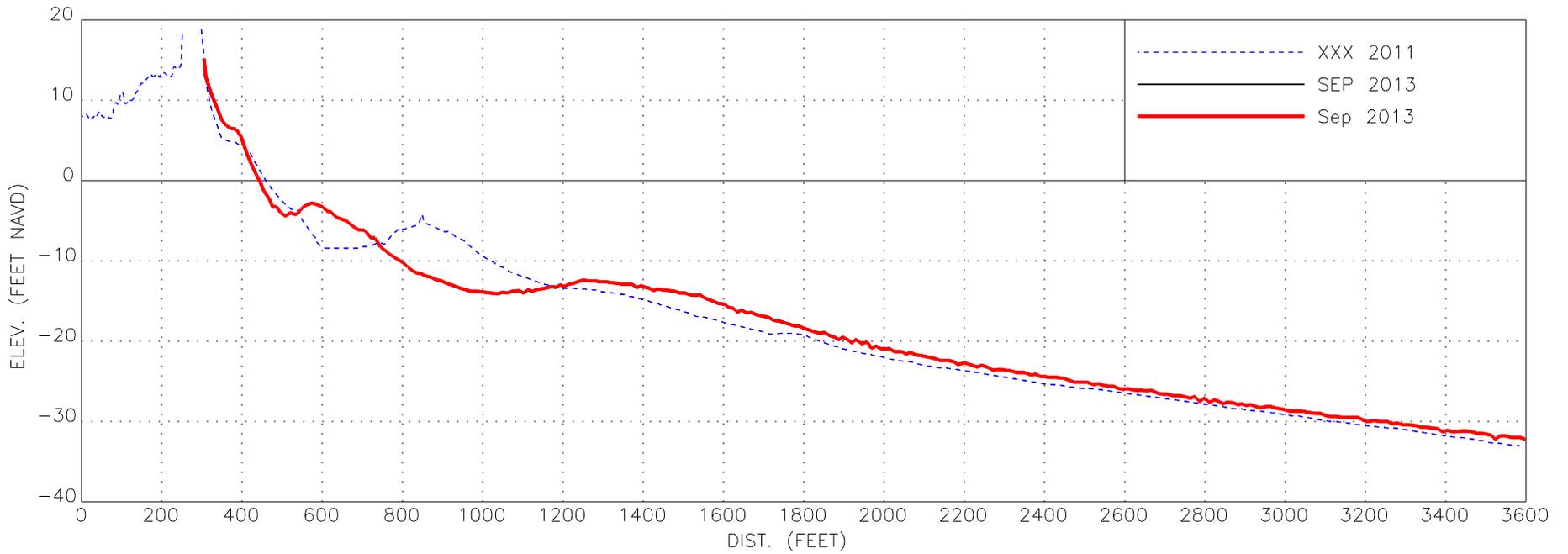
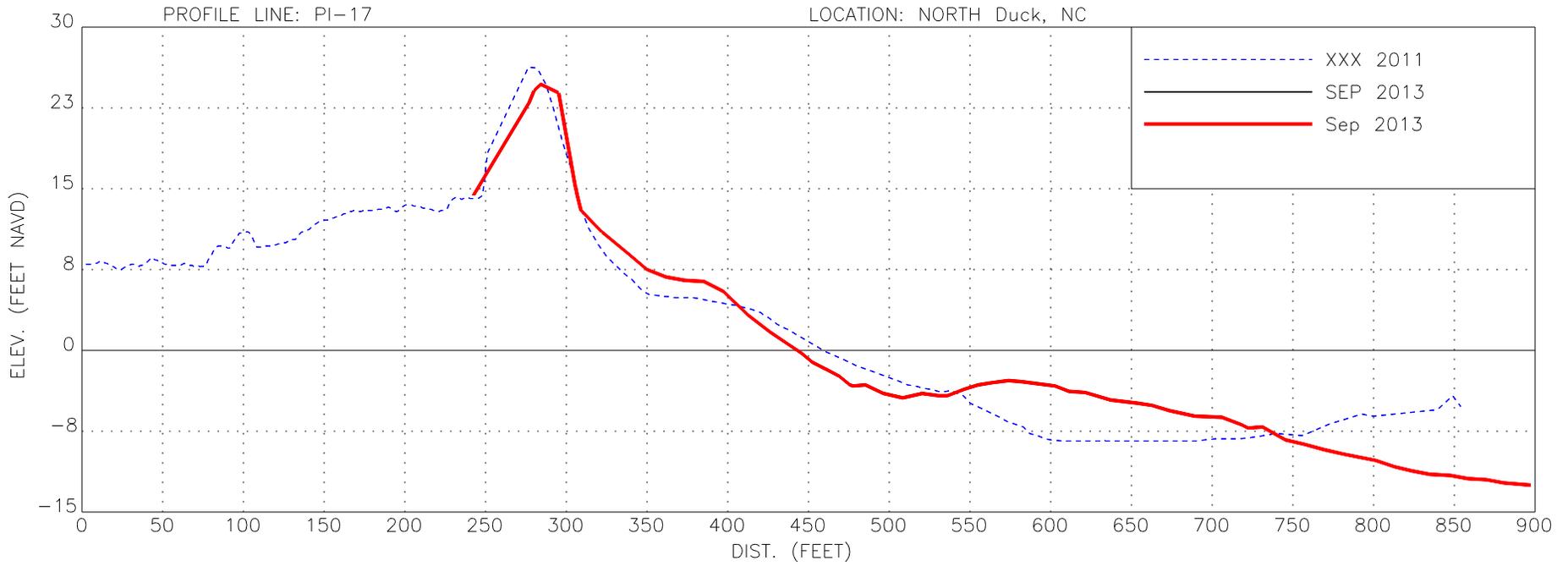
Mean of Inverse Shots - Published Versus CPE Found				
Monument	No. of Shots	ΔN	ΔE	ΔZ
Y254	8	-0.02	0.02	0.00

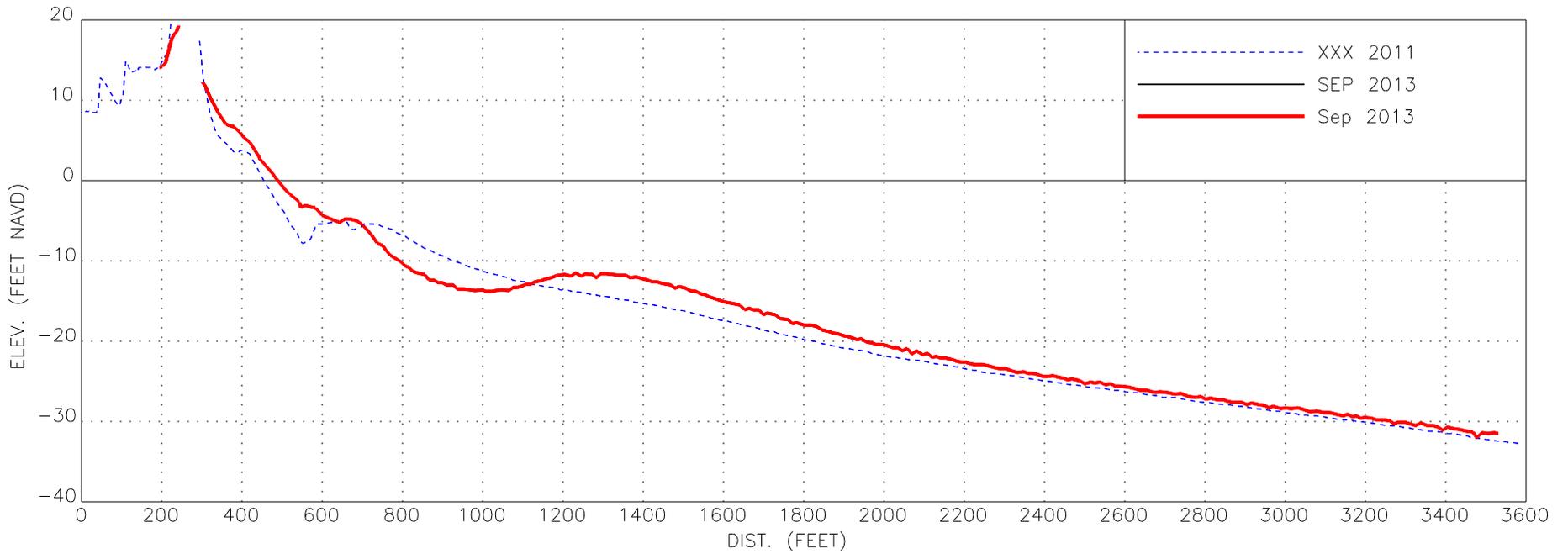
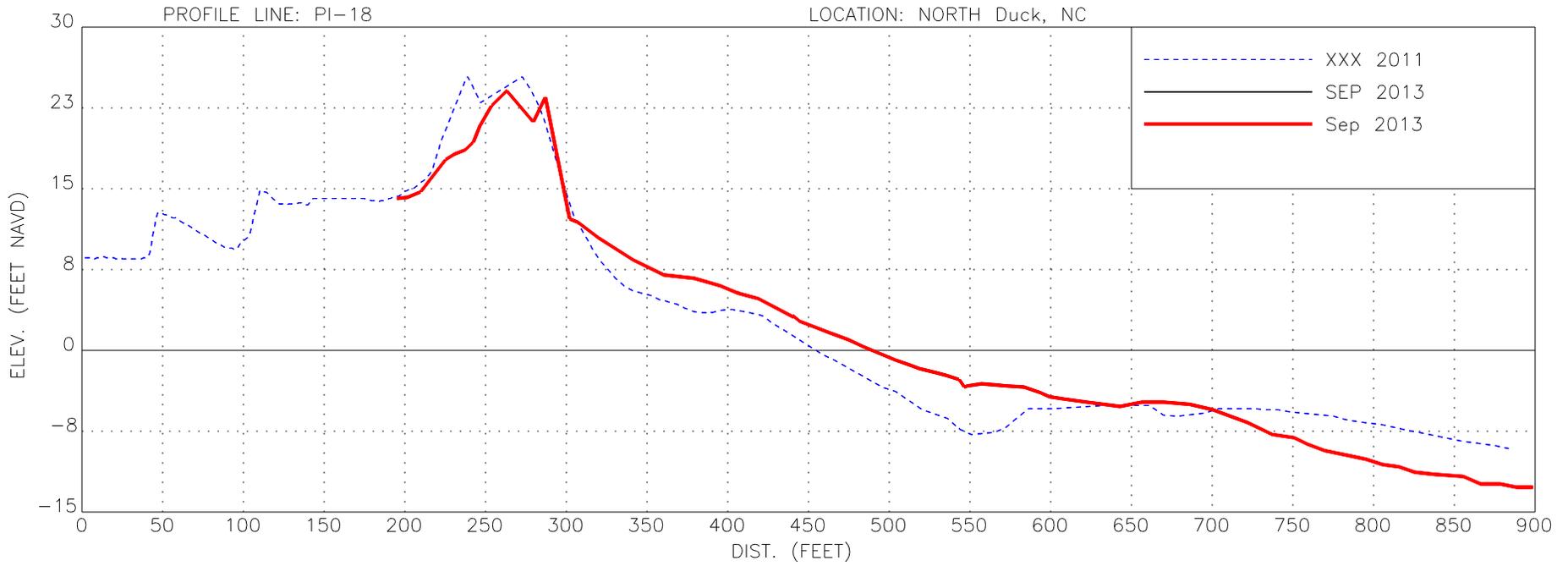
APPENDIX 2

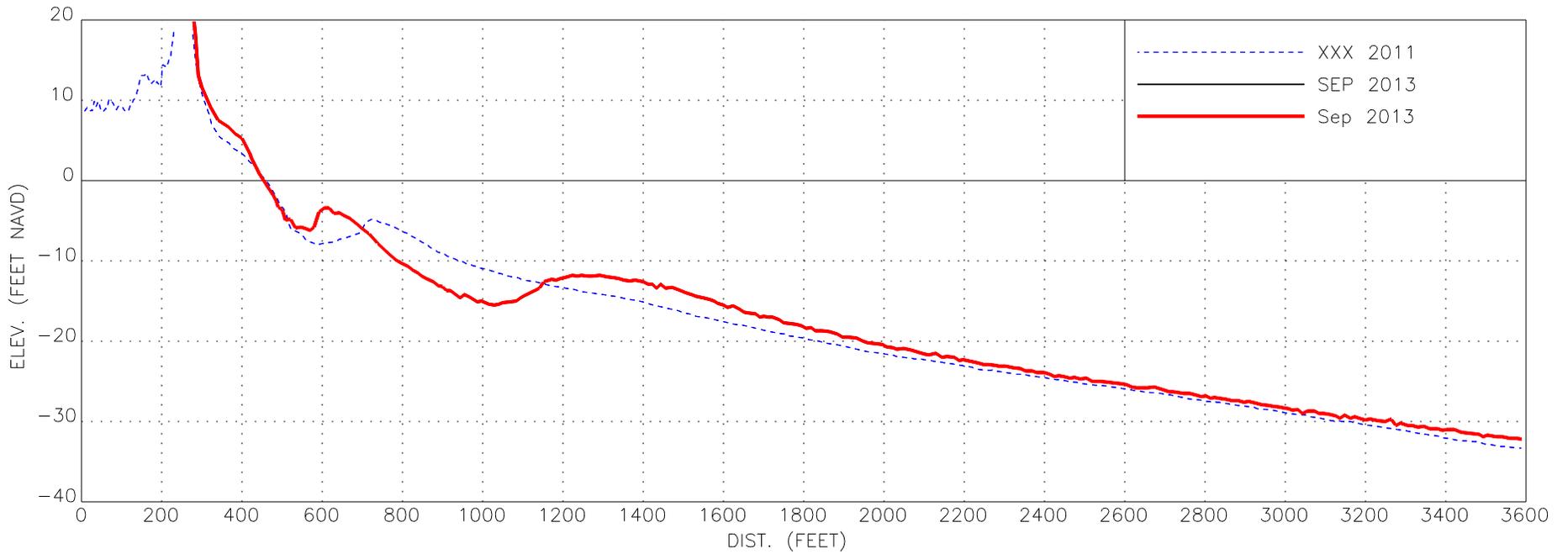
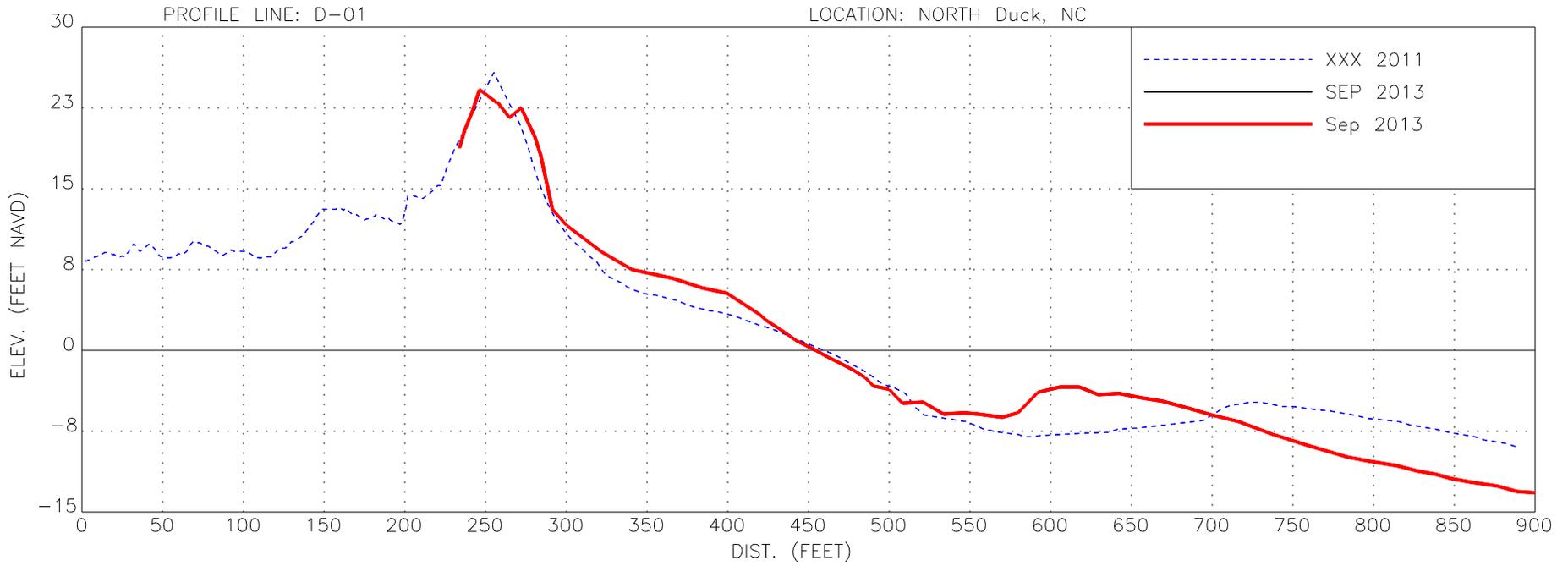
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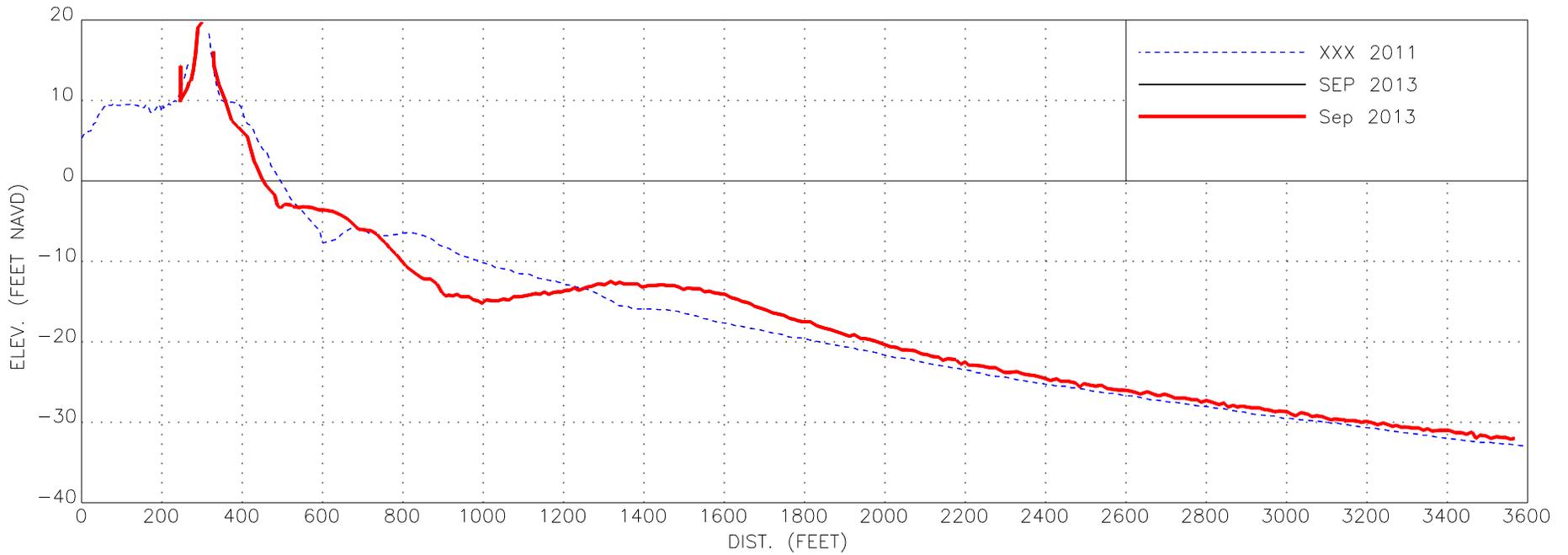
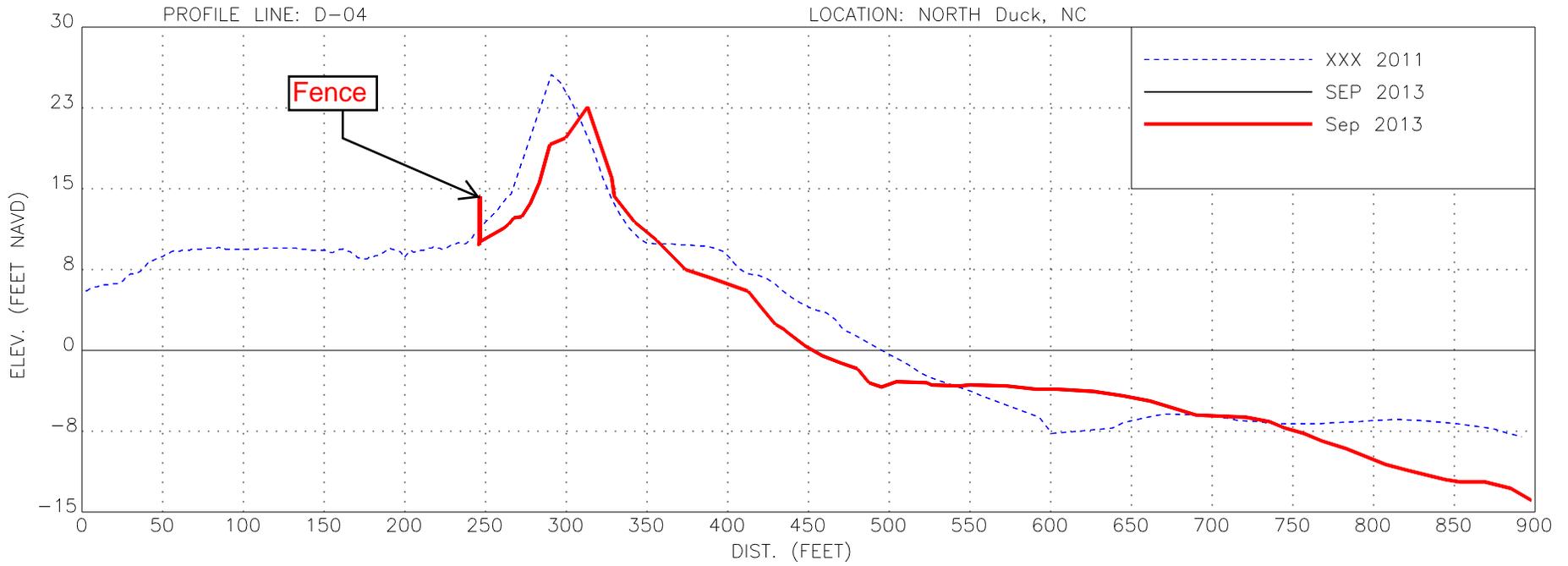
Available in digital format only and can be found on the accompanying CD

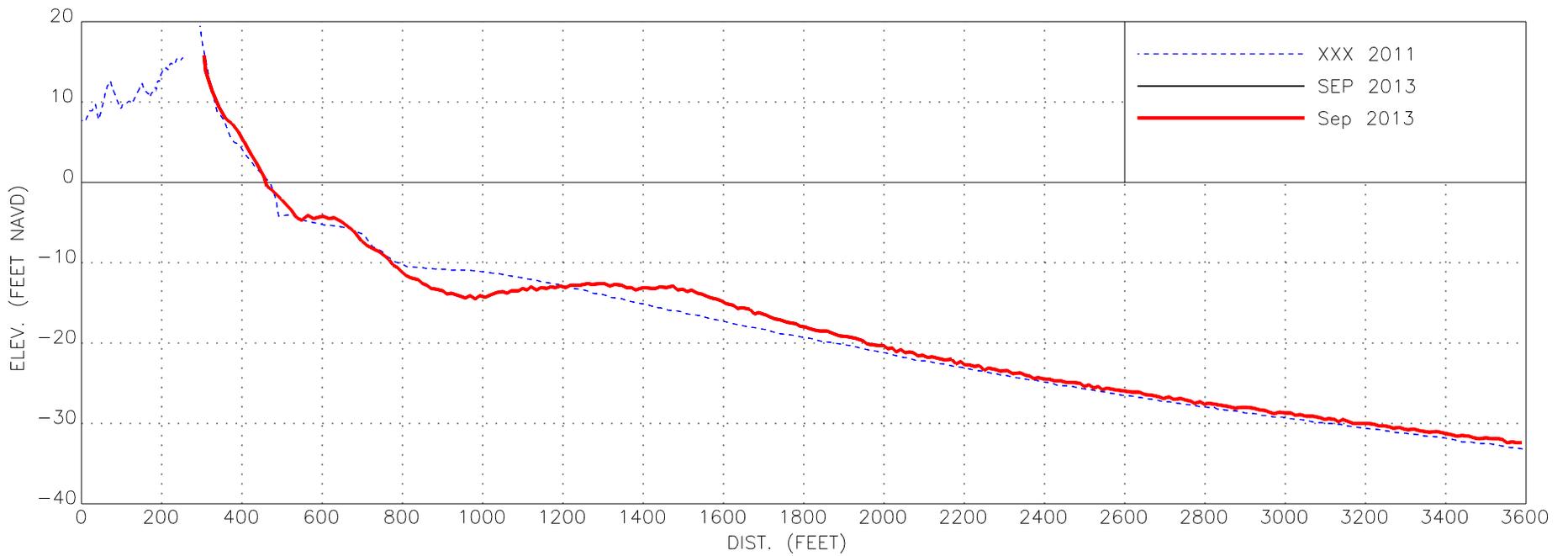
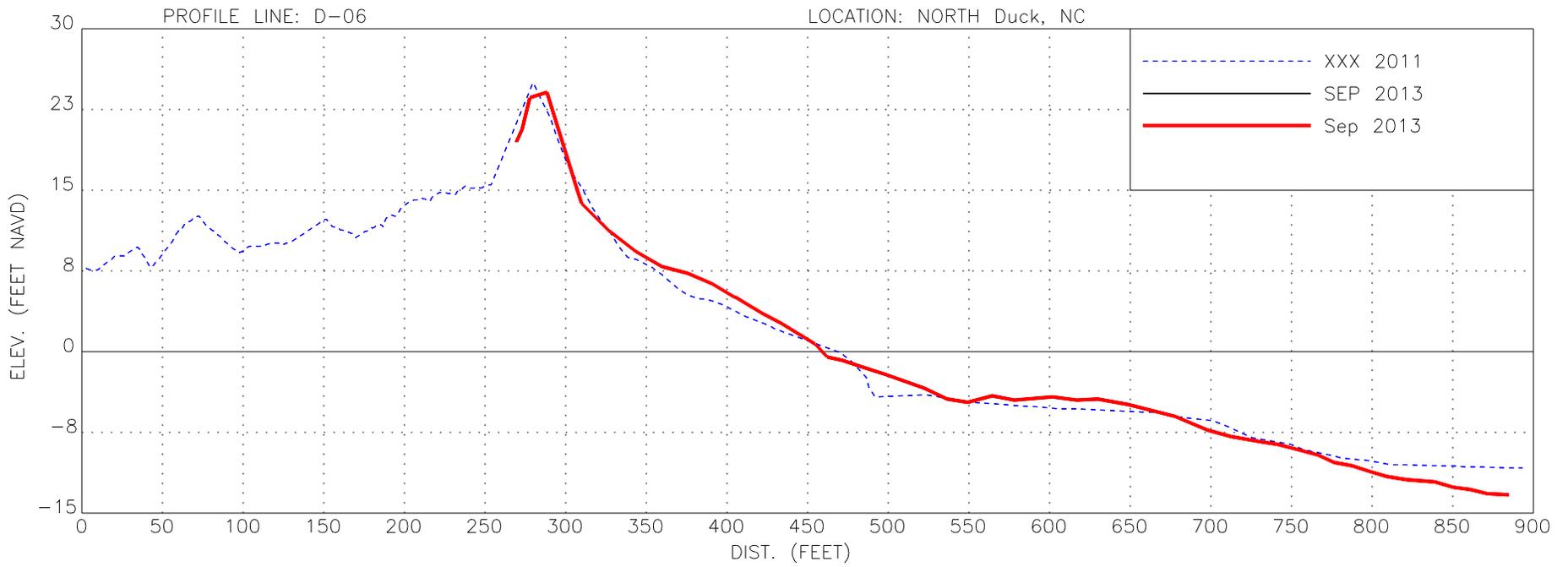
APPENDIX 3
PROFILE PLOTS

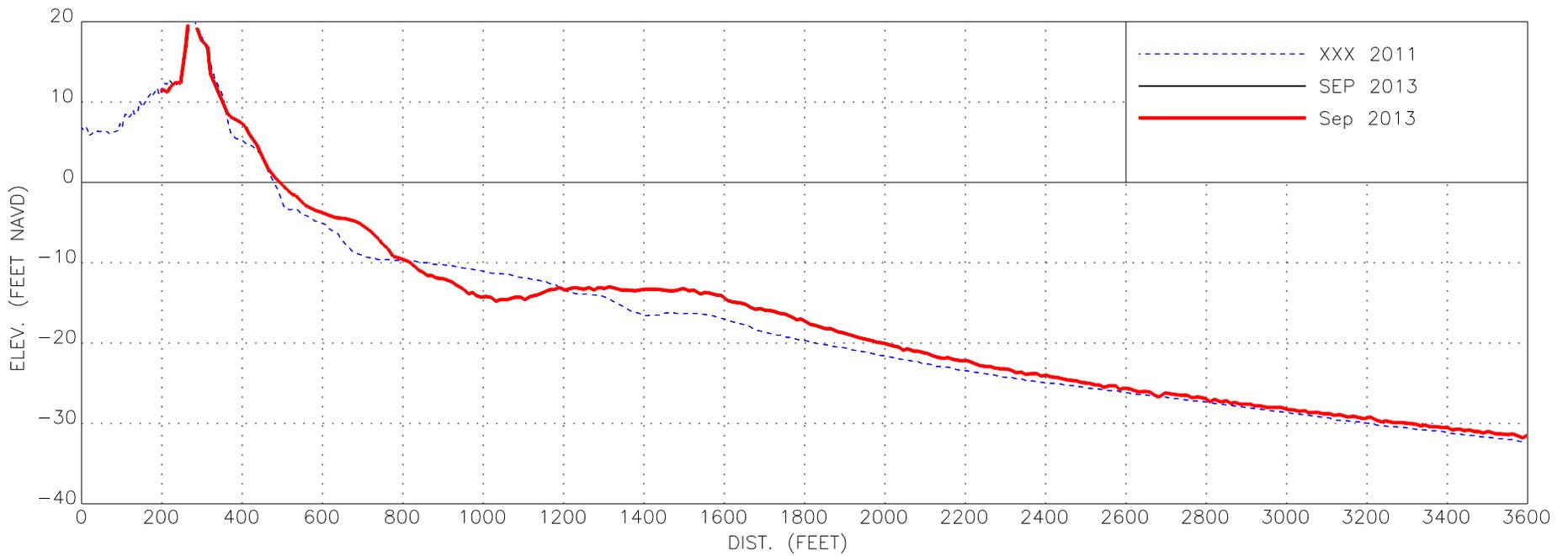
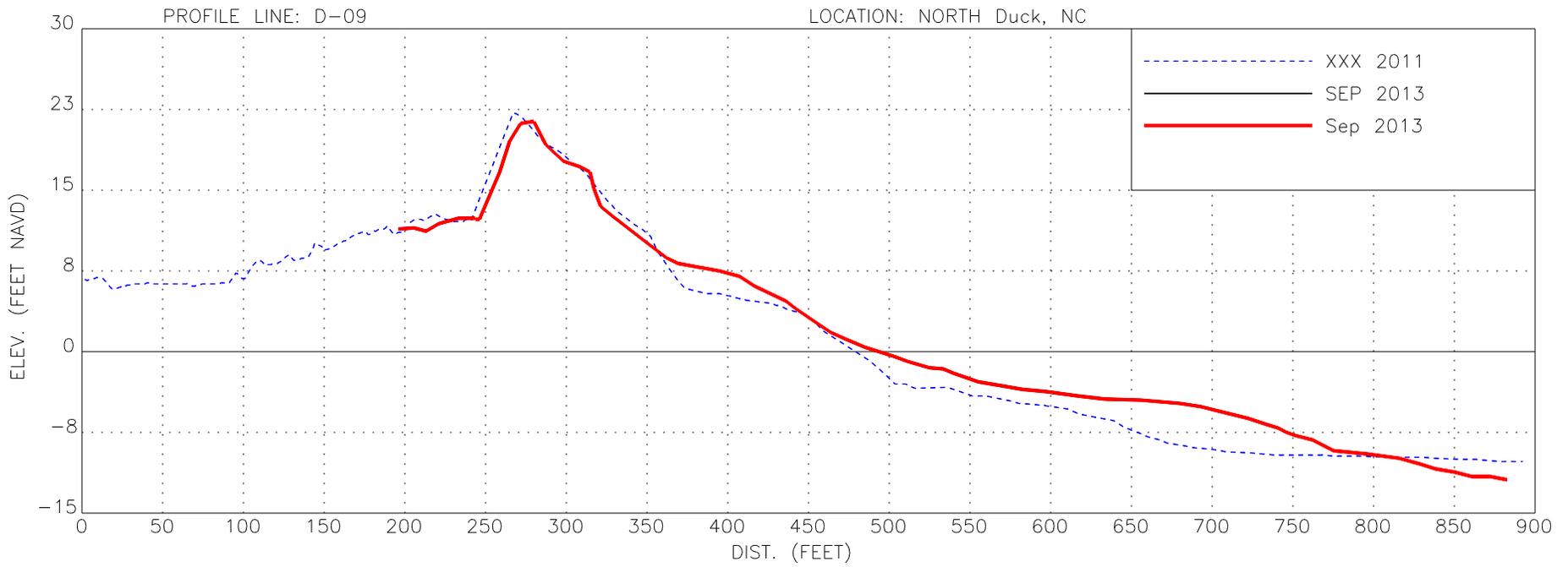


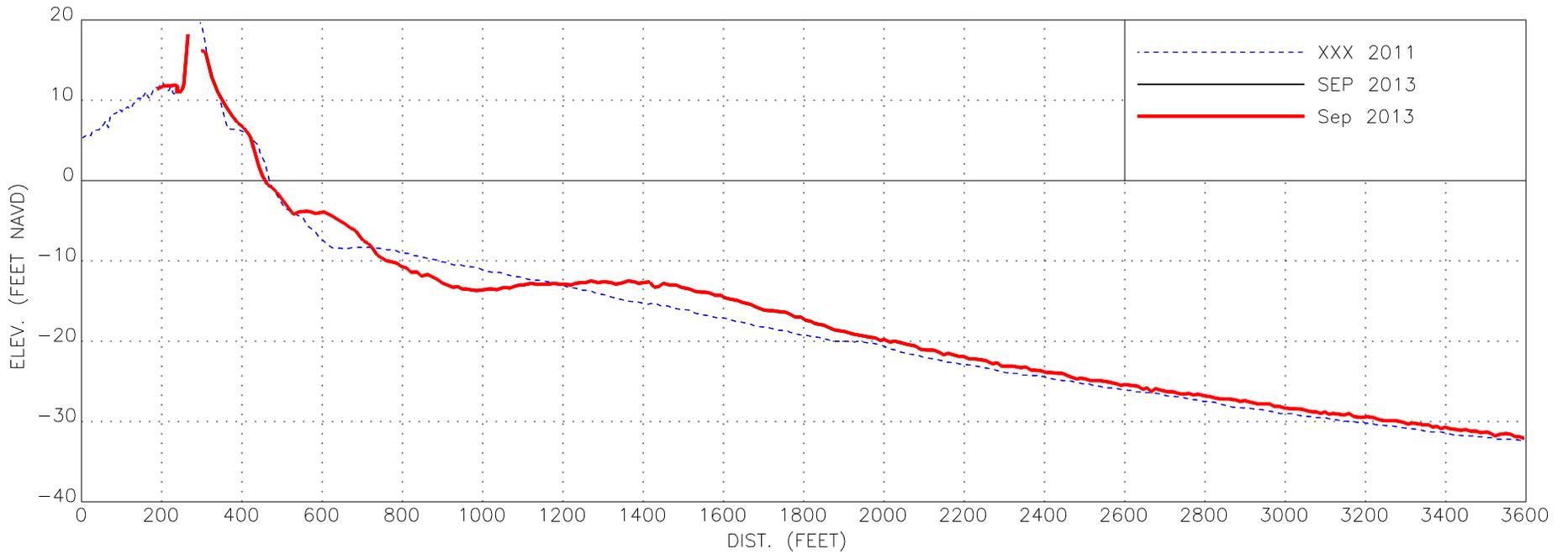
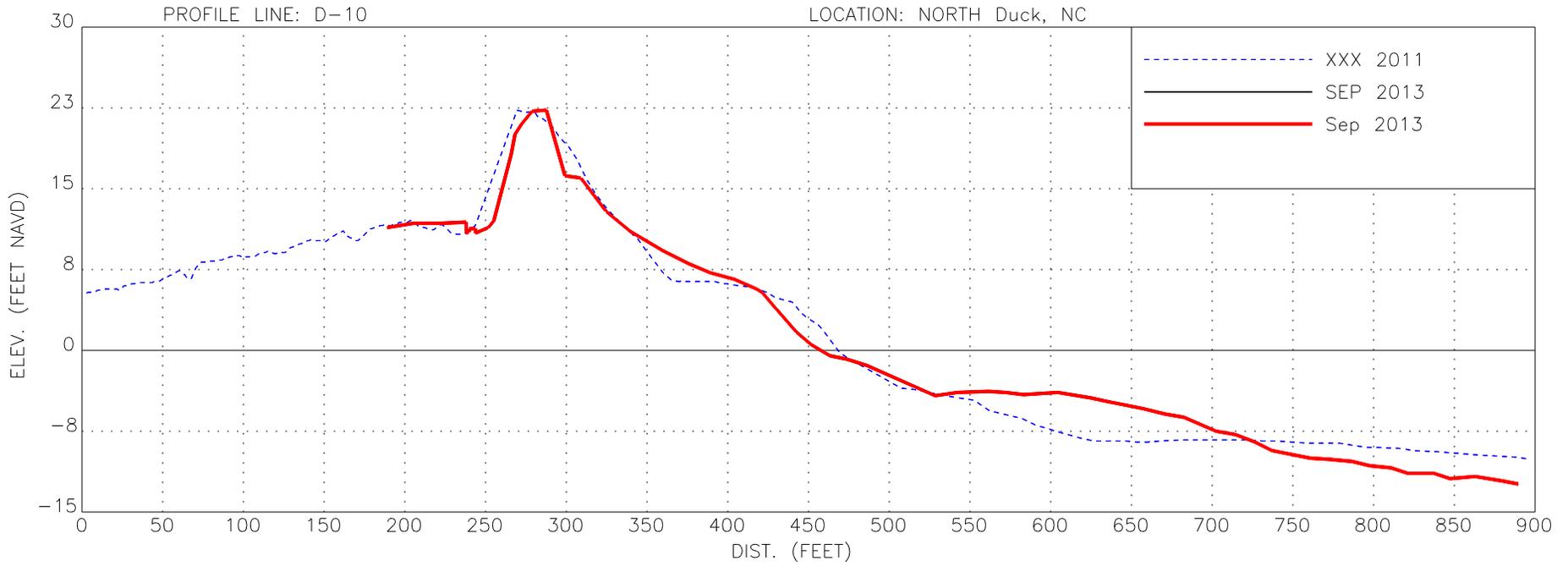


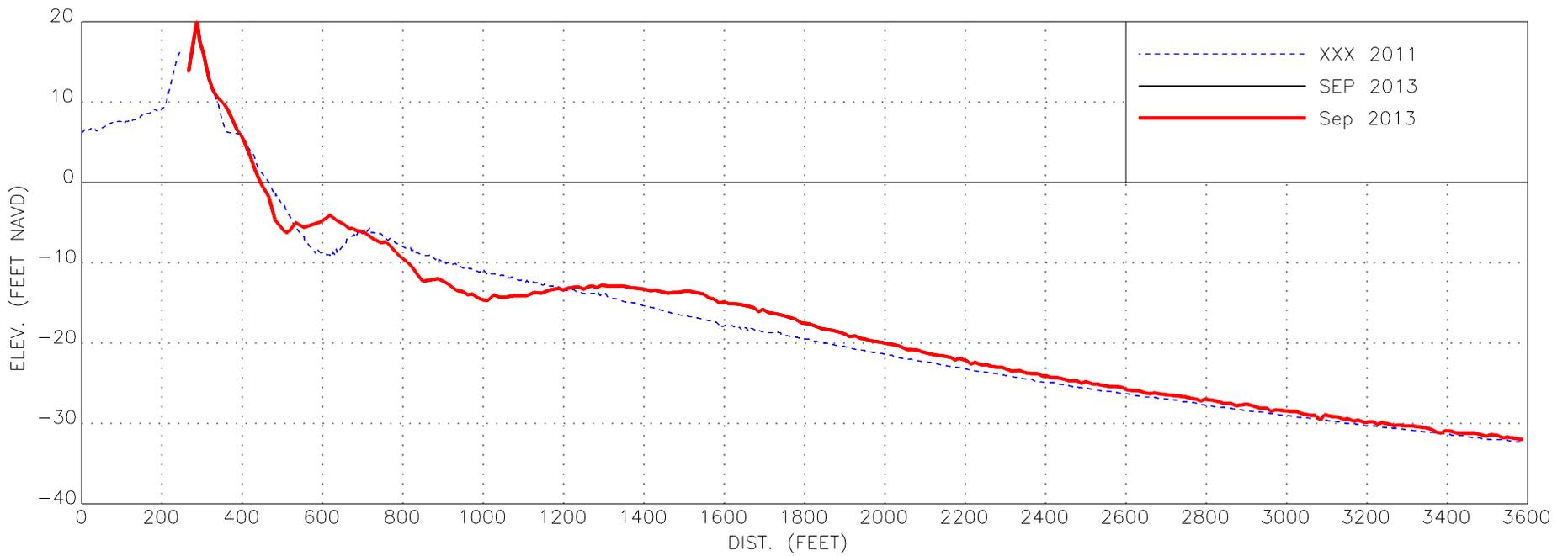
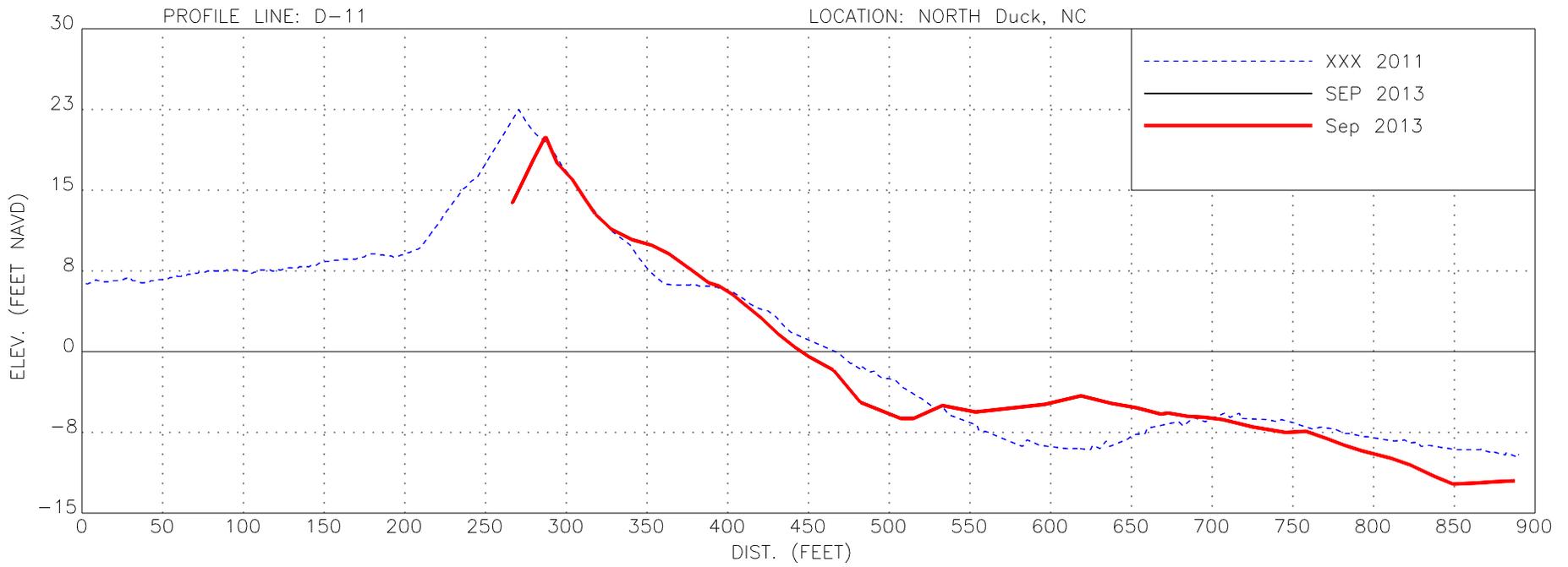


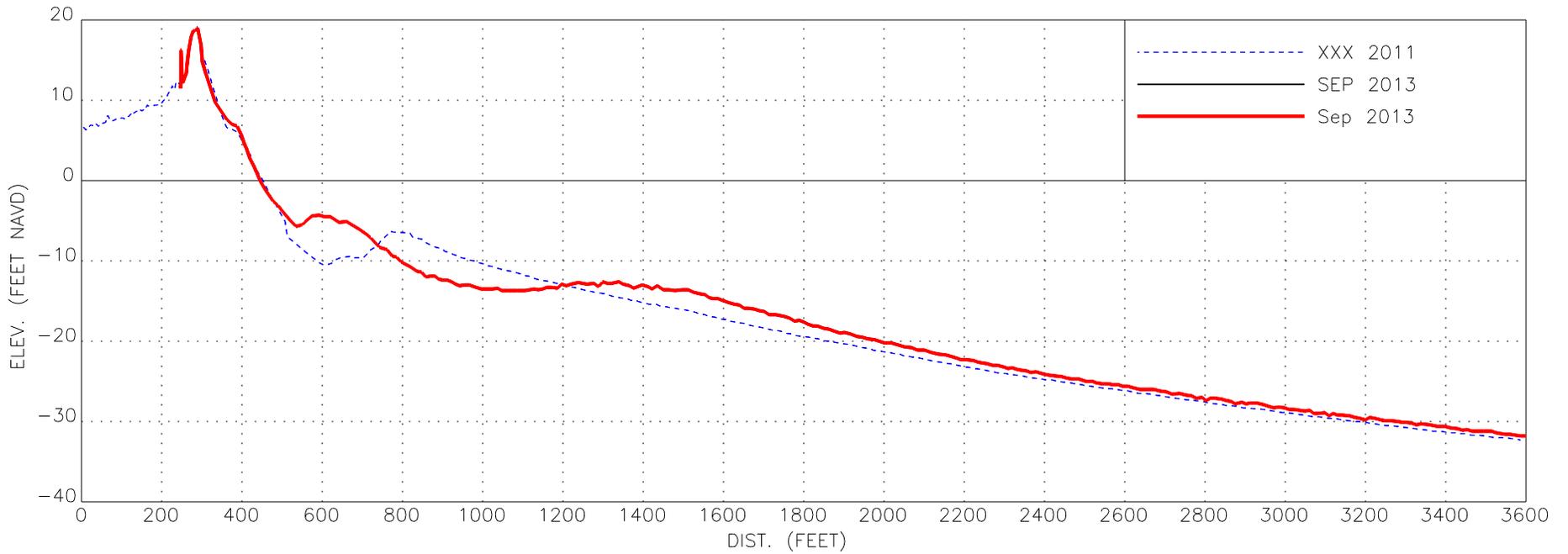
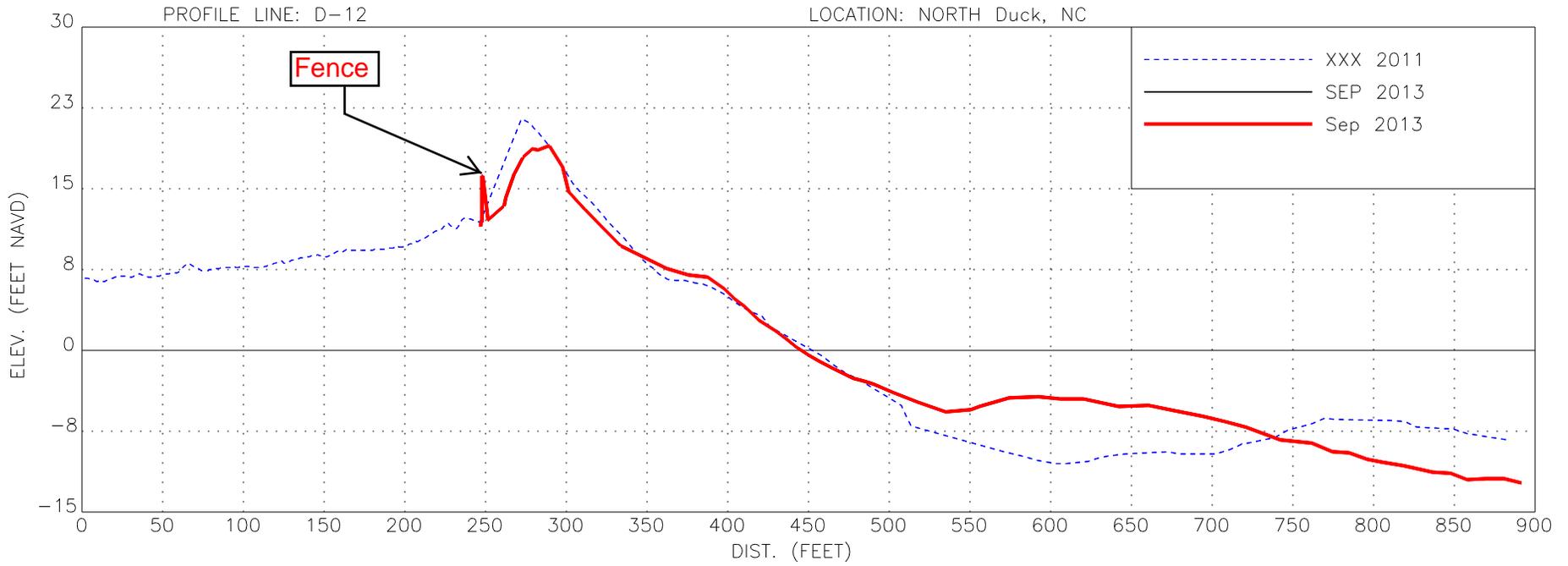


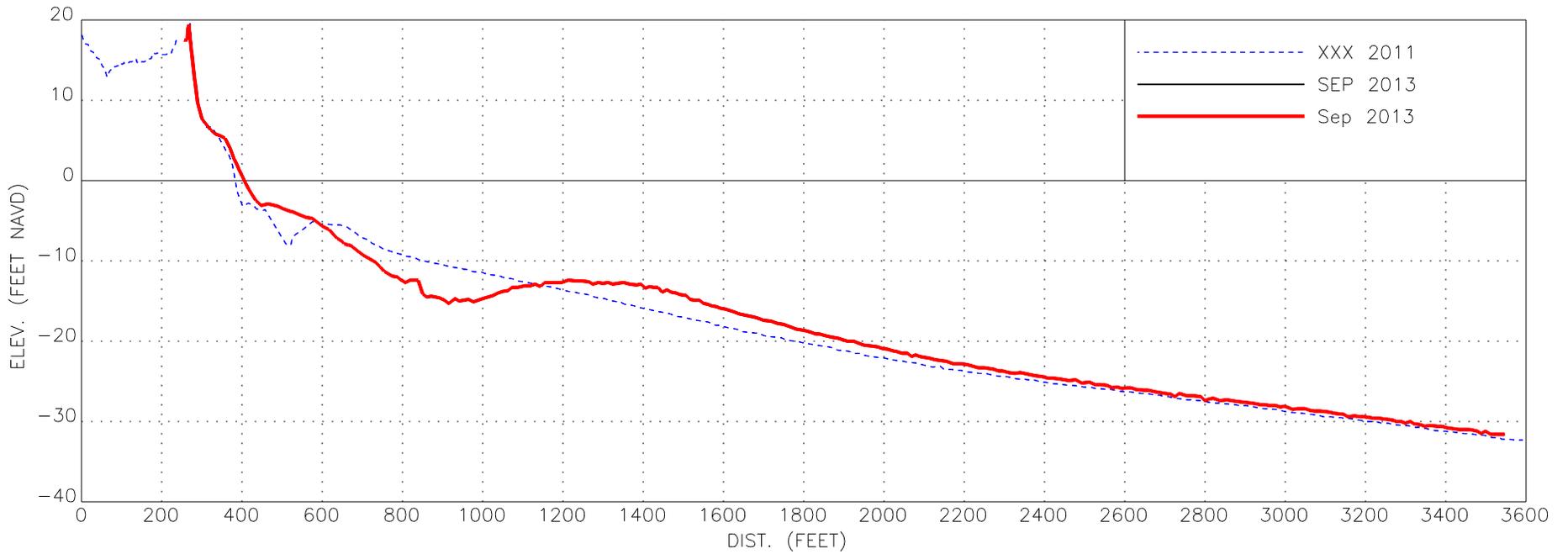
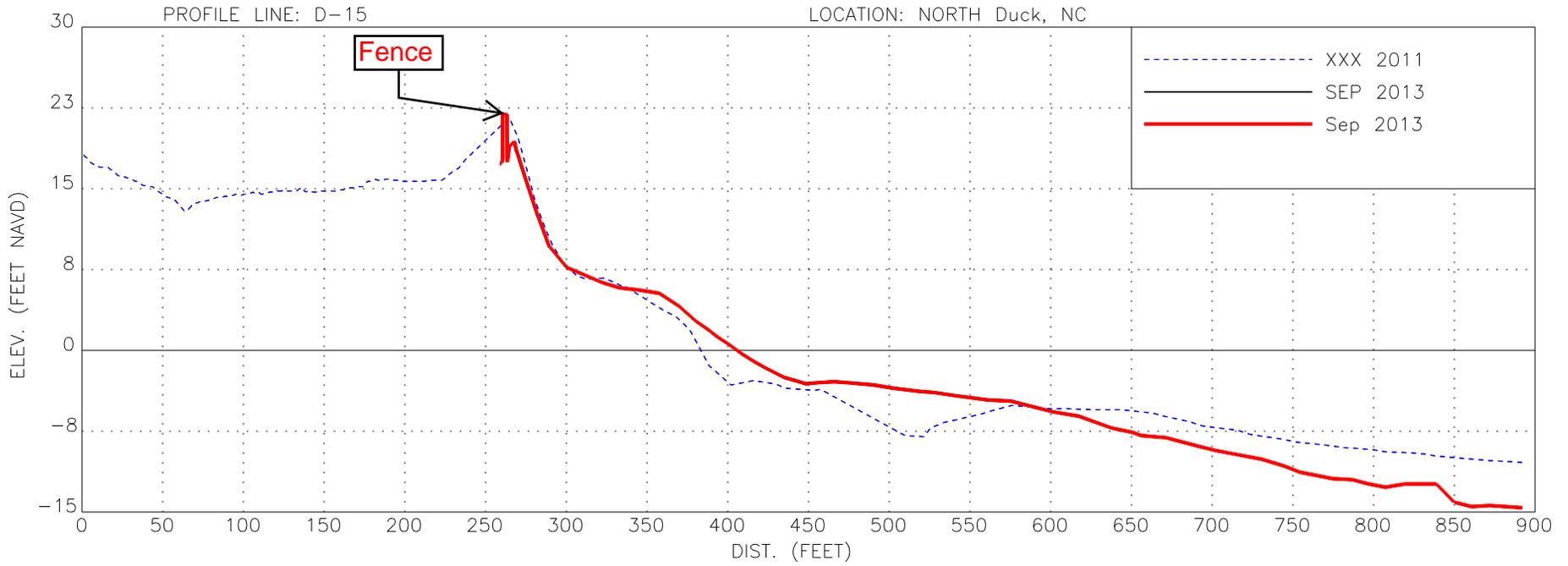


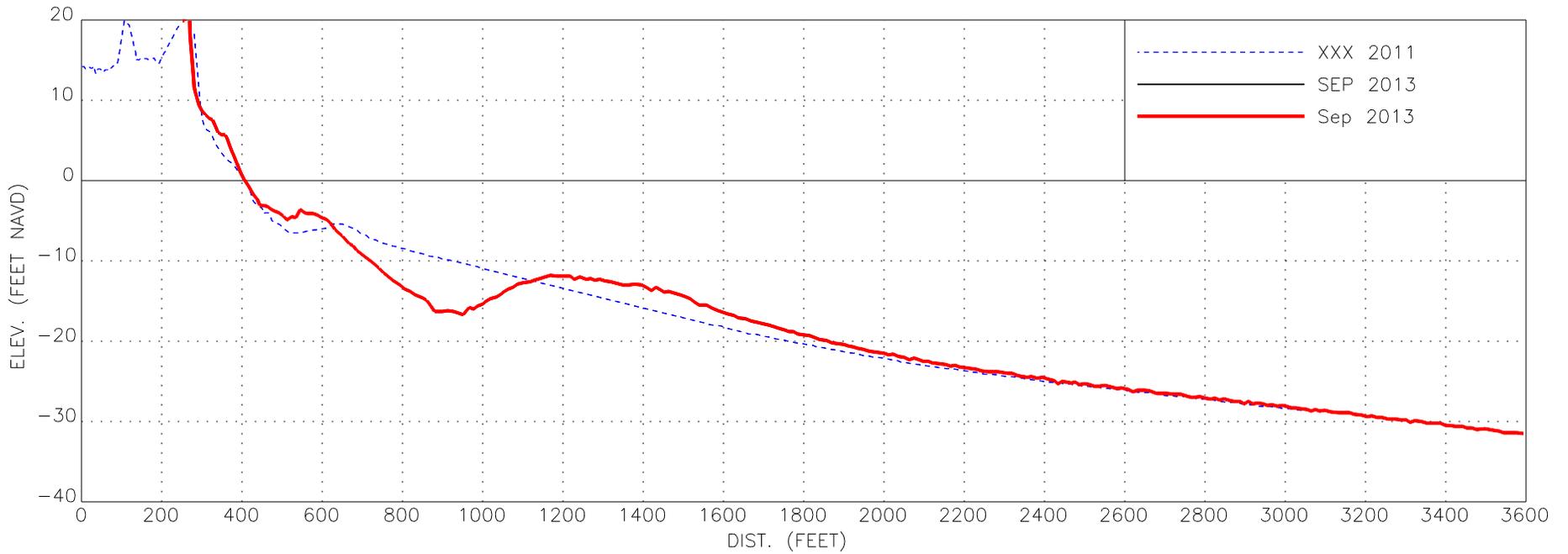
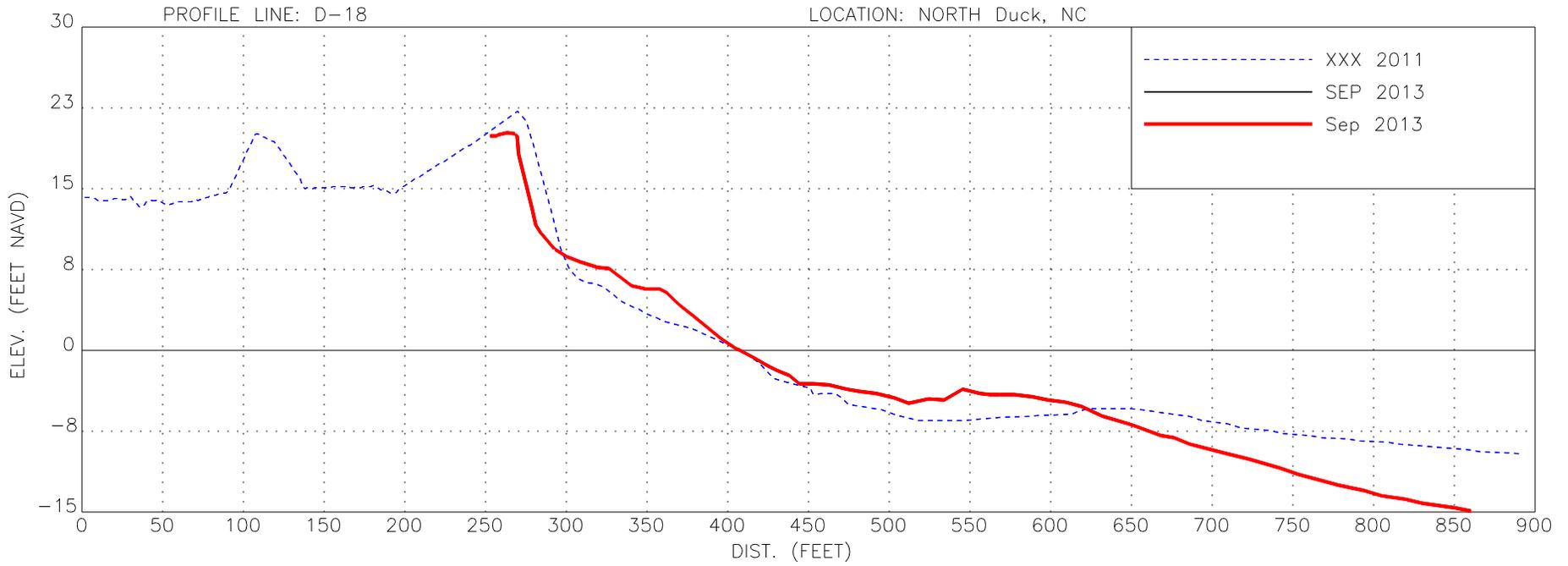


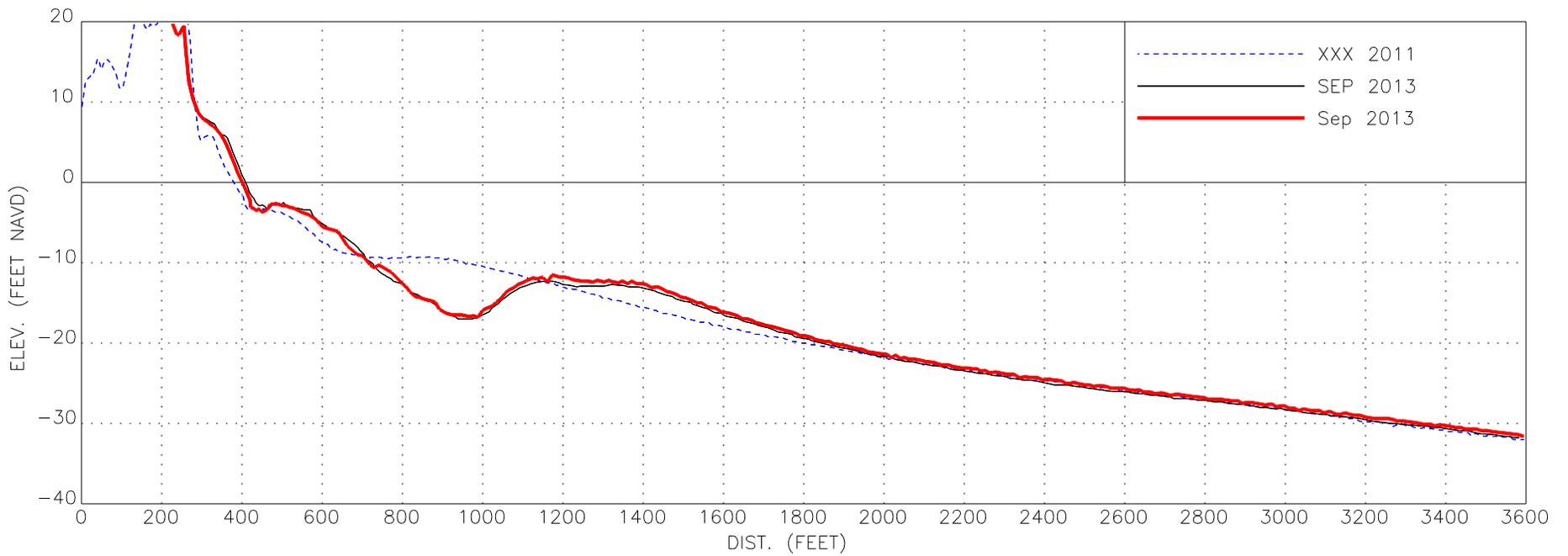
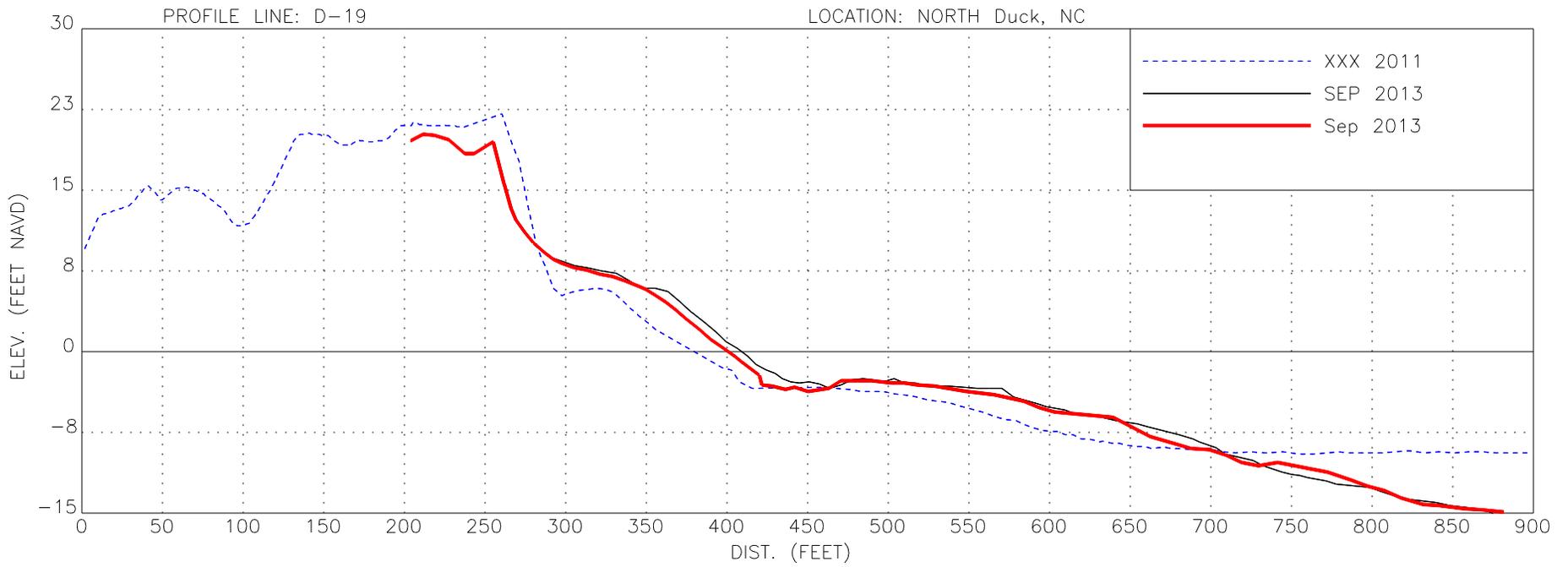


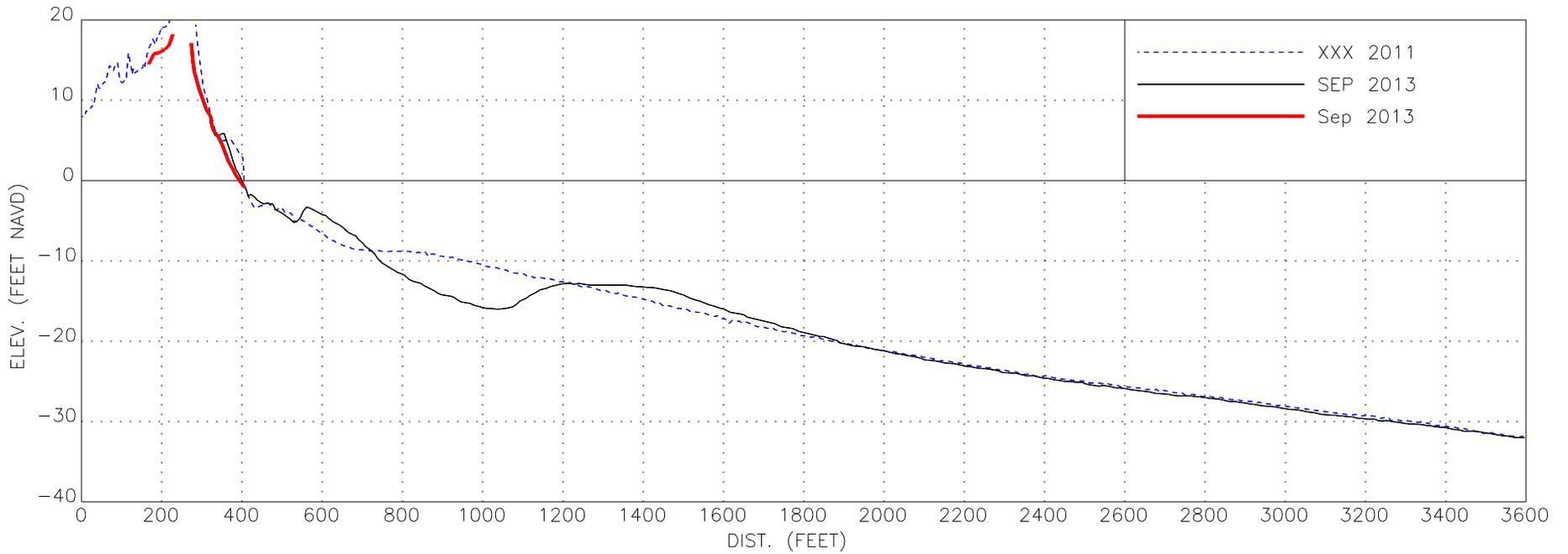
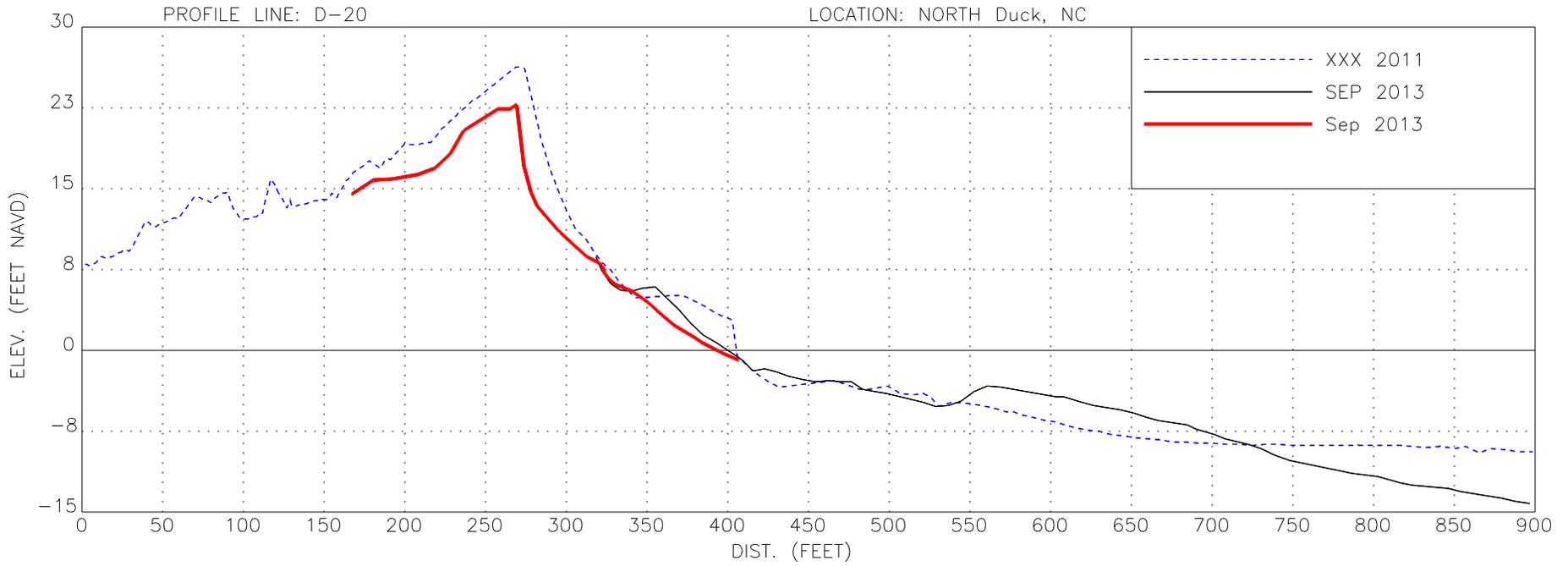


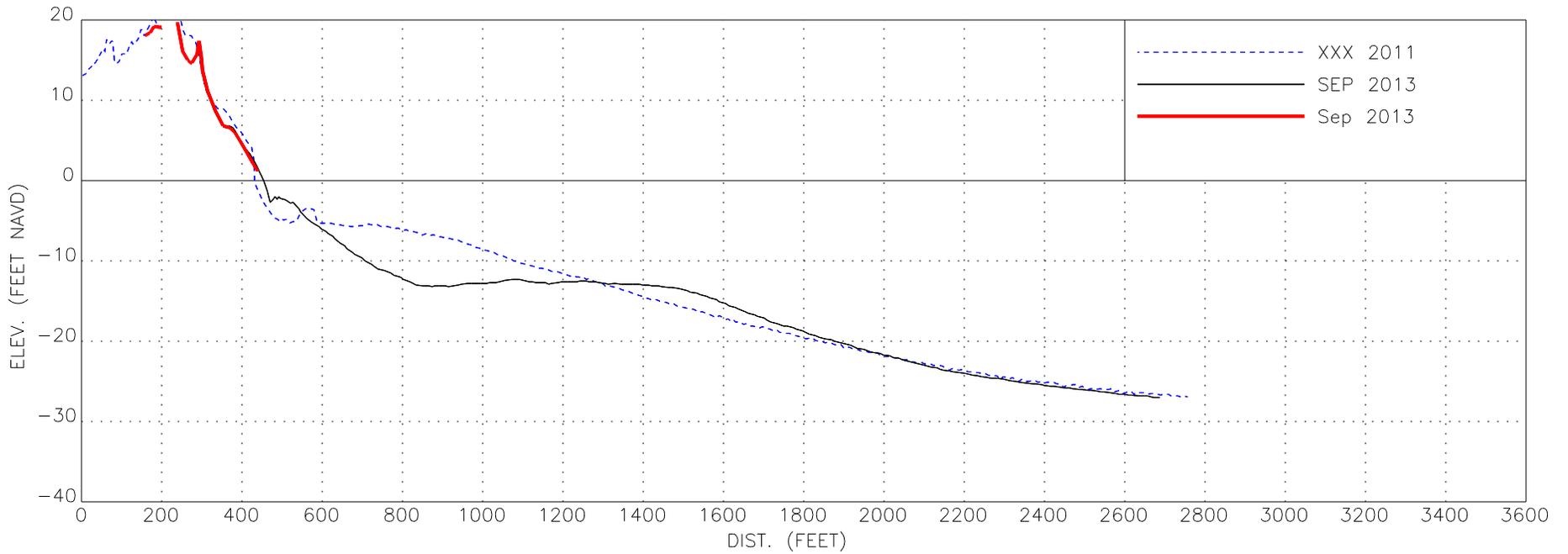
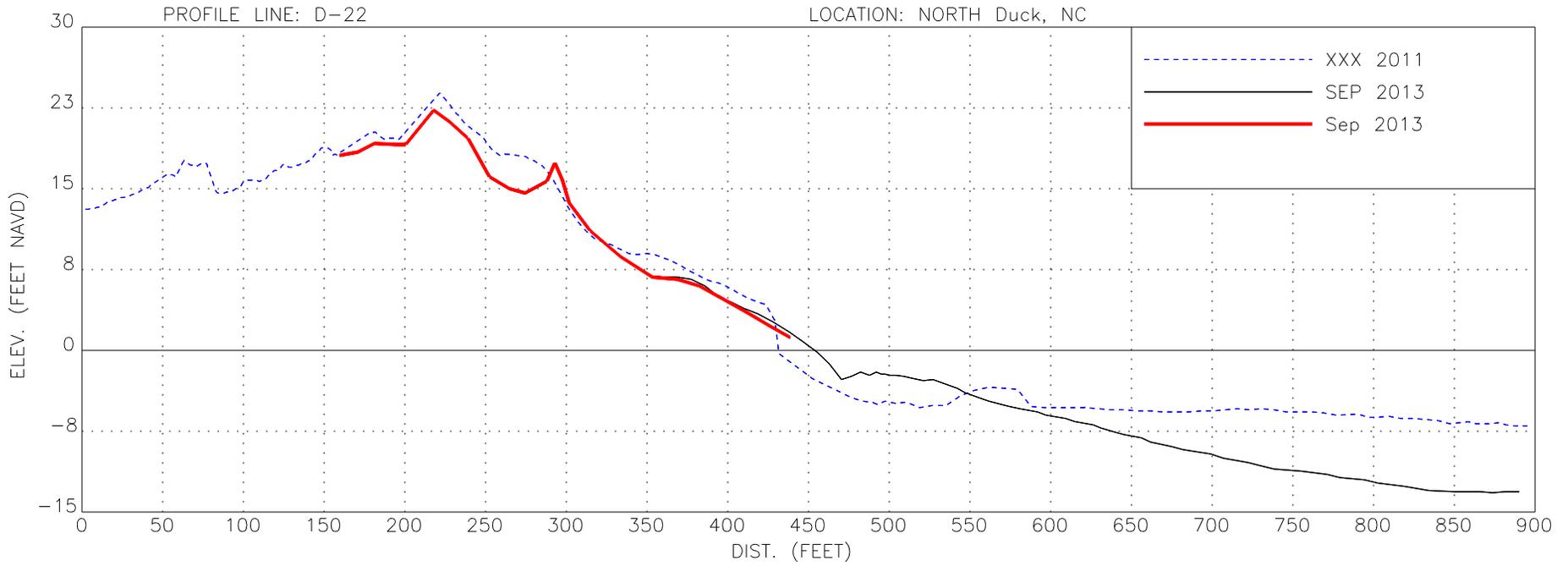


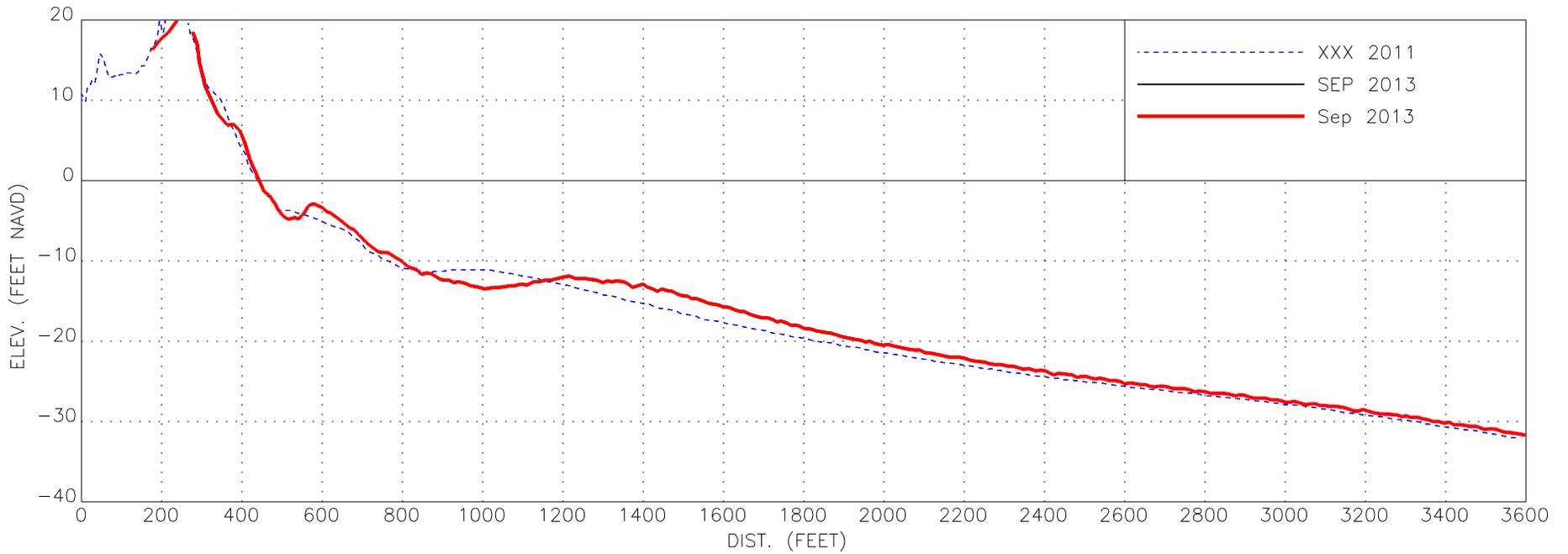
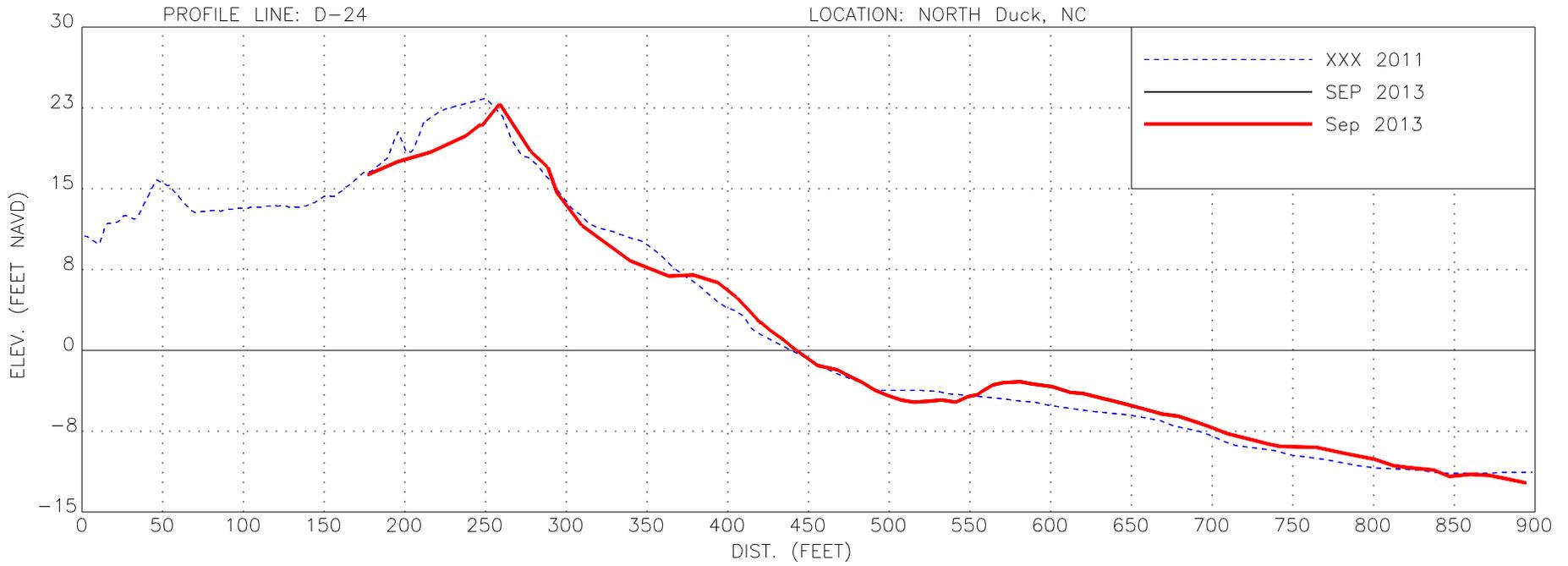


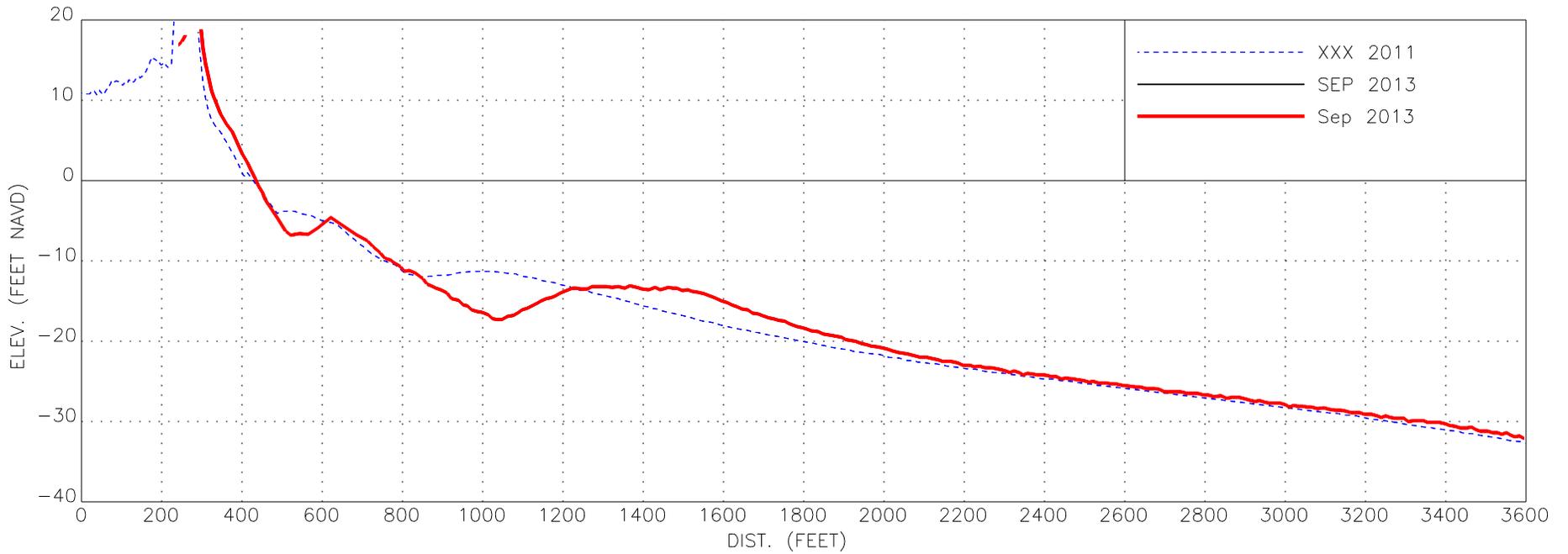
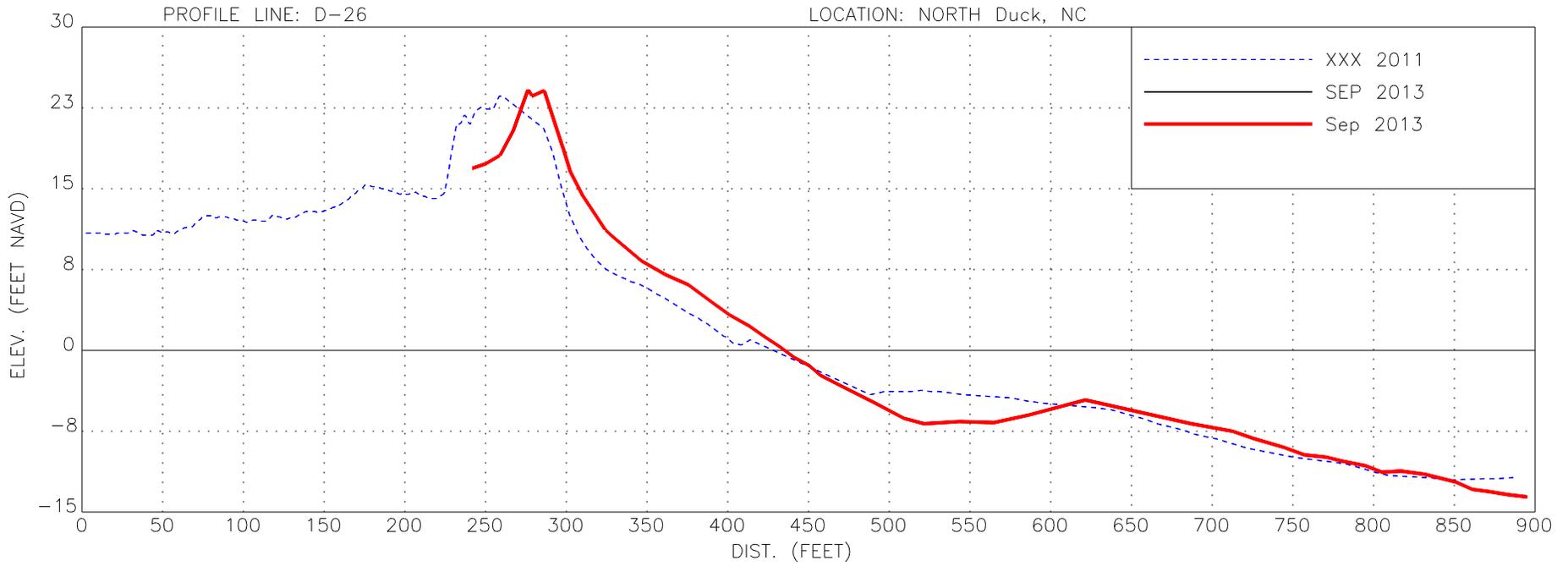


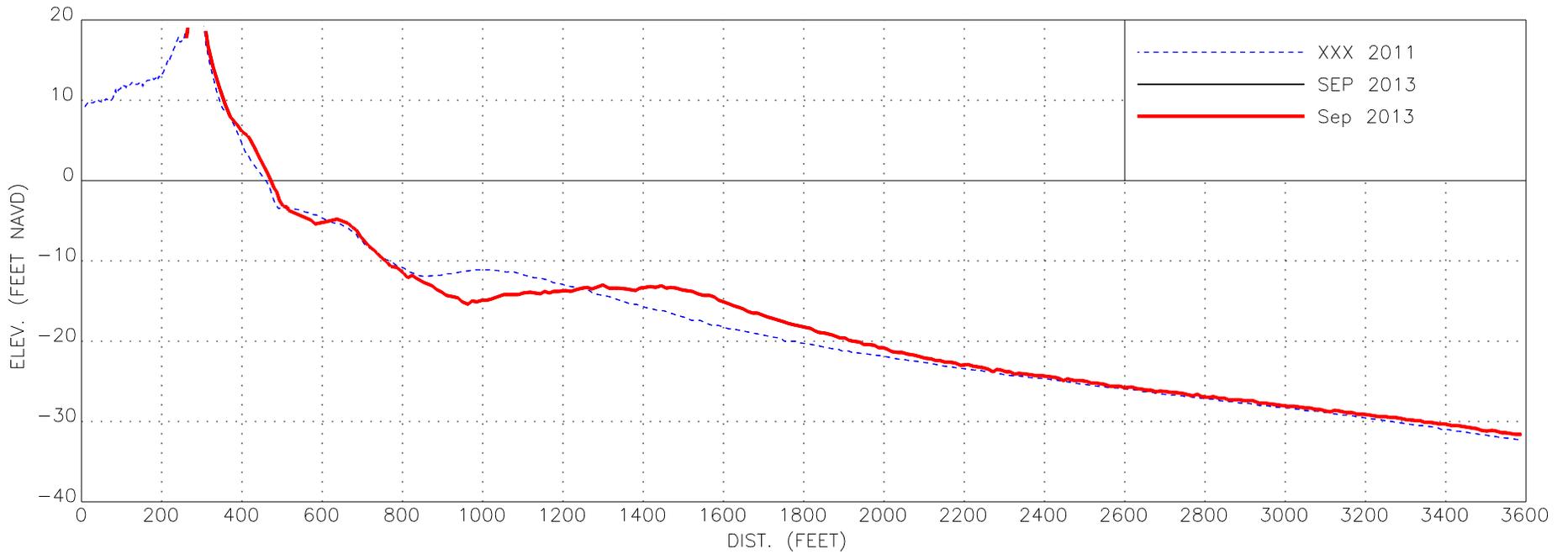
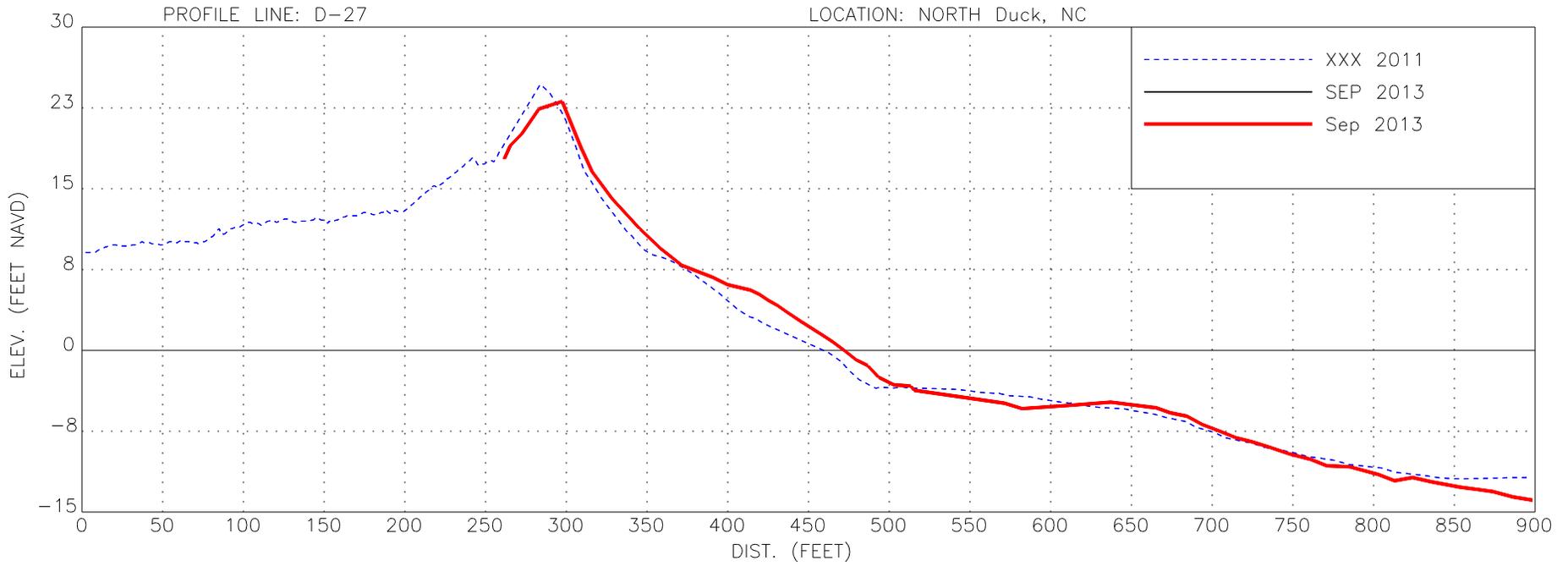


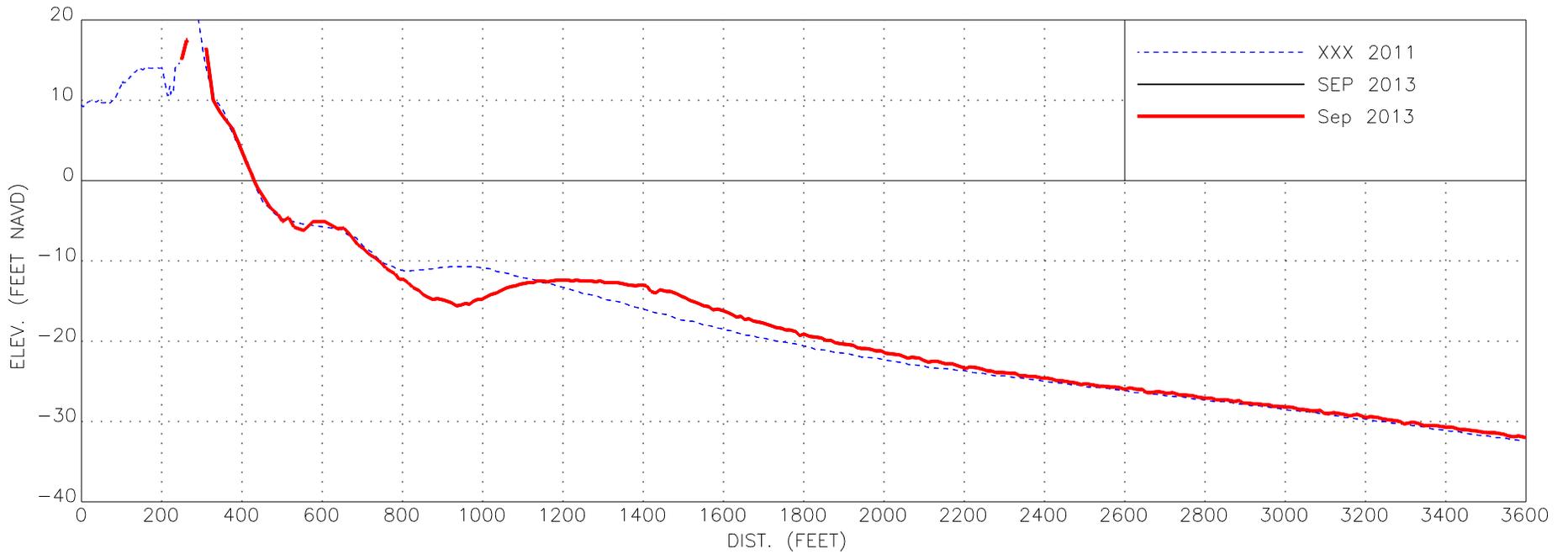
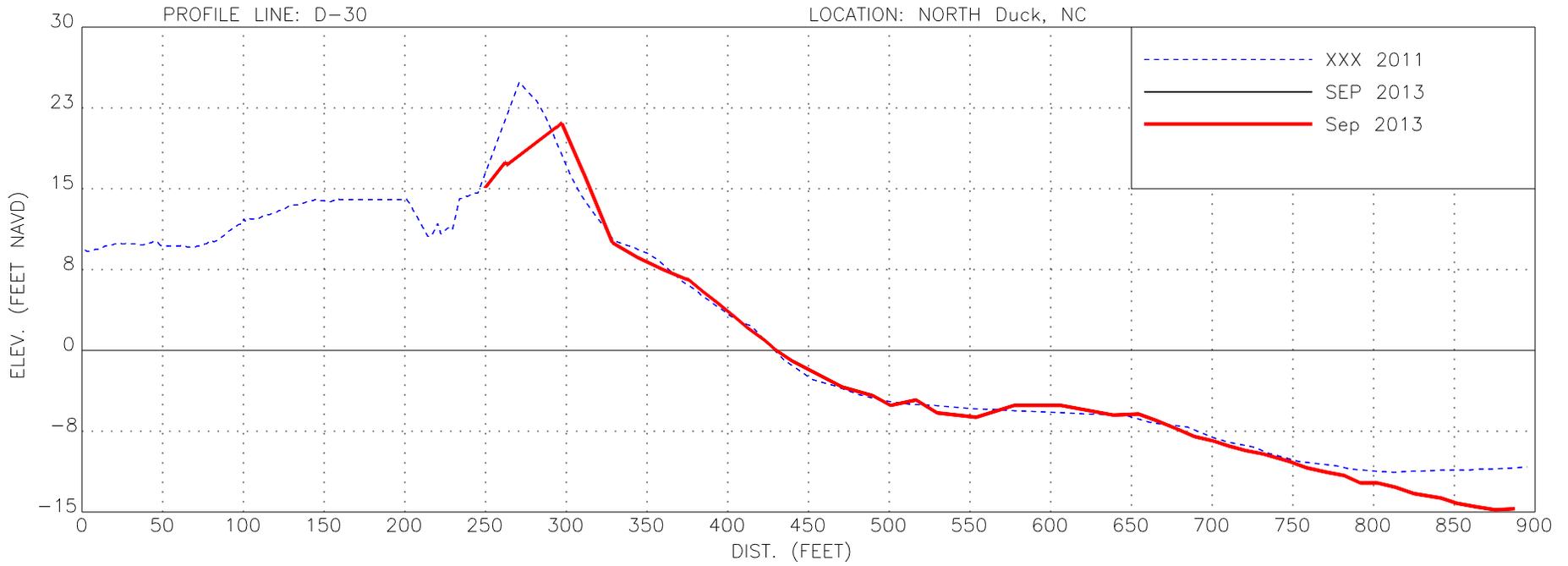


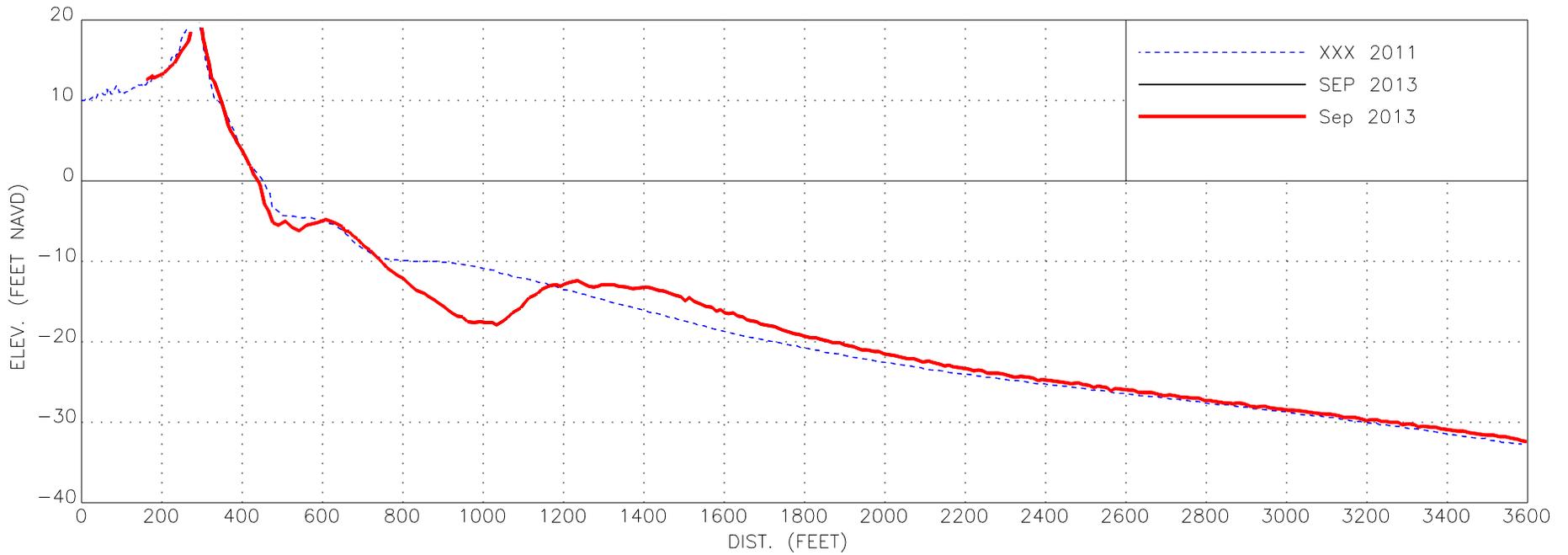
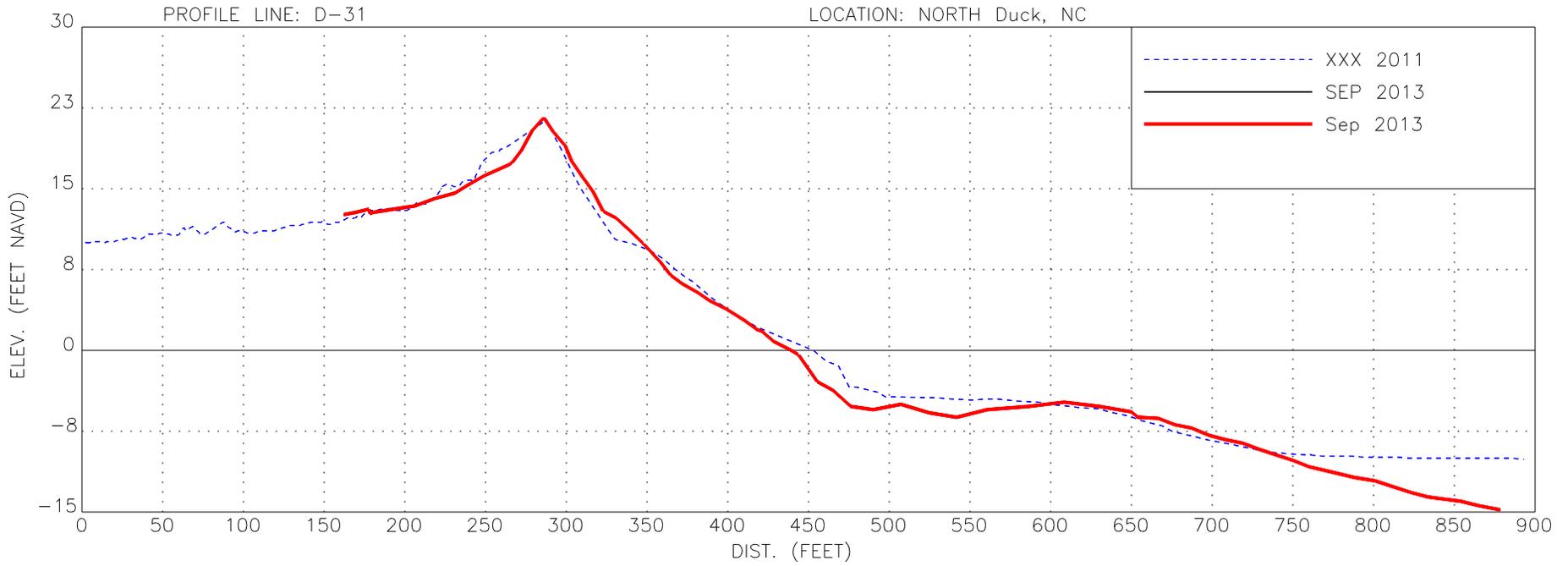


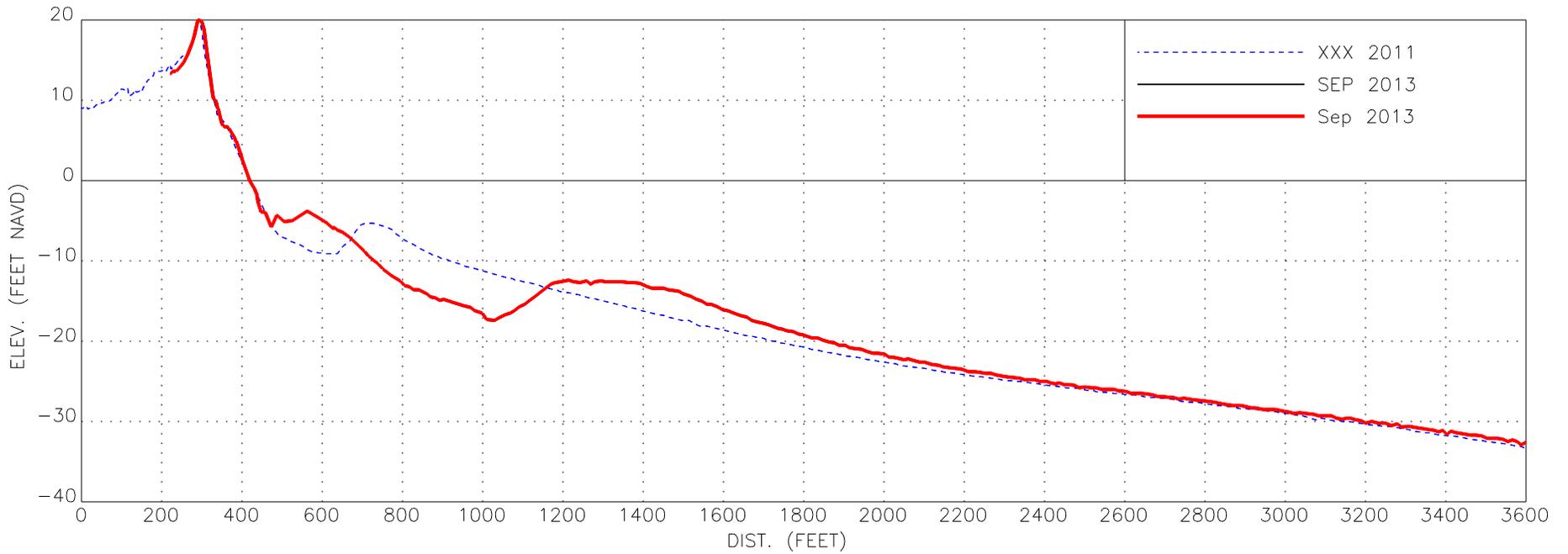
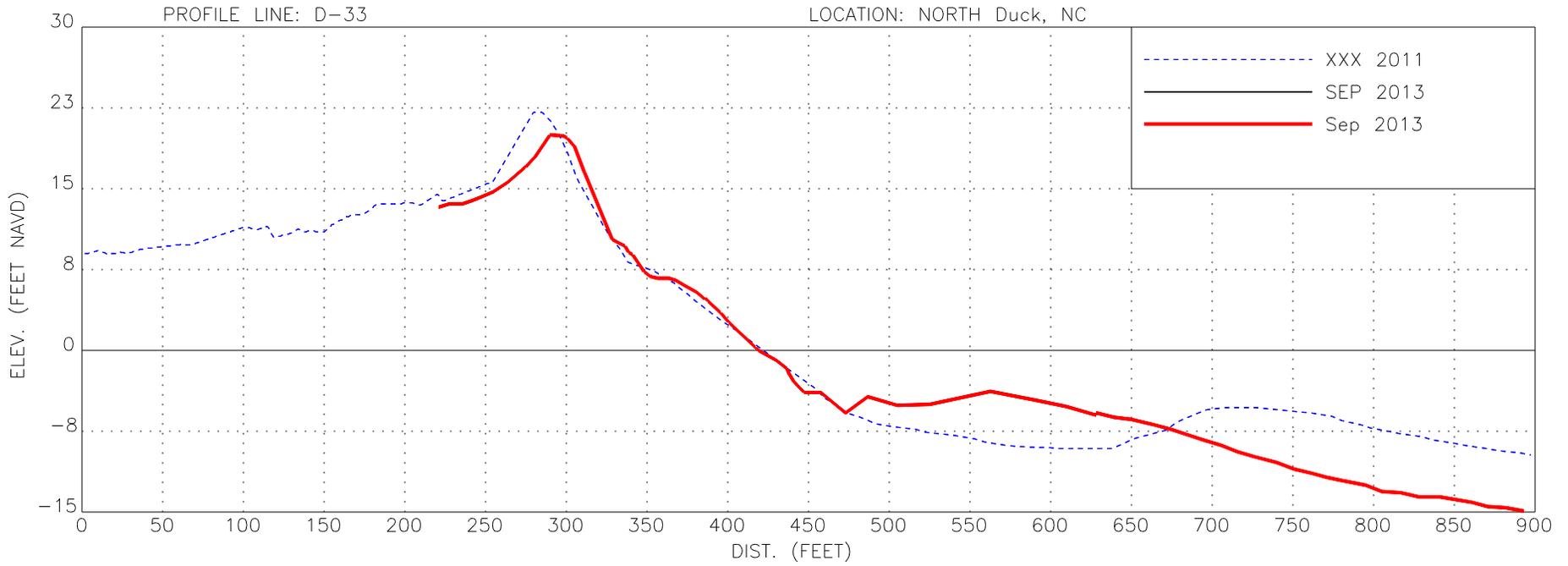


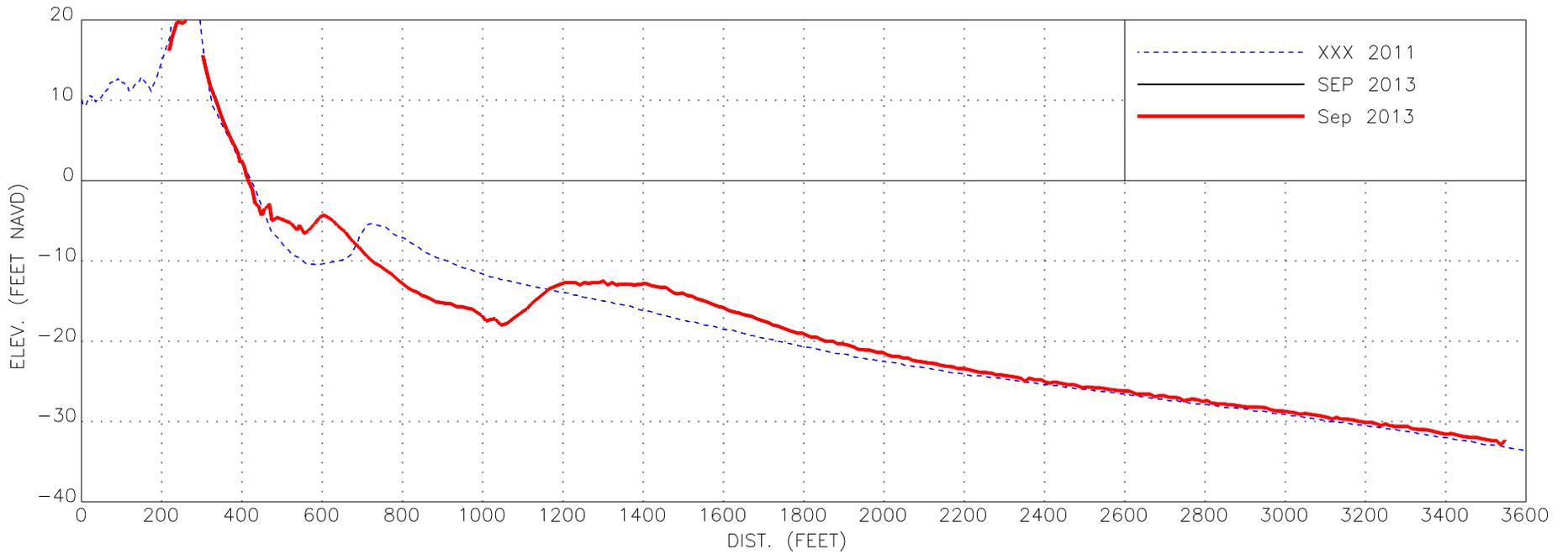
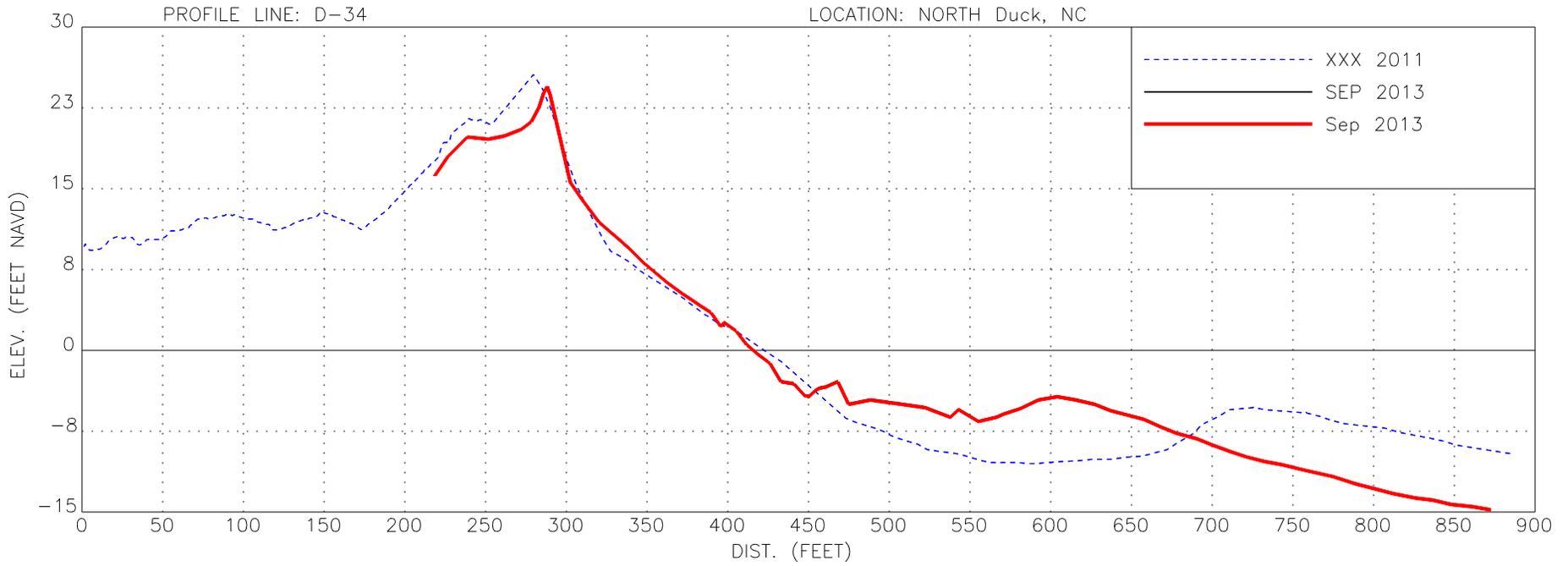


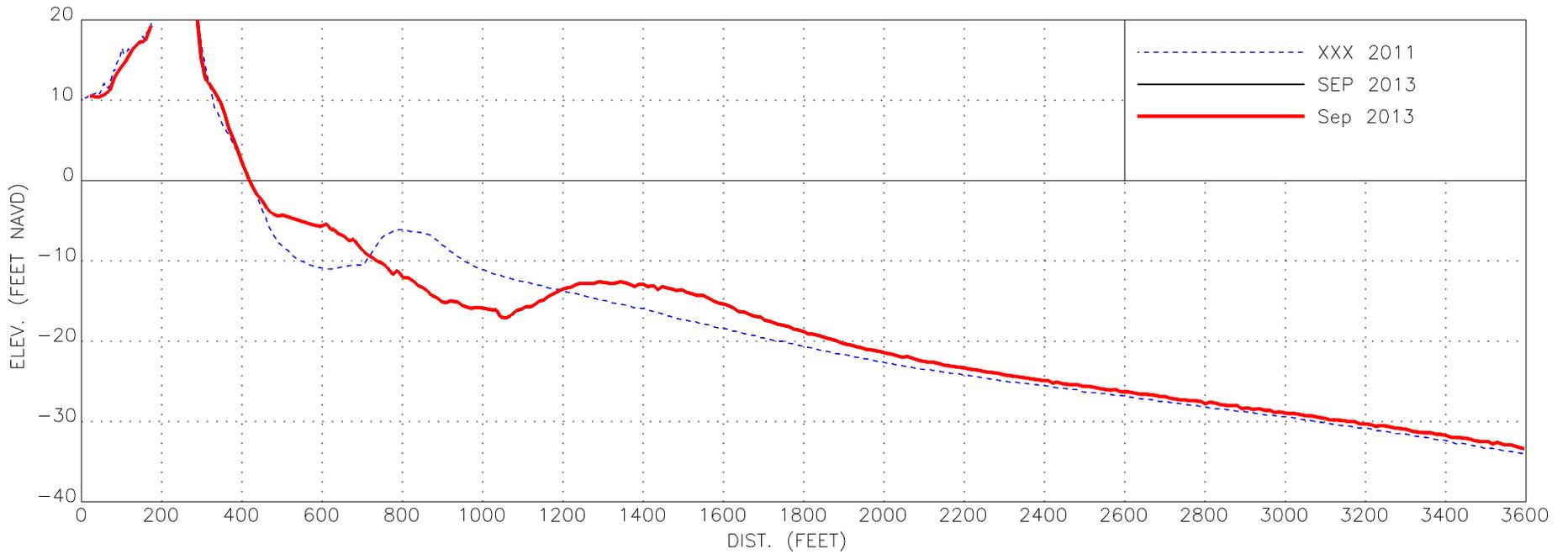
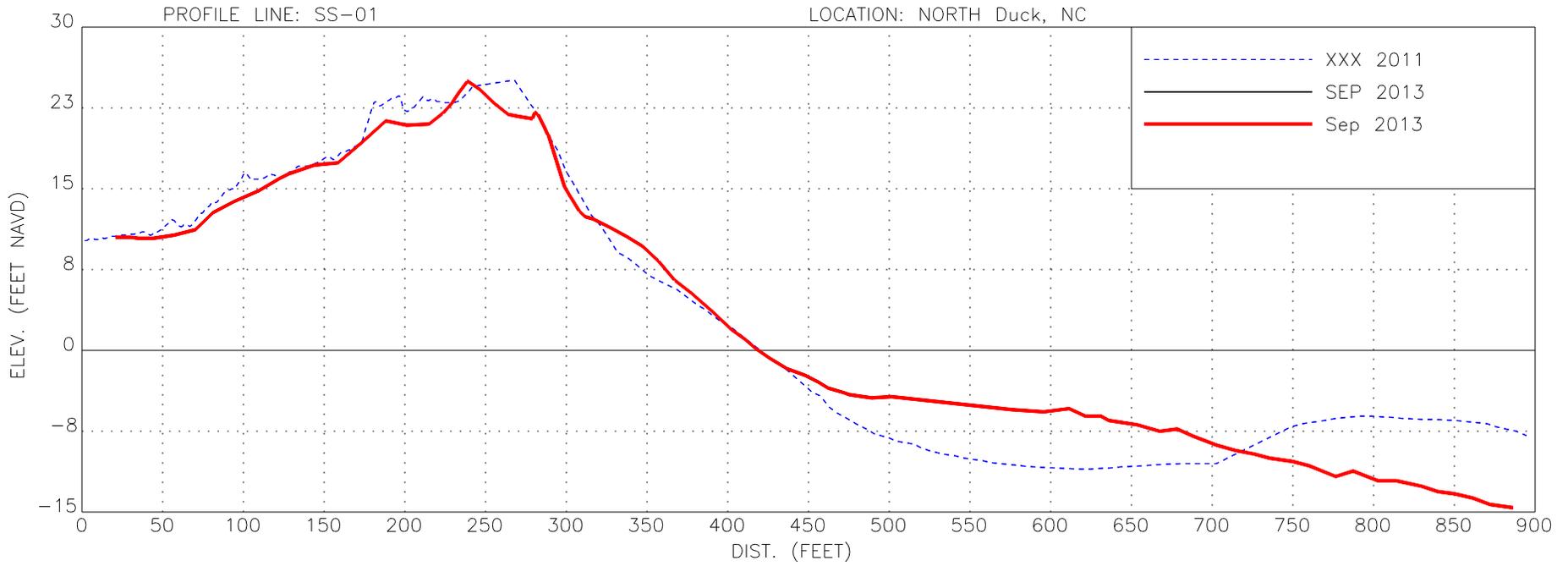












APPENDIX 4

GROUND DIGITAL PHOTOGRAPHY



**Ground Digital Photography
Monument**

D-01



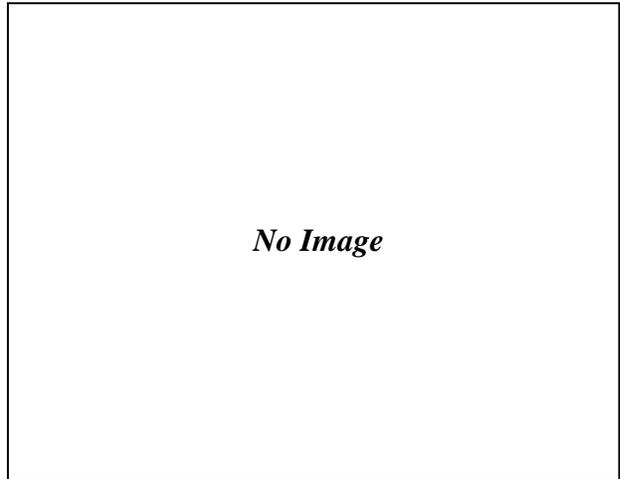
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-02



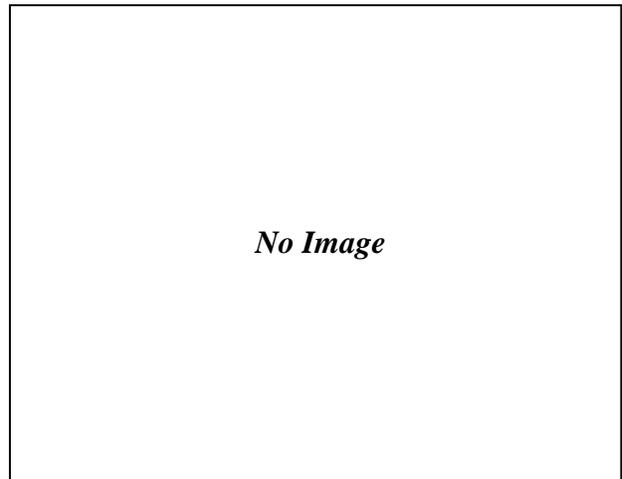
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-03



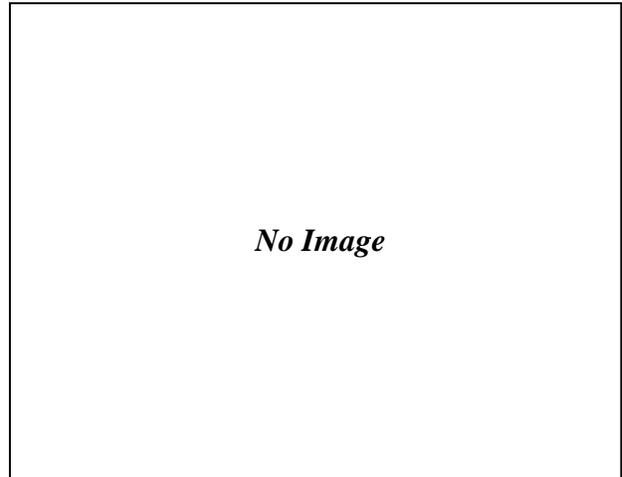
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-04



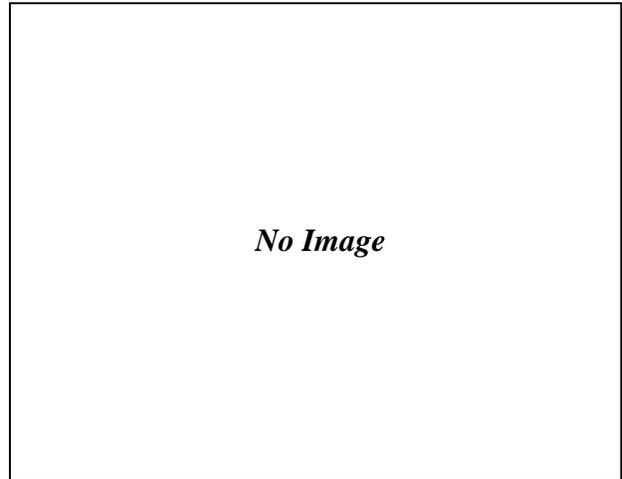
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-05



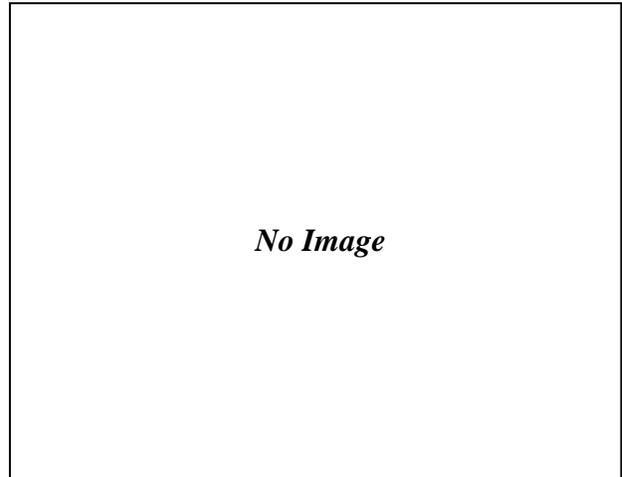
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-06



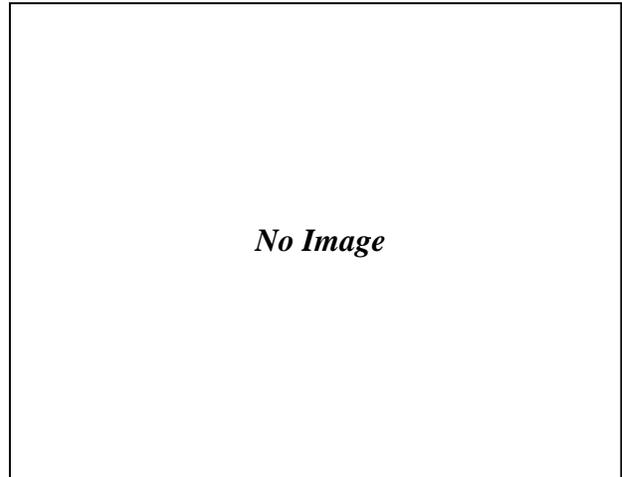
North View



South View



Landward View



Monument – Reference Point

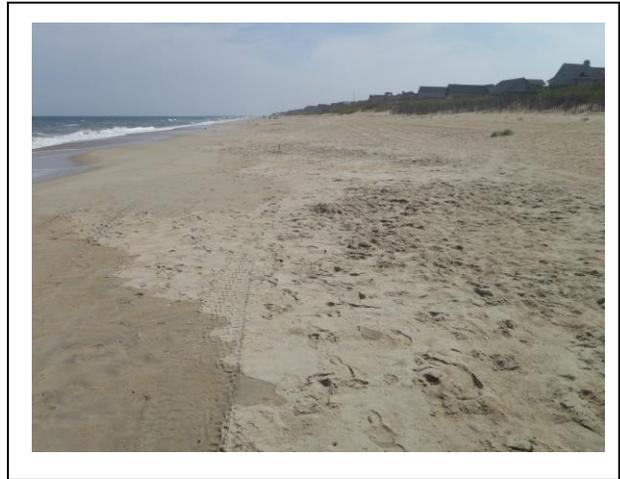


**Ground Digital Photography
Monument**

D-07



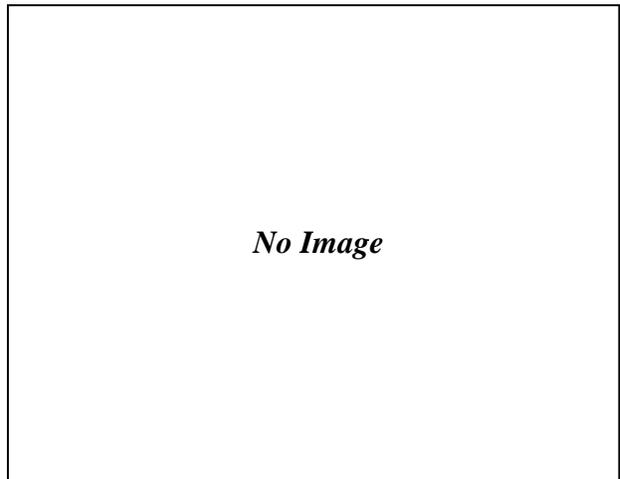
North View



South View



Landward View



Monument – Reference Point

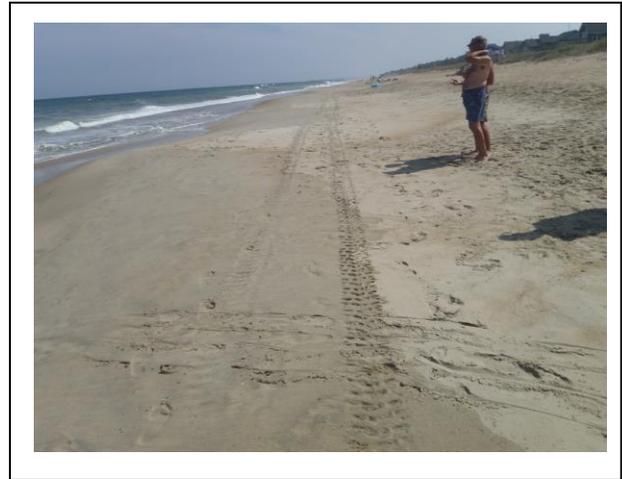


**Ground Digital Photography
Monument**

D-08



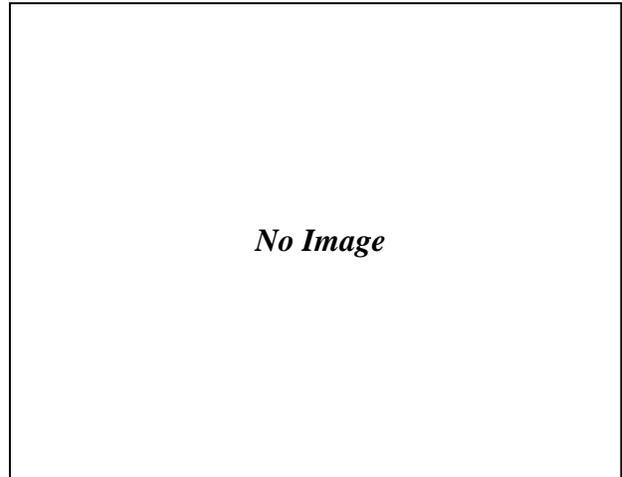
North View



South View



Landward View

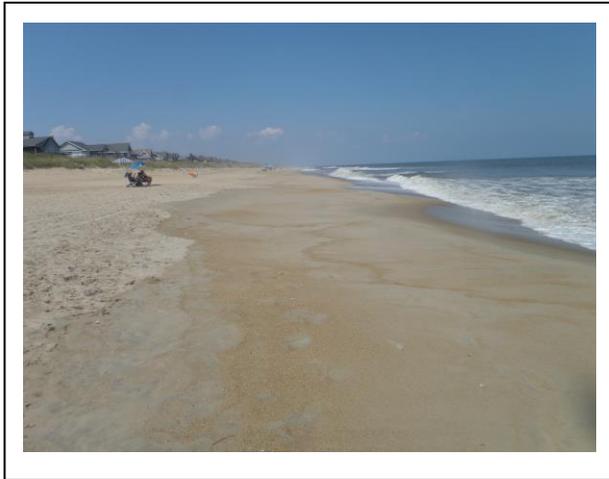


Monument – Reference Point



**Ground Digital Photography
Monument**

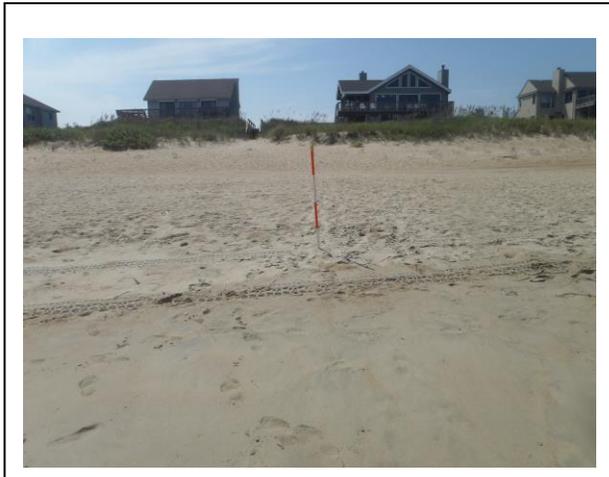
D-09



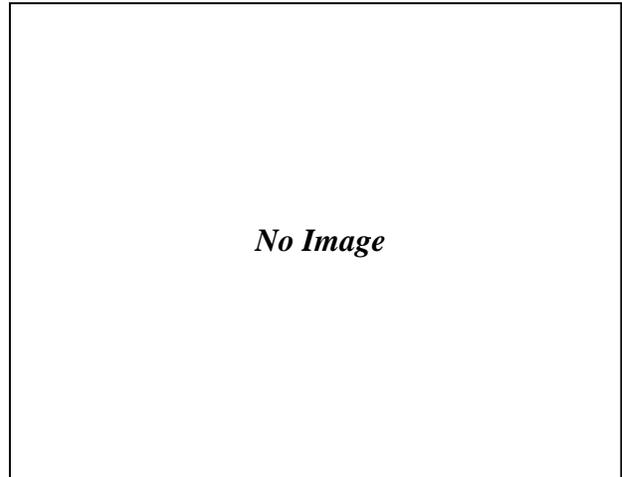
North View



South View



Landward View



Monument – Reference Point

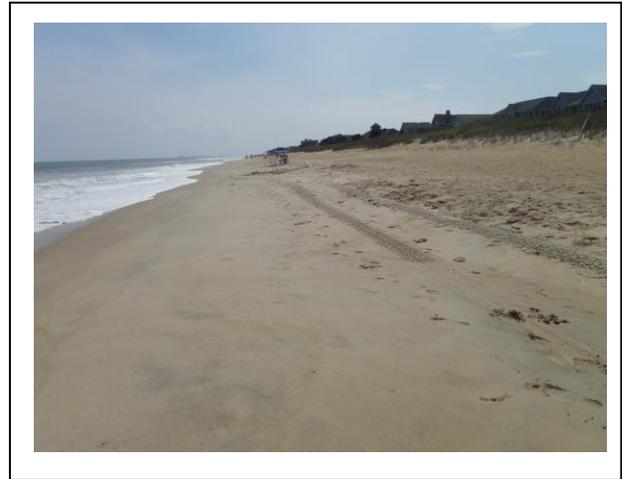


**Ground Digital Photography
Monument**

D-10



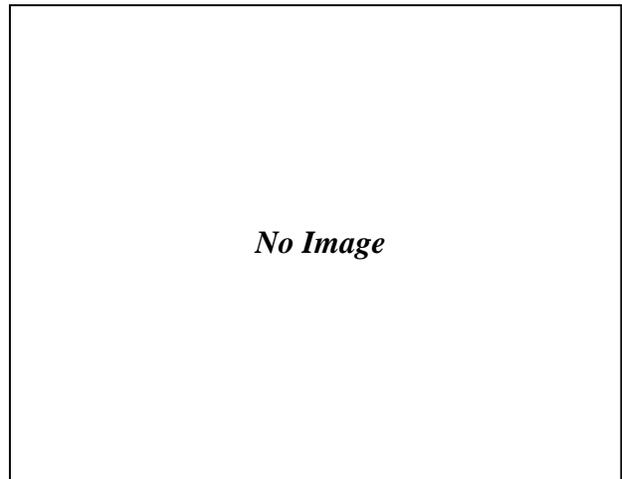
North View



South View



Landward View



Monument – Reference Point

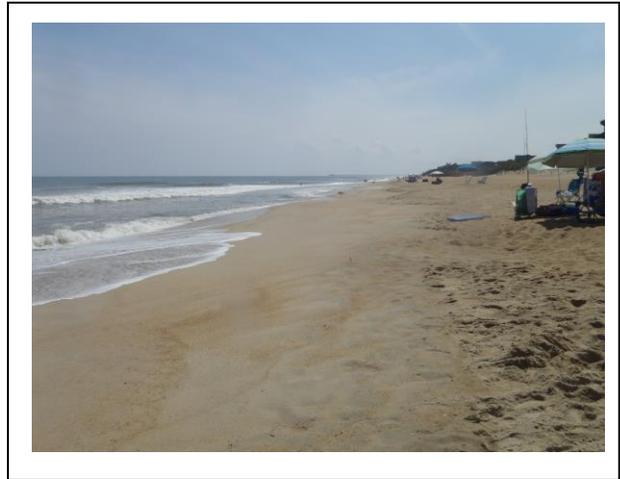


**Ground Digital Photography
Monument**

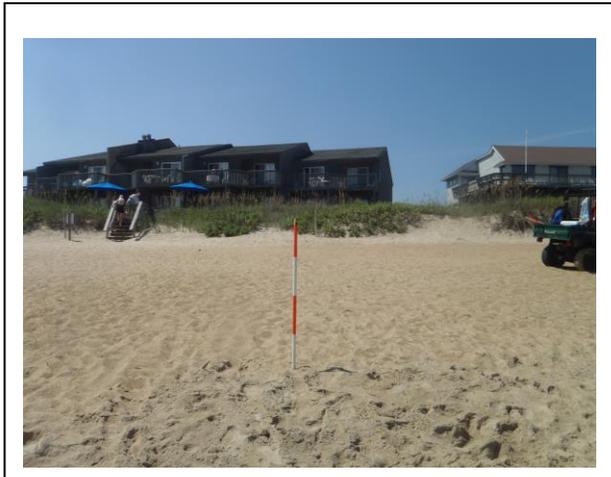
D-11



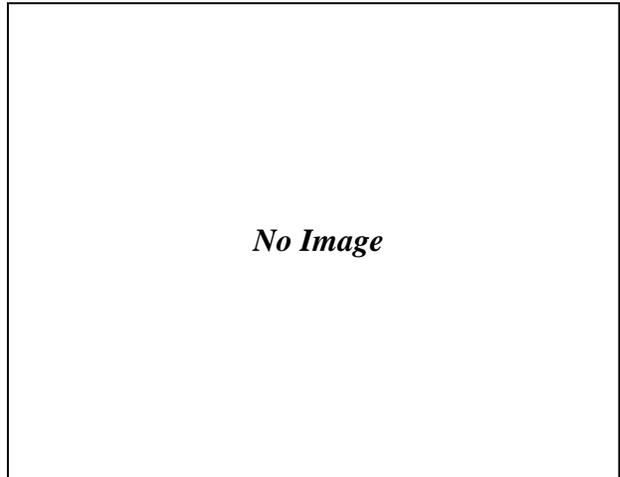
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-12



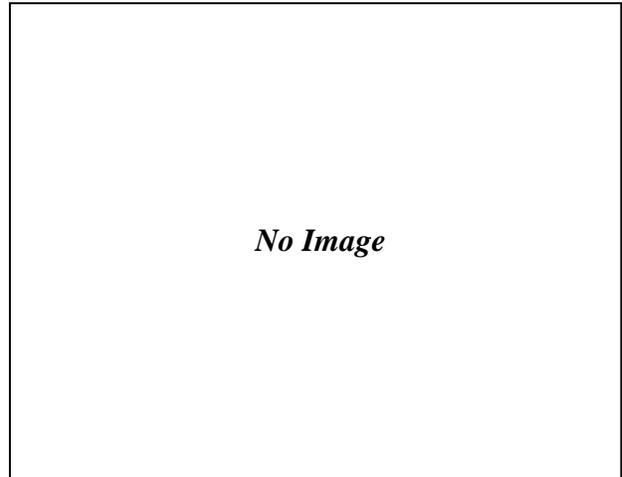
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

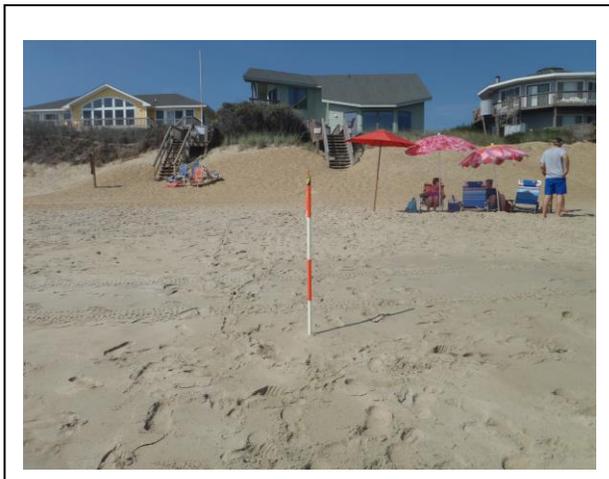
D-13



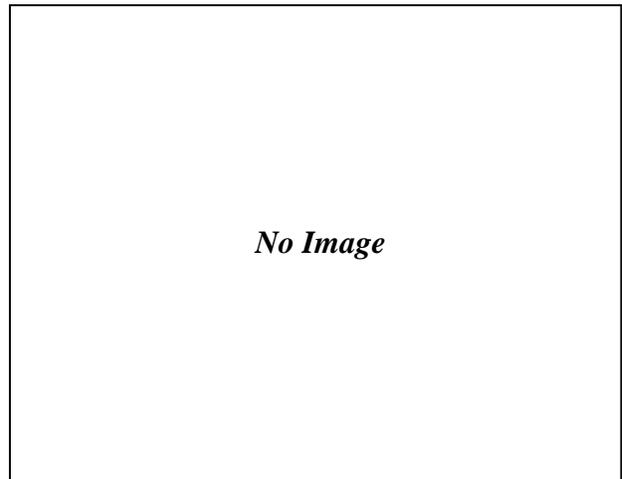
North View



South View



Landward View



Monument – Reference Point

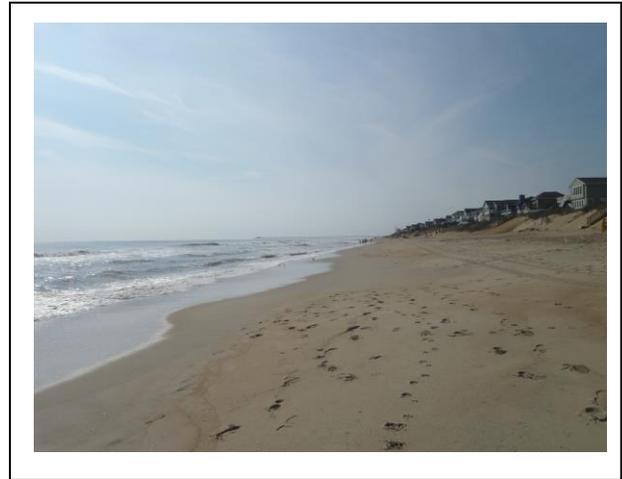


**Ground Digital Photography
Monument**

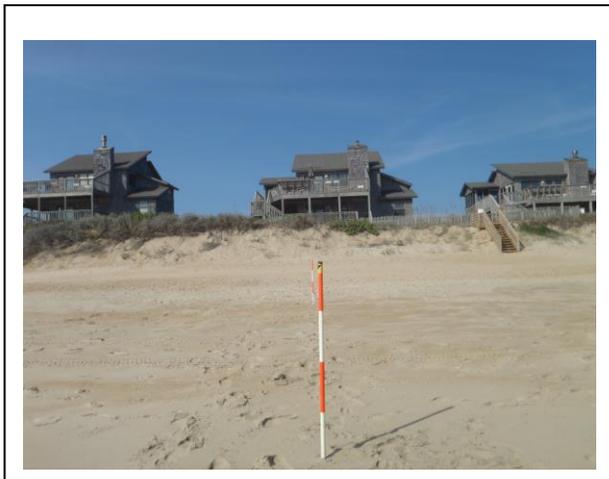
D-14



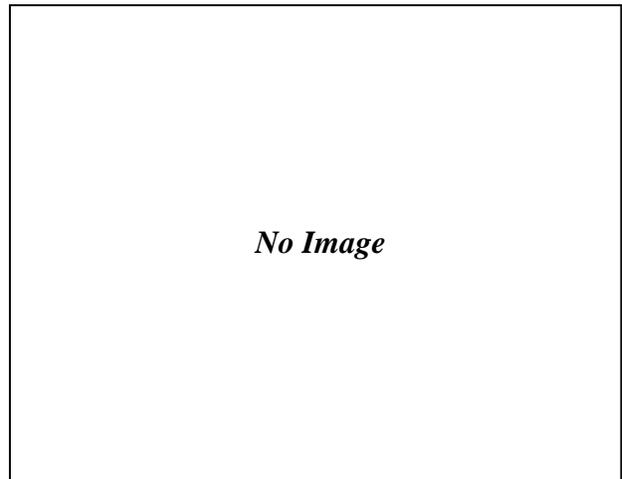
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-15



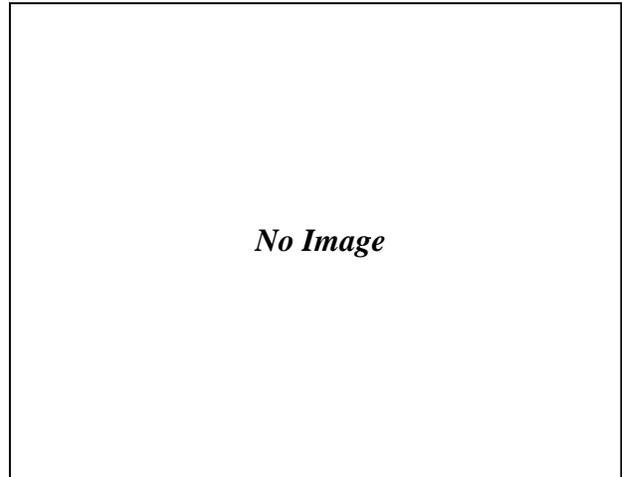
North View



South View



Landward View



Monument – Reference Point

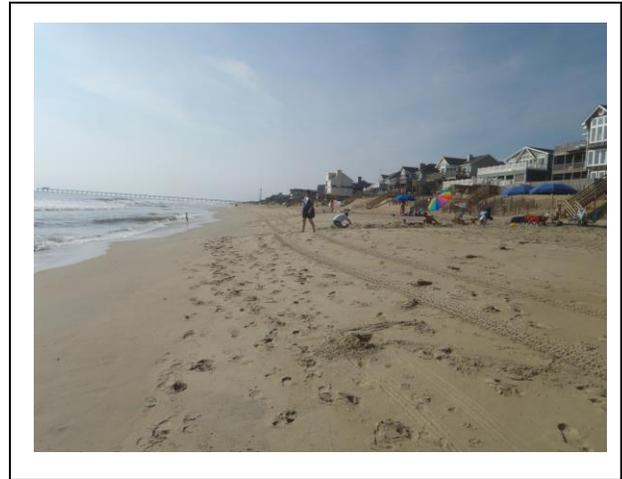


**Ground Digital Photography
Monument**

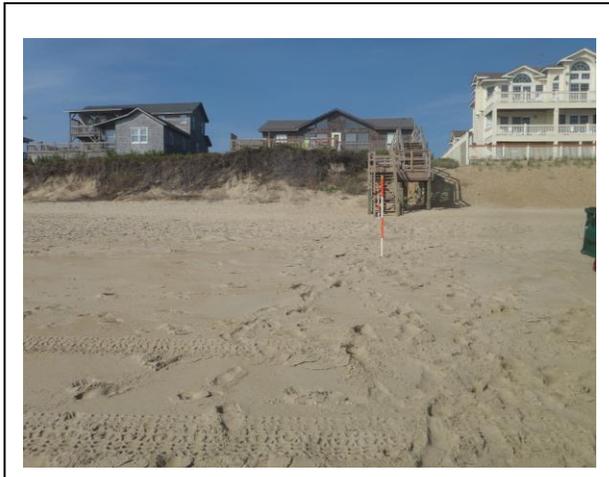
D-16



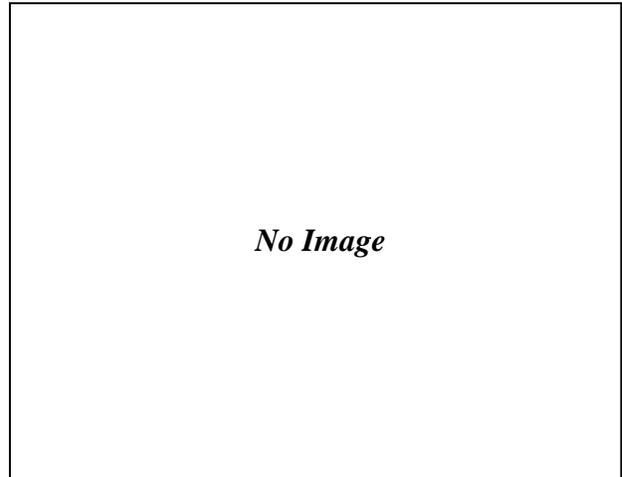
North View



South View



Landward View



Monument – Reference Point

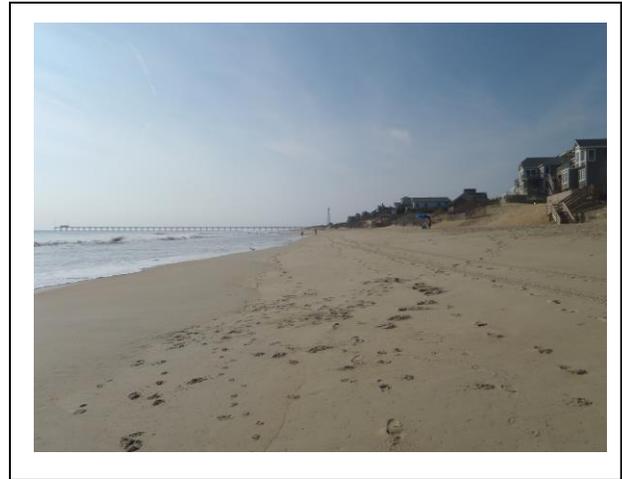


**Ground Digital Photography
Monument**

D-17



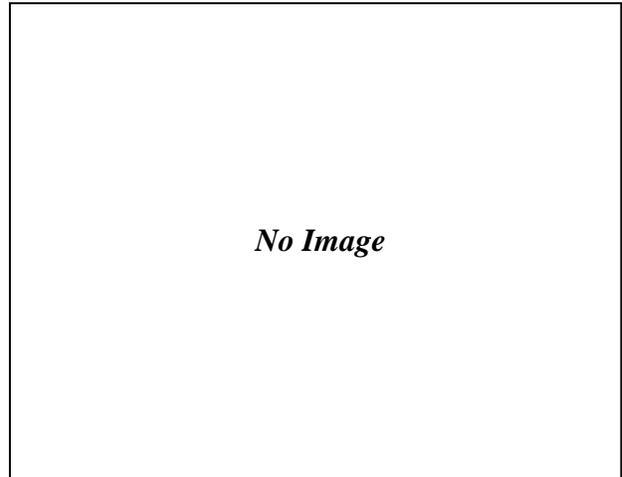
North View



South View



Landward View

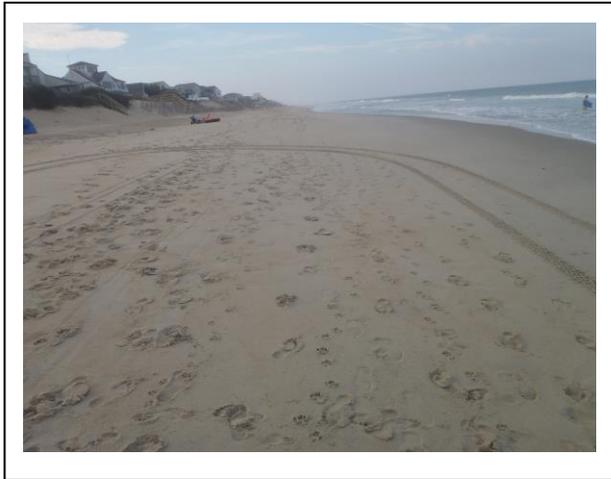


Monument – Reference Point

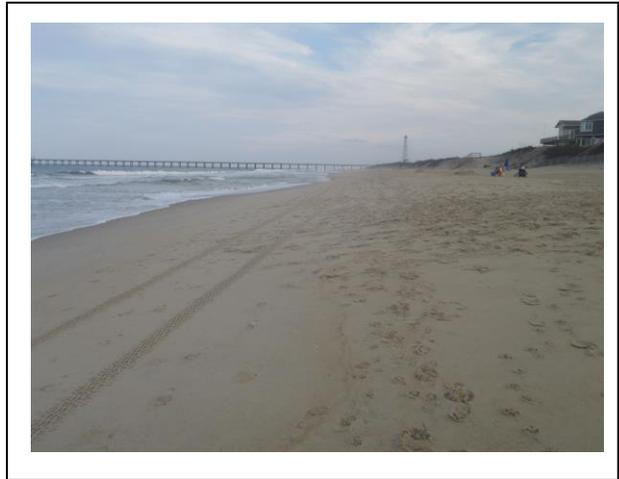


**Ground Digital Photography
Monument**

D-18



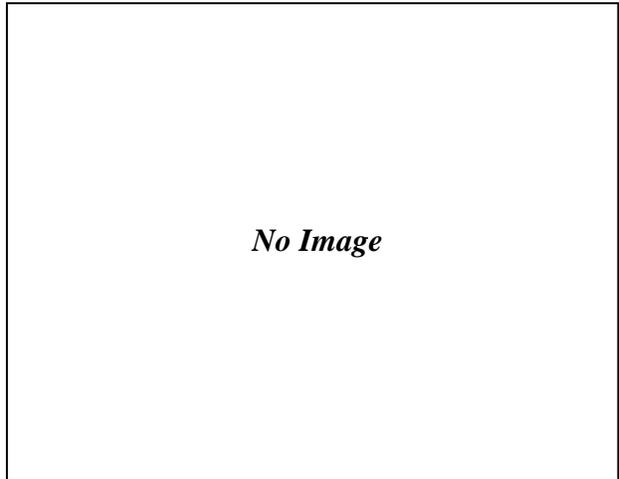
North View



South View



Landward View

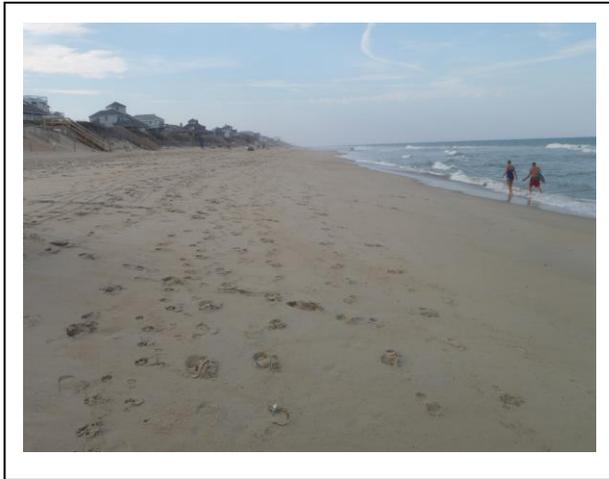


Monument – Reference Point

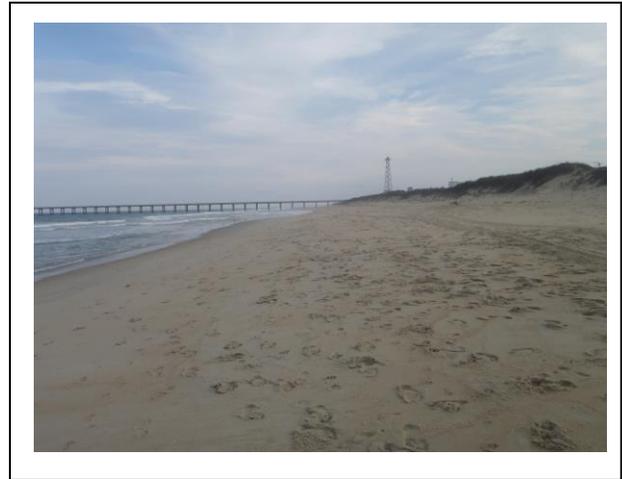


**Ground Digital Photography
Monument**

D-19



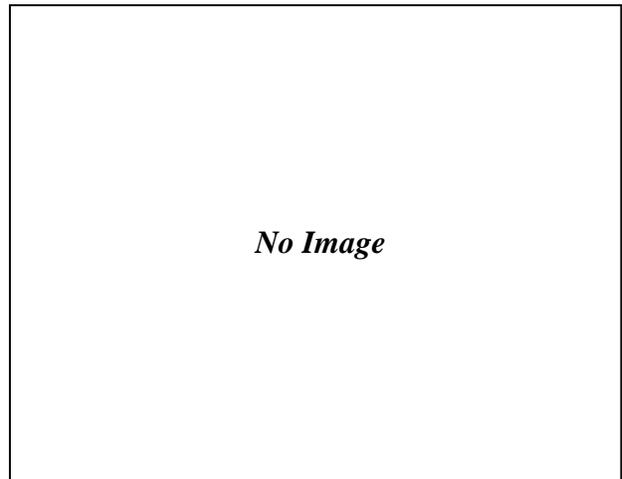
North View



South View



Landward View



Monument – Reference Point

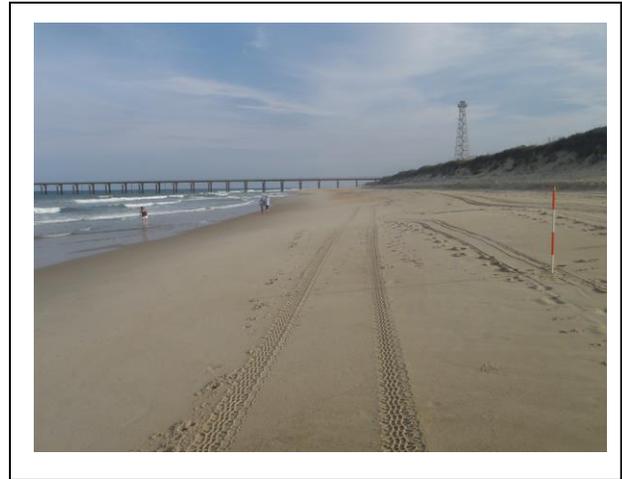


**Ground Digital Photography
Monument**

D-20



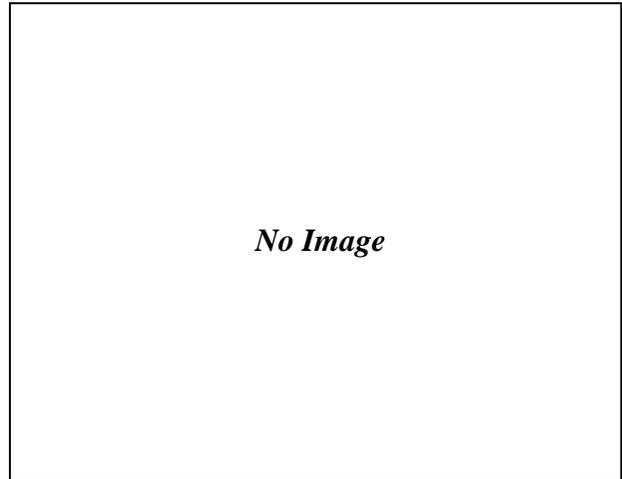
North View



South View



Landward View

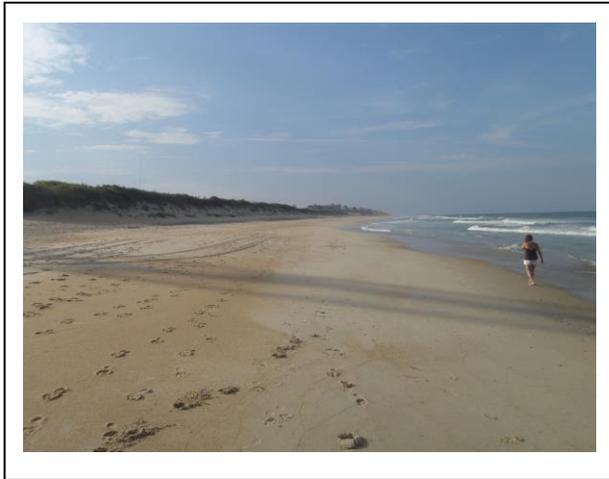


Monument – Reference Point



**Ground Digital Photography
Monument**

D-21



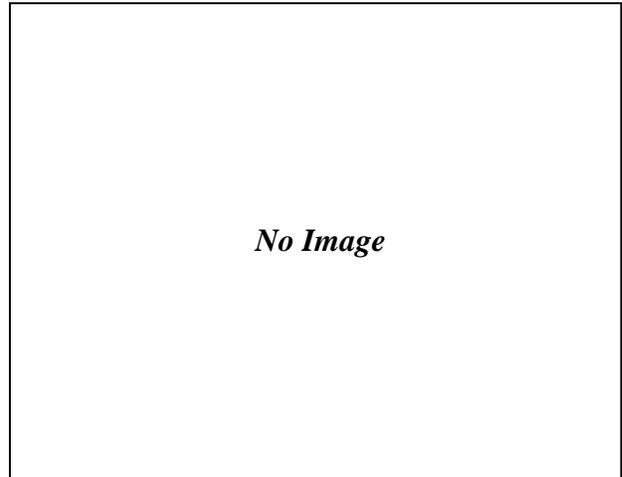
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-22



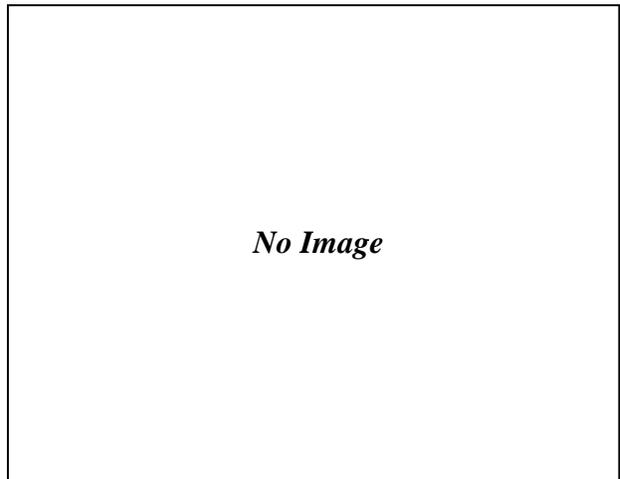
North View



South View



Landward View



Monument – Reference Point

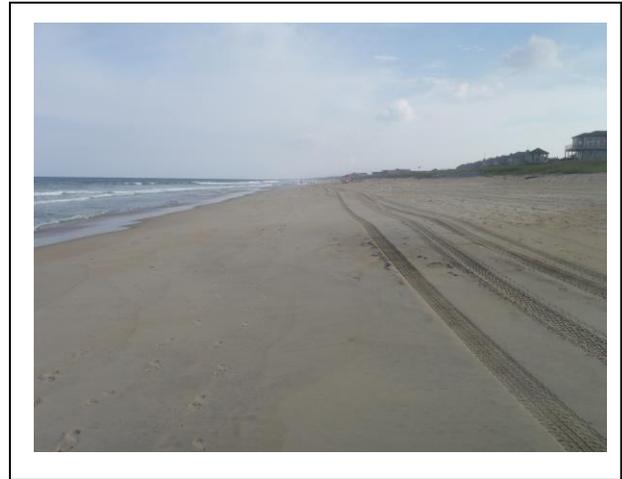


**Ground Digital Photography
Monument**

D-23



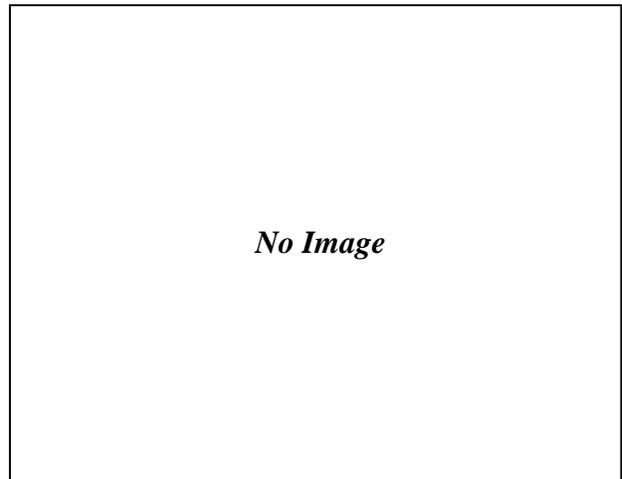
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-24



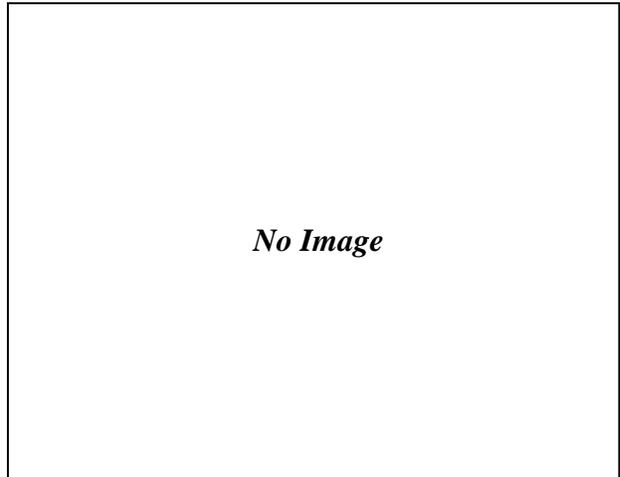
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-25



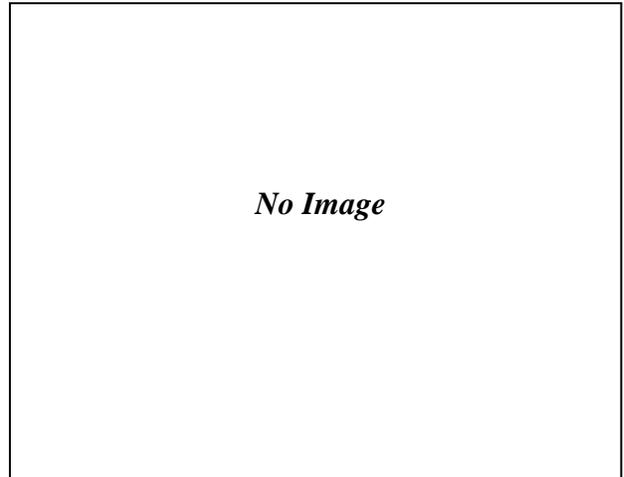
North View



South View



Landward View

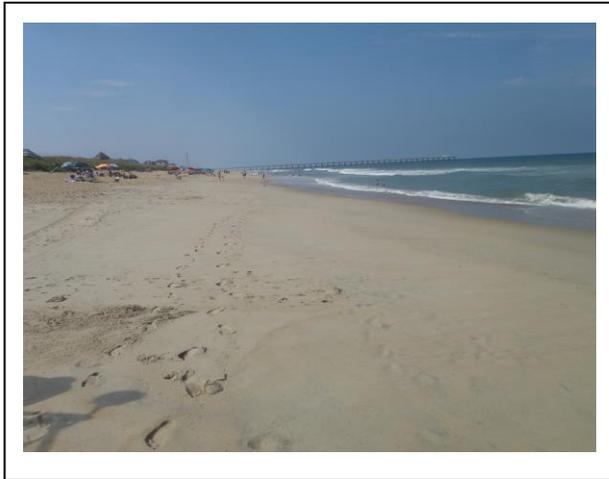


Monument – Reference Point



**Ground Digital Photography
Monument**

D-26



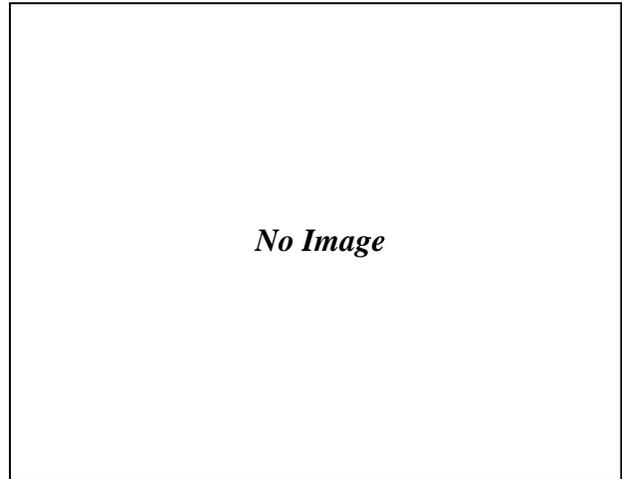
North View



South View



Landward View

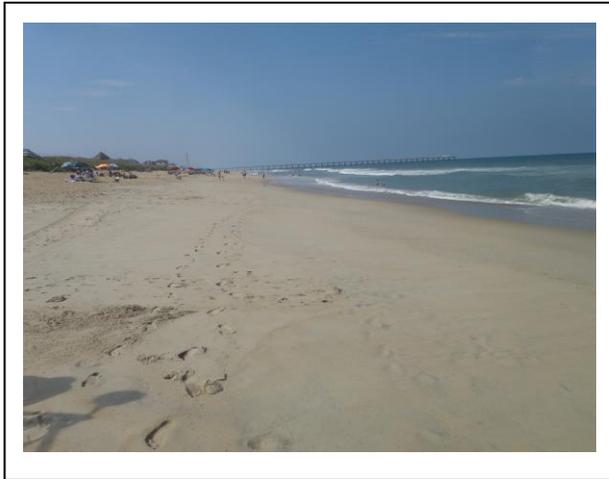


Monument – Reference Point



**Ground Digital Photography
Monument**

D-27



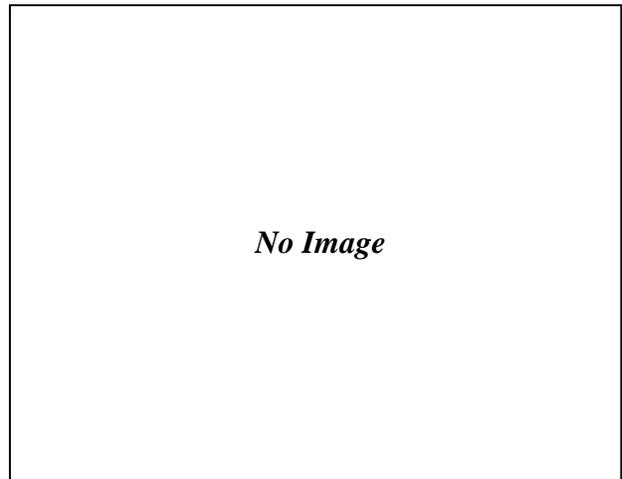
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-28



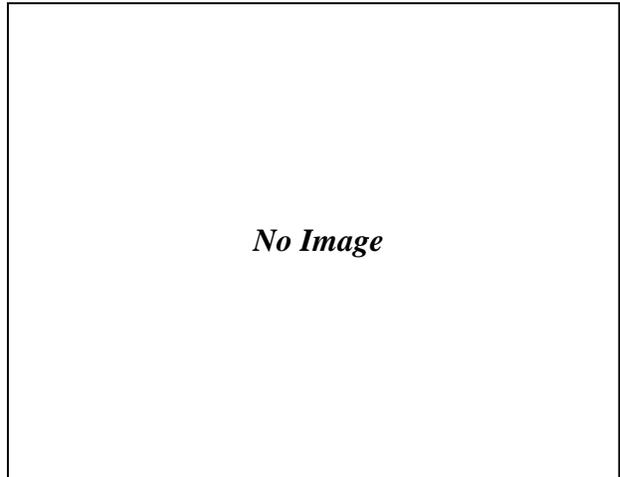
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-29



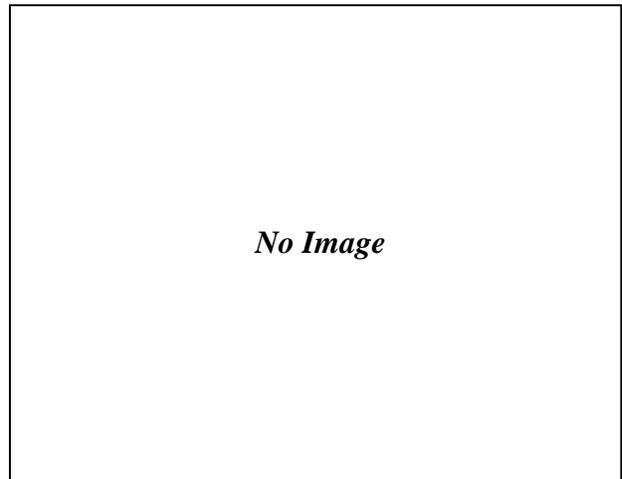
North View



South View



Landward View



Monument – Reference Point

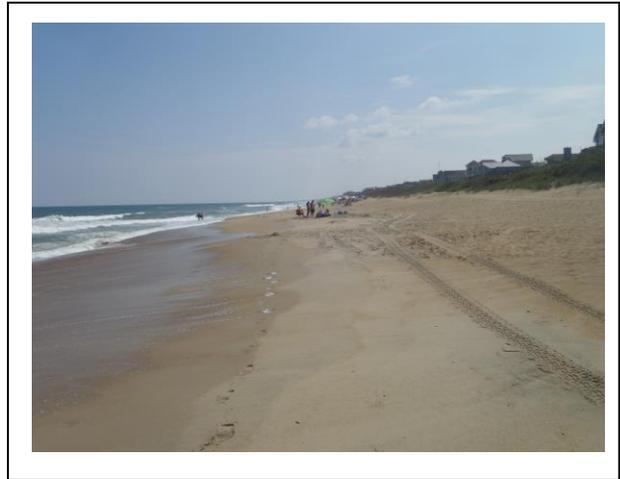


**Ground Digital Photography
Monument**

D-30



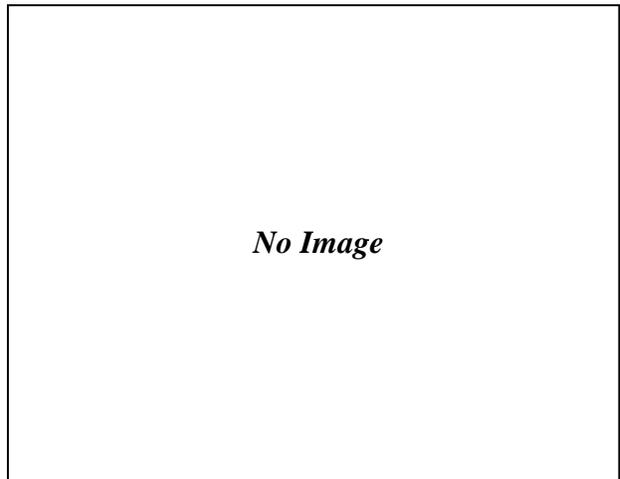
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

D-31



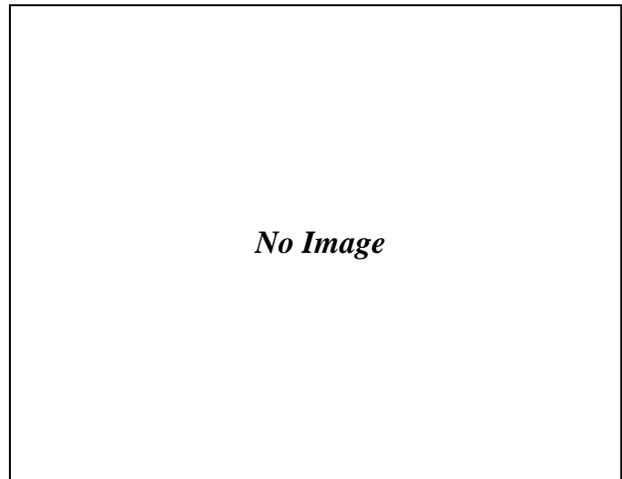
North View



South View



Landward View

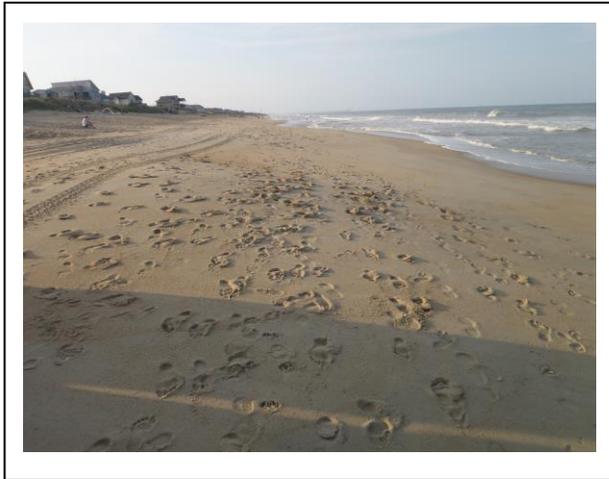


Monument – Reference Point

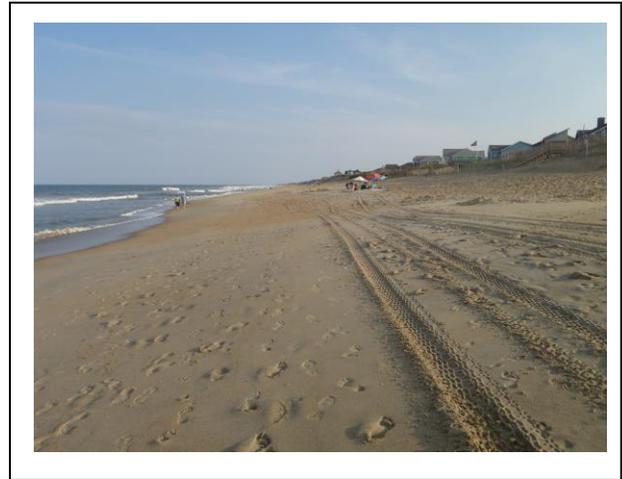


**Ground Digital Photography
Monument**

D-32



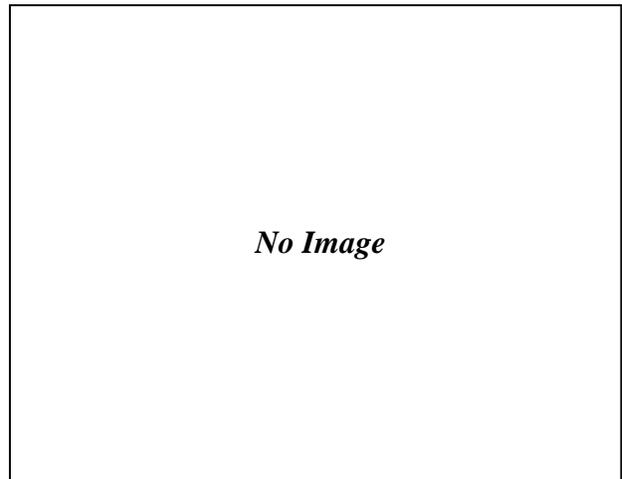
North View



South View



Landward View

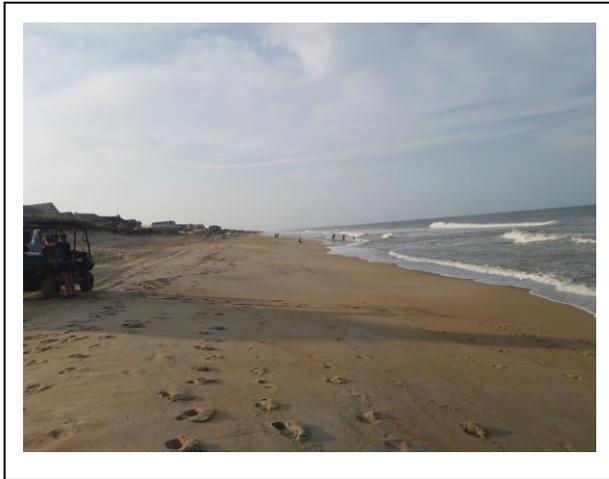


Monument – Reference Point



**Ground Digital Photography
Monument**

D-33



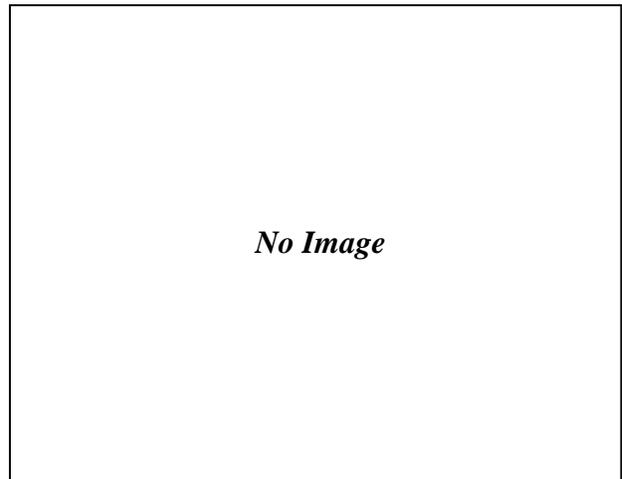
North View



South View



Landward View

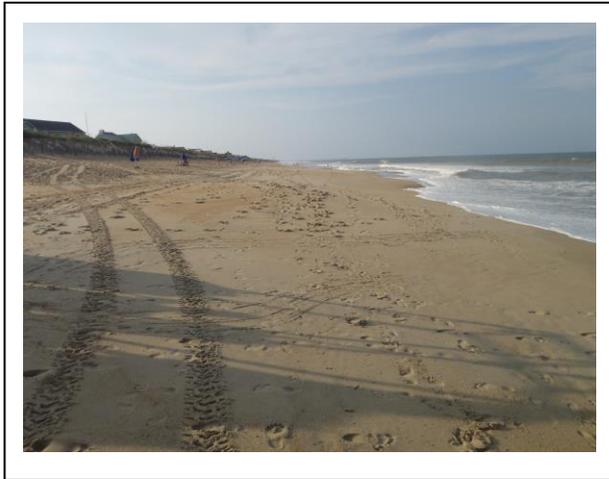


Monument – Reference Point



**Ground Digital Photography
Monument**

D-34



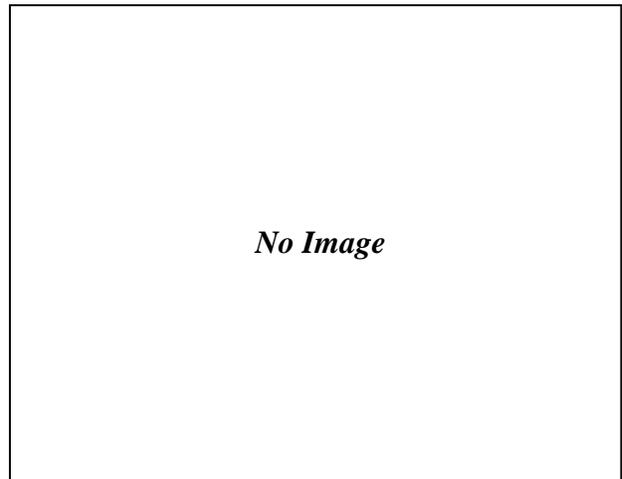
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

PI-17



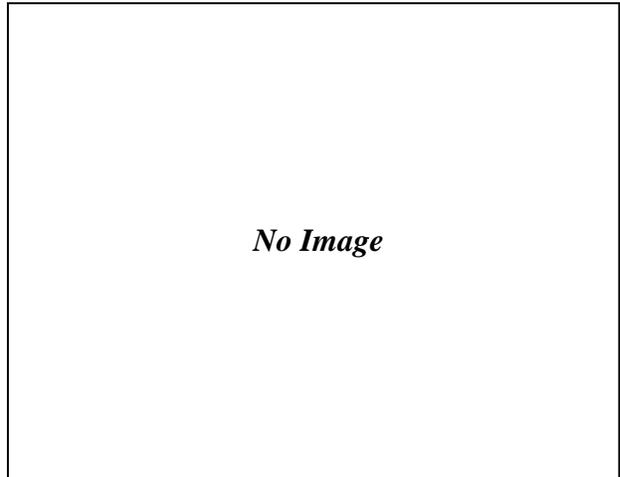
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

PI-18



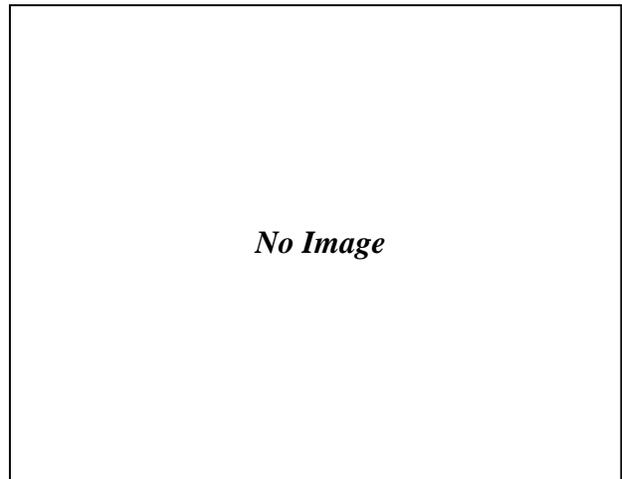
North View



South View



Landward View

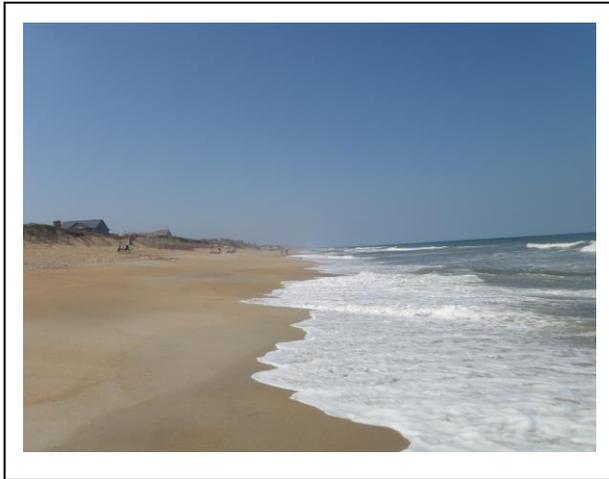


Monument – Reference Point

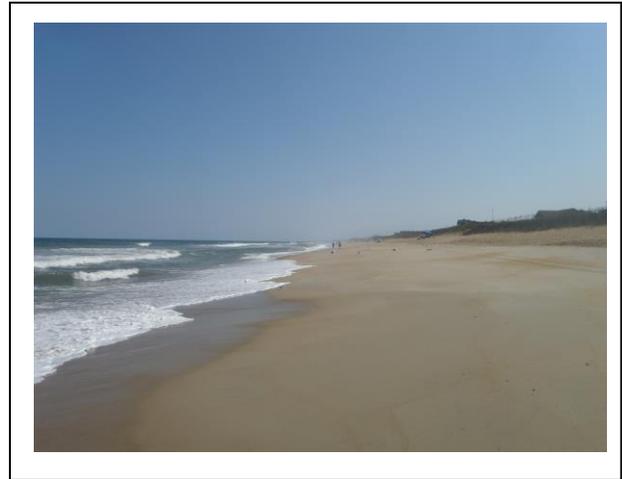


**Ground Digital Photography
Monument**

SS-01



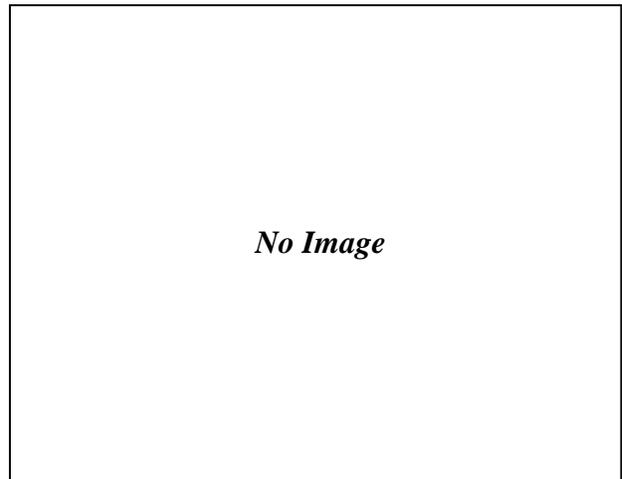
North View



South View



Landward View



Monument – Reference Point



**Ground Digital Photography
Monument**

SS-02



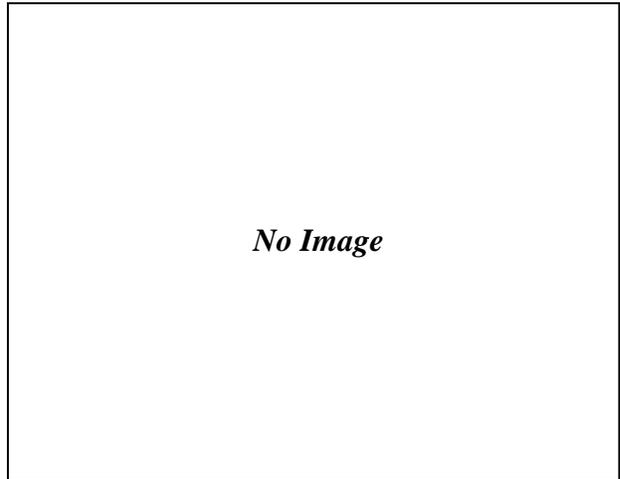
North View



South View



Landward View



Monument – Reference Point

APPENDIX 5
FIELD BOOK PAGES

**NORTH
CAROLINA**

481



SINCE 1956

FLT

Geosystems

8418

**OUTER
BANKS**

481

JS,KG

DUCK 0913

9/10/13

0910 SETUP BASE 865 1370 C TIDAL
1.5m channel 5

1000 SOD CNK CAFFEY

H 0.051

H 0.060

V -0.039

V -0.047

1020 SOD CNK Y254

H 0.048

H 0.012

V -0.034

V -0.034

1040 SOD CNK C255

H 0.028

H 0.035

V -0.021

V -0.015

1100 ESTABLISHED COORDS ON "NOS 1370 K"

N 901318.46

E 2959889.05

ELEV 24.45

1115 SOD CNK 865 1370 D TIDAL (Vertical only)

H 2.051

H 2.038

V -0.018

V -0.011

1320 SETUP BASE NOS 1370K
1.5m channel 5

1323 SOD CNK C255

H 0.017

H 0.022

V -0.003

V -0.006

NAD83/2011 NAVD88

Pics 96-97

Pics 98-100

Pics 101-103

Pics 104-106

Pics 107-108

NOS DISK along the South Side
OF THE ACOE Pier. 3' North
from the Pier edge. Approx 1250'
East of the ACOE Building

Pics 109-110

JS, KG

Duck 0913

9/10/13

1325 SOD CHK 865 1370 C

H 0.051

H 0.036

V -0.046

V -0.042

SS02 Topo 1-41

Pics 111-113

Az 70

WL, Wsnd, snd, EV, VI, VZ

SS01 Topo 1-49

Pics 114-117

Az 70

WL, Wsnd, snd, EV, VI, VZ, VI, Swalk, road

1520 EOD CHK Y254

H 0.030

H 0.014

V 0.031

V 0.020

1520 END SURVEY

JS,KG,BA,AP,JW,JB DUCK0913

9/11/13

NAD83/2011 NAVD88

3

0730 SET BASE 865 1370 K tidal
1.5 m channel 5 8000 baud

0900 SOD CHK 865 1370 C tidal
H 0.063 H 0.054
V 0.011 V -0.001

0905 SOD CHK C255
H 0.113 H 0.114
V -0.071 V -0.061

1000 changed Band Rate TT450s at 4800

1757 EOD CHK C255
H 0.113 H 0.109
V -0.002 V -0.007

1805 EOD CHK 865
H 0.081 H 0.081
V -0.016 V -0.011

JS, JW, JB, AP

DUCK 0913

9/11/13

SS02 Topo 100-127

Az 70

SS01 Topo 100-116

Az 70

D34 Topo 100-140

Az 70

D33 Topo 100-135

Az 70

D32 Topo 100-125

Az 70

D31 Topo 100-128

Az 70

D30 Topo 1-13 Pics 121-124
 wsnd, snd, eov, vi (stopped at fence)
 Topo 100-121

Az 70

D29 Topo 1-13 Pics 125-127
 wsnd, snd, eov, vi (stopped at post fence)
 Topo 100-125

Az 70

D28 Topo 1-14 Pics 128-130
 wsnd, snd, eov, vi (stopped at pool & over)
 Topo 100-125

Az 70

D27 Topo 1-14 Pics 131-135
 wsnd, snd, eov, vi (stopped at pool fence)
 Topo 100-126

Az 70

D26 Topo 1-17 Pics 136-138
 wsnd, snd, eov, vi (stopped at shrubbery) Az 70
 Topo 100-127

Az 70

NS Dtg 493, Dtg 575 delete 124 ✓

NS Dtg 457, Dtg 665 delete 116 ✓

NS Dtg 522, Dtg 610

Dtg 630

Dtg 665

Dtg 645

Dtg 640

Dtg 615 Delete 116 & 117 ✓

Dtg 645

Dtg 660

Dtg 745 delete 115 & 116 ✓

JS, JW, JB, AP DUCK 0913 9/11/13

D25 Topo 1-16 Picts 140-142
wsnd, snd, eov, vi (Thick shrubbery!) AZ 70
Topo 100-131

(15)
D24 Topo 1-19 Picts 143-146
wsnd, snd, eov, vi (crossed over a boardwalk) AZ 70
Topo 100-124

D23 Topo 1-21 Picts 147-148
wsnd, snd, eov, vi (crossed over shrub/berm; steep drop off) AZ 70
Topo 100 - Federal waters

D22 Topo 1-24 Picts 150-152
wsnd, snd, eov, vi (crossed over shrub/berm/sleep drop) AZ 70
Topo 100 - Federal waters

D21 Topo 1-21 Picts 153-155
wsnd, snd, eov, vi (flat shoreline & abrupt dune/berm) AZ 70
Topo 100 - Federal waters

D20 Topo 1-31 Picts 156-158
wsnd, snd, eov, vi (flat shoreline & abrupt dune/berm) AZ 70
Topo 100 - Federal waters

D19 Topo 1-32 Picts 159-161
wsnd, snd, eov, vi (flat shoreline & abrupt dune/berm) AZ 70
Topo 100-131

D18 Topo 1-25 Picts 162-164
wsnd, snd, eov, deck (flat shoreline & abrupt dune/berm) AZ 70
Topo 100-137

Dtg 705 ,

Dtg 745 , delete 119 ✓

Dtg ,

Dtg ,

Dtg ,

Dtg ,

Dtg 635 ,

✓ verify last few offshore points. 126-131 change Rd Ht to 12.04. delete 125 ✓

Dtg 565 ,
added 50

JS, JW, JB, KG

Duck 0913

9/12/13

6

0800 Set Base 865 1370 K Tidal
1.5m Channel S 1800 Band Rate

0803 SOD CHK C255
H 0.068 H 0.042
V -0.074 V -0.065

0806 SOD CHK 865 1370 C Tidal
H 0.053 H 0.038
V -0.015 V -0.009

1815 EOD CHK C255
H 0.148 H 0.164
V -0.020 V -0.015

1820 EOD CHK 865 1370 C Tidal
H 0.043 H 0.041
V -0.034 V -0.017

* NEED TO ADD 50' OVERLAP

STA	DTG
D19	585
D18	565
D17	605 655
D16	555 605
D15	570 620
D14	600 650
D13	580 630
D12	615 695
D11	680 730
D10	685 735
D09	720 770
D08	700 750
D07	700 750
D06	660 710
D05	690 740
D04	720 760
D03	720 760
D02	690 740
D01	715 765
P118	725 775
P117	670 720

COLLECT NATIVE BEACH SAND SAMPLES

• SAND SAMPLES NEED TO BE TAKEN @ STA

- ① D24, ② D18, ③ D13, D08, D03

Date
D?
Location

• SAMPLE @

- ① DUNE
- ② DUNE TOE
- ③ MID BERM
- ④ BERM CREST
- ⑤ MHW (+1.18 NAVD)
- ⑥ MTL (-0.43 NAVD)
- ⑦ MLW (-2.05 NAVD) → TROUGH → BAR CREST

JS, JW, JB, KG Duck 0913 9/12/13
 A270

D17 Topo 1-29 Picts 165-167
 wsnd, snd, eov, vi
 Topo 100-134
 crossed over driveway;
 grass & e fence

D16 Topo 1-22 Picts 168-170 A270
 wsnd, snd, eov, vi
 Topo 100-126
 steep dune/scarp
 e of house

D15 Topo 1-25 Picts 171-173 A270
 wsnd, snd, eov, vi, fence, conc
 Topo 100-134

D14 Topo 1-18 Picts 174-176 A270
 wsnd, snd, eov, vi
 Topo 100-132
 flat shore, steep
 dune scarp
 up to house

(65) D13 Topo 1-18 Picts 177-179 A270
 wsnd, snd, eov, vi
 Topo 100-127
 flat shore, steep
 dune scarp
 crossed over stairs/
 boardwalk

D12 Topo 1-29 Picts 180-182 A270
 wsnd, snd, eov, vi, fence, conc
 Topo 100-112

D1 Topo 1-19 Picts 183-185 A270
 wsnd, snd, eov, vi
 Topo 100-133
 flat shoreline,
 steep dune/scarp
 right up to house/seawall

D10 Topo 1-29 Picts 186-188 A270
 wsnd, snd, eov, vi, bwalk, v2
 Topo 100-133

DTG 605,
 +50
 655 delete 116 ✓

DTG 555,
 +50
 605

DTG 570,
 +50
 620

DTG 600,
 +50
 650 Topo D14 D19, Topo 1-13 mislabeled ✓
 delete 126 ✓ delete 6+7 ✓

DTG 580,
 +50
 630 delete 124 + 127 ✓

DTG 645,
 +50
 695 delete 103 ✓

DTG 680,
 +50
 730

DTG 685,
 +50
 735 delete 106 + 126 ✓

JS, JW, JB, KG Deck 0913 9/13/13
 D09 Topo 1-32 Picts 189-191 AZ 70
 wsnd, snd, cov, vi
 Topo 100-131

D08 (55) Topo 1-38 Picts 238-240 AZ 70
 wsnd, snd, cov, vi
 Topo 100-132

D07 Topo 1-12 Picts 235-237 AZ 70
 wsnd, snd, cov, vi
 Topo 100-131

D06 Topo 1-12 Picts 232-234 AZ 70
 wsnd, snd, cov, vi
 Topo 100-128

D05 Topo 1-13 Picts 229-231 AZ 70
 wsnd, snd, cov, vi
 Topo 100-127

D04 Topo 1-24 Picts 226-228 AZ 70
 wsnd, snd, cov, vi, fence, grass
 Topo 100-130
 *Wedding ceremony setup

D03 (55) Topo 1-25 Picts 223-225 AZ 70
 wsnd, snd, cov, vi
 Topo 100-134
 *dolphins

D02 Topo 1-26 Picts 220-222 AZ
 wsnd, snd, cov, vi
 Topo 100-132

Dtg 770,
 (610-570) NEED! (9-12-13)

Dtg 750,

Dtg 750,

Dtg 710,

Dtg 740,

Dtg 760,

Dtg 760,

Dtg 740, delete 127 ✓

J5, JW, JB, KG	Duck 0913	9/12/13	
D31 Topo 1-22 wsnd, snd, eov, vi	Picts 217-219	AZ 70	
Topo 100-137			
P118 Topo 1-27 wsnd, snd, eov, vi	Picts 21-216	AZ 70	
Topo 100-138			
P117 Topo 1-19 wsnd, snd, eov, vi	Picts 211-213 long flat shoreline + brush + steep scarp dense dense brush impassable	AZ 70	
Topo 100-139			
5502 W Topo 130-144		AZ 70 ^{9/12/13}	
5501 W Topo 120-142		AZ 70	
D34 W Topo 1-19 wsnd, snd, eov, vi	Picts 192-194	AZ 70	
Topo 150-178			
D33 Topo 1-24 wsnd, snd, eov, vi	Pics 195-197	AZ 70	
D32 Topo 1-38 wsnd, snd, eov, vi, v2	Picts 198-200	AZ 70	
P31 Topo 1-33 wsnd, snd, eov, vi, bwalk	Picts 201-204	AZ 70	

Dtg 765,

Dtg 775,

Dtg 720,

GAP

Gap

Gap delete 160 ✓

Jb, JW, J13, AP Duck 0913 9-13-13

0830 Set Base 865 1370 K Tidal
1.5 Channel 5 4800 Baud rate

0835 SOD CHK C255
H 0.090 H 0.068
V -0.115 V -0.102

SOD CHK 865 1370 C Tidal
H 0.030 H 0.044
V -0.028 V -0.038

0850 set up new control point: IRC "Jenn"

1615 MOD CHK C255
H 0.261 H 0.222
V 0.061 V 0.045

1530 MOD CHK 865 1370 C Tidal
H 0.023 H 0.024
V -0.069 V -0.096

* Need to take Base 865 1370 K Tidal down for USACE Pier Inspection.

1616 Ended Survey

1707 Set Base Jenn IRC
1.5m Channel 5

1710 MOD CHK 865 1370 C Tidal
H 0.109 H 0.087
V -0.012 V -0.024

*Written by Jennifer Brooks

0901 JENNIRC set 1550 ft North of the ACOE pier. Located in the dunes 11.0 ft west of the dune escarpment (Eov), 11.5 ft ^{south} west of wooden tripod and 19.0 ft west of a "NO trespassing government sign".

Distances
Wooden tripod 11.5 ft
Government signage 19.0 ft
Dune escarpment 11.0 ft
*Written by Jennifer Brooks

Pictures (205-210)

N 902391.456
E 2958173.459
ELEV 18.729
JENN (IRC SET)

09 Topo 500-517 Az70

JS, JW, JB, AP

Duck 0913

09/13/13

EOD CHK 065 1370 C Tidal

H 0.144 H 0.122

V 0.009 V -0.009

~~Handwritten scribbles and marks on the right side of the grid.~~

0640 Start Base JENN
1.5 m channel 5

0650 SOD CHK 865 1370 C tidal
H 0.093 H 0.125
V -0.009 V -0.008

0715 SOD CHK CAFFEY
H 0.142 H 0.190
V -0.029 V -0.033

1236 EOD CHK 865 1370 C Tidal
H 0.042 H 0.035
V -0.007 V 0.004

Rock survey

NW corner (Dune toe) NE corner (MLW)
N 909210.76 N 909264.82
E 2955470.25 E 2955617.00
ELEV 12.16 ELEV -2.05

SW corner (Dune toe) SE corner (MLW)
N 908923.61 N 908988.84
E 2955611.58 E 2955789.63
ELEV 10.15 ELEV -2.01

SAND SAMPLES

D24
D18

1445 Start Base JENN
1.5m R8-4 channel 5

1500 SOD CHK 865 1370 C Tidal
H 0.085 H 0.084
V -0.034 V -0.046

1510 SOD CHK CAFFEY
H 0.103 H 0.063
V -0.008 V -0.008

1745 EOD CHK CAFFEY
H 0.141 H 0.111
V -0.041 V -0.070

1810 EOD CHK Y254
H 0.127 H 0.100
V 0.019 V 0.026

JA, AP, JB

Duck 0913

9.15.13

D12 Topo 500 - 517

Az 70

D14 Topo 500 - 514

Az 70

~~EOD CHECK CAFFEY~~

~~1745~~

~~H 0.141~~

~~H 0.111~~

~~V -0.041~~

~~V -0.070~~

~~EOD CHECK Y254~~

~~1810~~

~~H 0.127~~

~~H 0.100~~

~~V 0.019~~

~~V 0.026~~

SAND SAMPLES

D08

D13

labeled as Topo

JS, JB, AP

DUCK0913

9/16/13

18

0735 Start Base JENN
R8-4 channel 5 1.5m

0750 SOD CHK CAFFEY
H 0.456 H 0.490
V -0.043 V -0.084

0800 SOD CHK 865 1370 C Tidal
H 0.083 H 0.094
V 0.004 V -0.007

0937 EOD CHK 865 1370 C Tidal
H 0.111 H 0.135
V 0.012 V 0.012

0948 EOD CHK 0255
H 0.053 H 0.103
V -0.071 V -0.100

0950 END SURVEY JENN

JS, JB, AP

DUCK0913

9/16/13

D18 Topo 500-534

Az 70

D24 Topo 500-529

Az 70

SAND SAMPLES

D18

D24

CPE



SINCE 1956

FLT

Geosystems

8416

NORTH CAROLINA

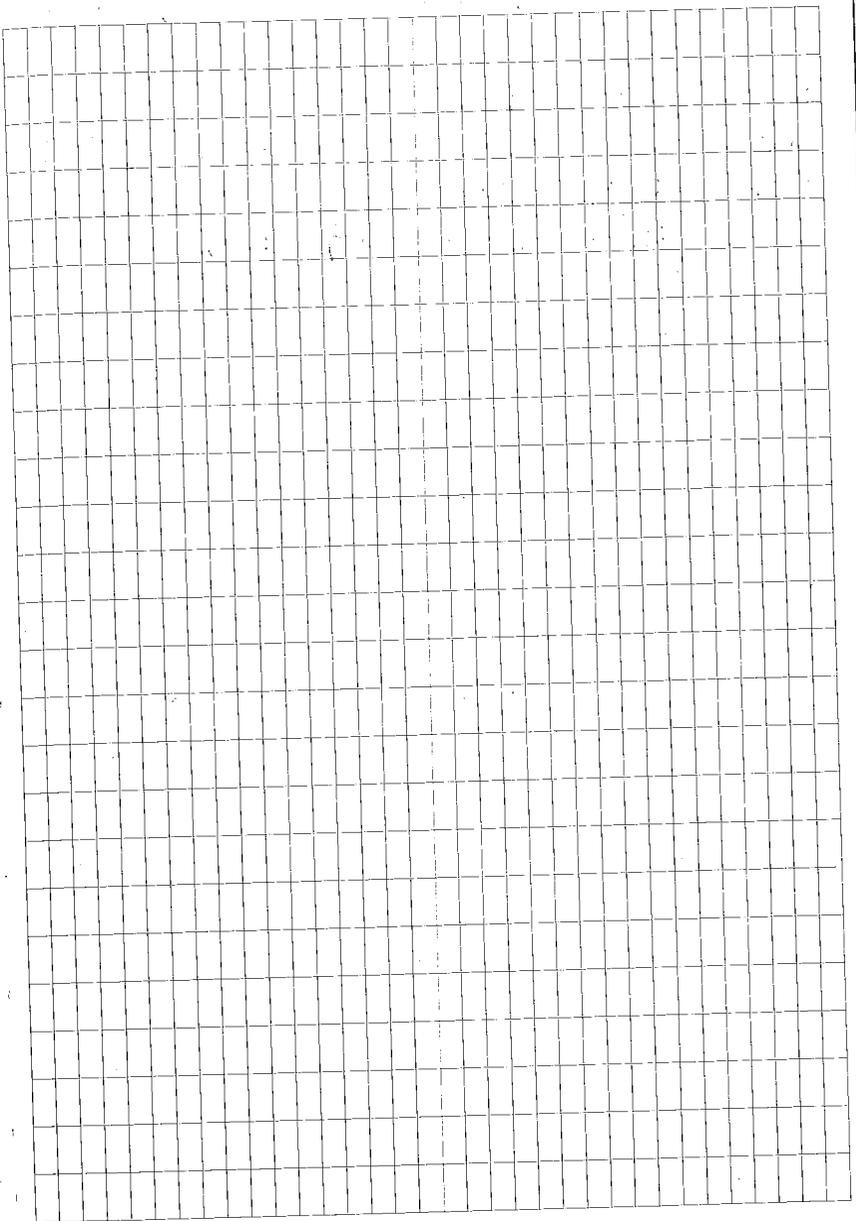
NAV41

AP, KG, BA

DUCK 0913

09/11/13

- 545 Mob @ Rental House
- 630 Arrive @ boat → test equipment
- 805 SVC 5008
- 810 Bar check 5, 10, 15, 20, 25
- 1750 SVP 3013
- 1800 Bar check 5, 10, 15, 20, 25
- 2000 Arrive back @ dock



BAKA DUCK 0913 09/11/13

LINE	TIME		EVENT		Hz
	SOL	EOC	SOL	EOC	
SS02	1100	1108	60	163	250
SS01	1114	1121	164	40	250
D34	1125	1132	39	160	250
D33	1137	1144	161	285	250
D32	1149	1156	286	410	250
D31	1201	1208	411	534	250
D30	1212	1218	535	659	250
D29	1222	1225	660	722	250
D29A	1228	1233	723	807	250
D28	1235	1243	808	931	250
D27	1245	1253	932	1058	250
D26	1257	1303	1059	1174	250
D25	1307	1314	1175	1292	250
D24	1318	1325	1293	1415	250
D19	1331	1339	1416	1544	250
D18	1342	1349	1545	1668	250
D17			1669		
D17B	1354	1401	1674	1792	250
D16	1405	1412	1793	1920	250
D15	1415	1422	1921	2042	250
D14	1425	1431	2043	2165	250
D13	1434	1441	2166	2288	250
D12	1447	1454	2289	2409	250

NAUD

PROP	RMS	SP	DTG	Comments
1.4	31	4.1	525	
1.6	25	4.5	615	
1.6	25	4.6	560	
2.0	25	4.4	580	
2.1	18	4.5	615	
2.0	14	4.5	595	
1.9	15	4.5	590	
1.4	33	4.5	2330	Hypack error
1.9	24	4.3	565	Scale NS
2.5	20	4.4	595	
2.7	20	4.5	610	
2.9	16	4.6	695	
2.2	21	4.2	655	
2.3	16	4.5	695	
2.3	16	4.5	585	
2.2	18	4.5	565	
	ODOM	GRITZ		
2.0	16	4.9	605	
1.6	20	4.6	555	
1.5	24	4.8	570	
1.8	24	4.8	600	
1.5	23	4.6	580	Scale NS
1.5	24	4.5	645	

BA169

DUCK 0913

9/11/13

LINE	TIME		EVENT		
	SOL	EOL	SOL	EOL	AL
D11	1500	1506	2410	2530	250
D10	1509	1515	2531	2649	250
D09	1521	1528	2650	2767	250
D08	1531	1539	2768	2885	250
D07	1543	1551	2886	3004	250
D06	1554	1601	3005	3125	250
D05	1607	1613	3126	3243	250
D04	1617	1623	3244	3360	250
D03	1626	1633	3361	3480	250
D02	1636	1643	3481	3598	250
D01	1646	1653	3599	3721	250
P118	1700	1705	3722	3836	250
P117	1712	1718	3837	3958	250

9

PDO P	RMS	SP	DTG	Comments
1.7	27	4.7	680	
2.1	22	4.9	685	Scale NS
1.9	24	4.8	720	
1.9	21	4.6	700	
1.8	26	5.3	700	
1.7	24	4.6	660	
1.9	30	4.7	690	
1.5	32	4.6	720	
1.7	30	4.9	720	
1.8	32	4.6	690	
1.9	27	4.7	715	
1.7	20	4.8	725	
1.8	23	5.2	670	