2024 Currituck County Data Acquisition Survey Report

Currituck County, North Carolina

Prepared for:

Coastal Protection Engineering of North Carolina, Inc.

4038 Masonboro Loop Road

Wilmington, NC 28409

Prepared by:

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243 North Front Street
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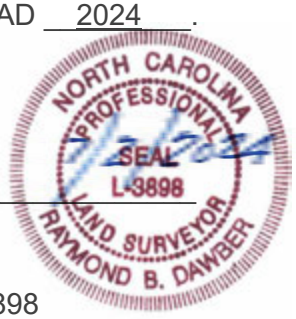
June 2024

Survey Certification

I, Raymond B Dawber NCPLS 3898, certify that this project was completed under my direct and responsible charge from an actual survey made under my supervision; meeting the requirements of the SOW, the hydrographic and topographic survey was performed at the 95% percent confidence level to meet Federal Geographic Data Committee Standards; meets the requirements for a topographic/planimetric survey to the horizontal and vertical accuracy of Class III surveys, and that the original data was obtained on 28 May 2024 through 1 June 2024; horizontal coordinates are presented in the North Carolina State Plane Coordinates (NAD83 2011) and all elevations are based on North American Vertical Datum of 1988 (NAVD88). All coordinates are ground unless specified otherwise.

THIS 2 DAY OF JULY, AD 2024.



RAYMOND B DAWBER

PROFESSIONAL LAND SURVEYOR NCPLS 3898

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General scope of work

The work under the Task Order consisted of topographic and hydrographic beach profiles collected along the entire 22.6 miles of Currituck County Atlantic Ocean Shoreline. 120 beach profiles were surveyed using a combined crew of employees of Coastal Protection Engineering of North Carolina, inc. and of McKim & Creed Inc.

Planning

On 8 May 2024 a project kickoff meeting was held between CPE and McKim & Creed to review the scope of work in detail. The McKim & Creed Field Manager held a meeting with field and office staff to discuss the scope of work for the 120 beach monitoring profiles surveys. The field team began monitoring the weather conditions at the end of May to determine the best time to mobilize to the survey area. Field work commenced on 28 May 2024, with a reconnaissance of control monuments and general mobilization activities. Survey data was collected from 28 May 2024 through 1 June 2024. All anticipated safety conditions were discussed alone with the necessary safety equipment.

The surveys were conducted to meet or exceed the Minimum Performance Standards for the U.S. Army Corps of Engineers (USACE), Engineering and Design Hydrographic Surveying Manual (EM 1110-2-1003). and also 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). The hydrographic survey was conducted under the direct supervision of an NSPS-THSOA Certified Hydrographer (CH).

Vertical data was collected in the North American Vertical Datum of 1988 (NAVD88) using Geoid 18. All Horizontal data is provided in the North Carolina State Plane Coordinate System, North American Datum (NAD) of 1983(2011).

All survey personnel adhered to the safety standards and used the necessary PPE as required for this type of project.

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 1-Control Reconnaissance/Establishment/Verification

Prior to surveying beach profiles, reconnaissance of the monuments was conducted to confirm that survey control was in place and undisturbed. Real Time Kinematic Global Positioning System (RTK GNSS) base stations were used in conjunction with the North Carolina virtual reference station (NCVRS) network to locate and confirm survey control for this project using a 3-minute observation at each monument 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). To achieve required accuracy, the surveys were controlled using 2nd order monuments, including ADRIATIC and Q261 from the National Geodetic Survey (NGS). Three-minute GNSS observations were measured on all monuments utilized and temporary benchmarks (TBM) established. Horizontal and vertical positioning checks were conducted at the beginning and end of each day using at least two control benchmarks in the project area. The control check shots were acquired using a minimum of five (5) epochs.

Phase 2-Beach Profiles

Upon completion of the control reconnaissance survey, beach/upland and nearshore operations were initiated. Profiles of the beach in the project area were surveyed using extended rod RTK GNSS rovers, and standard RTK GNSS rovers. Extended rod RTK GNSS rovers were used to augment RTK GNSS survey capability into the nearshore.

Profiles commenced from the baseline and extended seaward overlapping the nearshore/wade data. Nearshore portions of the profiles were surveyed by two (2) surveyors with an Extended Rod Trimble R8 or R10 RTK GNSS rovers. The nearshore survey extended seaward to a point overlapping the offshore portion of the profiles by at least fifty (50) feet.

Elevations were taken at a maximum of twenty-five (25) foot intervals along each profile line and at all grade breaks. The integrity of the profiles line directions used the RTK GNSS feature to remain on azimuth.

Phase 3-Nearshore/Offshore Profiles

The Nearshore/Offshore profiles were conducted along each required profile station. The profiles were obtained 2,500 feet beyond the shoreline or to the -30 NAVD88 contour, whichever is more landward. 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 200kHz with an Odom Echotrac E20 single beam echosounder, hull-mounted transducer on McKim & Creed's twenty-five (25) foot survey vessel, the S/V Cawood. To maintain the vessel navigation along the profile lines, HYPACK navigation software was used.

These soundings were reduced to 9' spacing, sufficient to provide a smooth and accurate depiction of the seafloor.

Data was digitally stored using HYPACK 2022/2023 Software. An Applanix POSMV Inertia Navigation System onboard the survey vessel provided pitch, roll, heave, and tide corrections. Bar checks were performed daily and as needed to check and calibrate the

system. Tide verifications, echosounder checks, and sound velocity results are presented in the tables presented below.

The AML sound velocity profiler was used to measure the sound velocity along the water column, with casts performed inside the project area. Bar-checks were performed from a depth of five (5) feet to a depth of at least twenty-five (25) feet. Offshore data was collected within 2 (two) days of onshore data collection for each line.

Phase 4-Data Processing/Submittals

Upon completion of the field work, data was edited using Trimble Business Center, and HYPACK 2022/2023. The upland and nearshore portions of the beach profile were viewed and edited in Trimble Business Center to provide the required comma delimited XYZ file. The raw bathymetry digital data was viewed and edited in HYPACK Single Beam Editor. The collected tide data was compared to NOAA measured water levels using NOAA Station ID: 8651370 for Duck, NC. Tide corrected offshore data was exported and included into a comma delimited XYZ file. All overlapping profile data was reviewed in the cross sections to ensure system accuracy. The edited beach profile data and offshore profile data were merged to create a representative profile for each station. The final plots were edited and reviewed with comparisons to previous years; discrepancies were noted and resolved. The profiles were developed using HYPACK C*ross-section and Volumes* software. Profiles are presented at two scales; one scale to highlight the upland/dune section of the profile and a second scale to encompass the entire length of the profile. Profiles are presented in PDF format with the digital files accompanying this report.

Map Preparation

Upon completion of the surveys and data reduction, the plan view map was prepared in Autodesk Civil 3D. Elevations are displayed in NAVD88 and were sorted for display for better visualization. NCOnemap imagery from 2020, and county GIS parcel lines were used for background reference.

Ground Digital Photography

A total of three (3) digital photos were taken at a mid-beach location at each profile line, facing North, West, and South. Additional photographs were taken as needed. Digital files are included with the deliverables in .jpeg format. Ground Photography is presented in digital format with files accompanying this report.

Control and GNSS Quality Checks

All Control Monuments provided by the client are shown in Table 1. Monuments utilized for survey control were found to be in good condition.

CURRITUCK COUNTY, NC – Control Provided by Client and Comments UNITS: US SURVEY FEET					
Station	Northing	Easting	Elevation	Comment	Station Description
ADRIATIC	974203.77	2933858.46	6.60	FOUND	GOOD CONDITION AS DESCRIBED
Q261	975483.22	2933511.61	7.14	FOUND	GOOD CONDITION AS DESCRIBED
TEETER	1033886.52	2919866.55	17.44	FOUND	GOOD CONDITION AS DESCRIBED
RUDY	934755.39	2945624.94	24.40	FOUND	GOOD CONDITION AS DESCRIBED
BELLA	1005575.66	2925821.66	27.92	FOUND	GOOD CONDITION AS DESCRIBED

TABLE 1-CONTROL PROVIDED BY CLIENT

Using RTK-, a 3-minute observation was performed on all monuments. Results of control measurements are presented in Table 2

Measured – RTK GNSS 3 min. Observation UNITS: US SURVEY FEET June 2024			
Station	Northing	Easting	Elevation
ADRIATIC	974203.85	2933858.45	6.64
Q261	975483.23	2933511.66	7.10
TEETER	1033886.50	2919866.57	17.37
RUDY	934755.39	2945625.04	24.29
BELLA	1005575.66	2925821.59	28.05
TBM	1033851.90	2919880.69	18.90
TBM-2	1000801.72	2927151.54	25.62
TBM-3	948018.18	2941241.52	24.85

TABLE 2-3-MINUTE GNSS OBSERVATIONS

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The provided control data was compared to the measurements from the surveyed 3-minute observations, the variations (delta values) are presented in Table 3.

Variations from Client Provided Control to RTK GNNS Measured			
Station	Deta Northing	Delta Easting	Delta Elevation
ADRIATIC	-0.08	0.01	-0.04
Q261	-0.01	-0.05	0.04
TEETER	0.02`	-0.02	0.07
RUDY	-0.01	-0.09	0.11
BELLA	0.01	0.07	-0.13

TABLE 3-VARIATIONS FROM PROVIDED CONTROL TO RTK GNNS MEASUREMENTS

Control checks were performed at the beginning and end of each survey day. Measurements are compared to the client provided control or results from an average of the 3-minute observations performed on TBMS. Inverses are presented in table 4 and table 5

TRIMBLE R8 UNIT	CONTROL POINT	Δ Horizontal (US Survey feet)	Δ Vertical (US Survey feet)
5/29/2024 Beginning of Day	Q161	0.097	0.1005
5/29/2024 End of Day	Q261	0.035	0.0105
5/30/2024 Beginning of Day	BELLA	0.016	-0.0525
5/30/2024 End of Day	BELLA	0.029	-0.051
5/31/24 Beginning of Day	Q261	0.043	0.058
5/31/2024 End of Day	Q261	0.065	0.025
6/1/2024 Beginning of Day	TBM3	0.1075	0.1075

TABLE 4-RESULTS OF DAILY CONTROL CHECKS

TRIMBLE R10 UNIT	CONTROL POINT	Δ Horizontal (US Survey feet)	Δ Vertical (US Survey feet)
5/29/2024 Beginning of Day	Teeter	0.035	0.15
5/29/2024 End of Day	TBM	0.045	0.125
5/30/2024 Beginning of Day	BELLA	0.02	0.05
5/30/2024 End of Day	TBM	0.059	-0.262
5/31/2024 Beginning of Day	Q261	0.043	0.058
5/31/2024 End of Day	Q261	0.065	0.025
5/31/2024 Beginning of Day	ADRIATIC	0.012	0.047
5/31/2024 End of Day	RUDY	0.094	0.111
6/1/2024 Beginning of Day	TBM3	0.152	-0.005

TABLE 5-RESULTS OF DAILY CONTROL CHECKS

VESSEL CALIBRATIONS

The Survey Vessel Cawood (a 25' Safe Boat) was used for this survey. Offsets were measured and calculated on May 28, 2024.

Daily vessel calibration verifications were performed in the survey area with values presented in table 6, table 7, and table 8.

Date Tide Checks	Trimble R8s (in elevation-Feet)	Vessel System/Hypack (Tidal CorrectionFeet)
05/29/2024	-1.27	1.29
05/30/2024	-1.00	0.99
06/01/2023	-0.74	0.80

TABLE 6-DAILY TIDE CHECKS

Date Depth Checks (in feet)	Rod Reading (Feet)	Vessel Echosounder (Feet)
05/29/2024	6.95	6.92
05/30/2024	6.90	6.85
06/01/2023	7.00	6.96

TABLE 7-DAILY ROD READINGS

Date	Average Sound Velocity (in feet/second)
05/29/2024	4961
05/30/2024	4954
06/01/2023	4961

TABLE 8-AVERAGE SPEED OF SOUND

List of Equipment Used

Below is a summary list of equipment utilized for the survey for data collection, processing, and deliverables.

- 25' Safe Boat Survey Vessel "Cawood"
- Teledyne ECHOTRAC E20 transducer 200 kHz
- Applanix Pos-MV Inertia Navigation System I2NS
- Sound Velocity Profiler AML CTD Base X Profiler
- Hypack 2023 for hydrographic data collection and processing (23.2.2.0)
- Trimble R8 GNSS Receivers/ TSC3 data collectors Trimble Access (20.00.2.12
- Trimble R10 GNSS Receivers/ TSC5 data collectors
- Trimble Business Center (2023.11)
- AutoCAD Civil 3D 2022 (13.4.214.0)
- ESRI ArcMap (10.8.2)