

# Appendix I

Sample of a bench mark datasheet obtained from the Center for Operational Oceanographic Products and Services (CO-OPS) web site for Atlantic Beach, North Carolina. Note that the location of the station (Atlantic Ocean) is listed as part of the station name. The latitude and longitude of the station are given, and the tidal bench marks for the site are listed along with descriptions of their respective locations. Many of the bench marks are linked to National Geodetic Survey (NGS) datasheets by their Permanent Identifier (PID#.) (See Appendix II for a sample NGS datasheet).

Tidal datum and bench mark elevation information are listed on "page 4 of 5" of this Appendix. The Length of Series (the total number of months or years used in the computation of the tidal datums) is listed, along with the Time Period of station operation, Tidal Epoch, and Control Tide Station. Not all of the data collected during the Time Period is necessarily used in the calculation of the tidal datums (S. Lyles, NOAA, pers. comm). Tidal datum elevations and the elevation of the fixed vertical datum, NGVD 29, are referenced to Mean Lower Low Water. Tidal bench mark elevations above MLLW and MHW are also given. From [http://co-ops.nos.noaa.gov/benchmarks/benchmarks\\_old/8656590.html](http://co-ops.nos.noaa.gov/benchmarks/benchmarks_old/8656590.html).

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Station ID: 8656590 PUBLICATION DATE: 06/06/1990  
Name: ATLANTIC BEACH, ATLANTIC OCEAN  
NORTH CAROLINA  
NOAA Chart: 11547 Latitude: 34° 41.6' N  
USGS Quad: BEAUFORT Longitude: 76° 42.7' W

To reach the tidal bench marks from the Atlantic Beach Post Office, proceed south on Morehead Avenue for 0.3 mile (0.5 km) to Fort Macon Boulevard, then east on Fort Macon Boulevard for 1.6 miles (2.6 km) to Henderson Boulevard, turn right onto Henderson Boulevard and go south for 0.2 mile (0.3 km) to Triple S Fishing Pier. The bench marks are near the pier and along Henderson Boulevard. The tide gage and electric tape gage were about 750 feet (229 m) south of the inshore end of pier.

T I D A L B E N C H M A R K S

PRIMARY BENCH MARK STAMPING: 6590 B 1976

MONUMENTATION: Survey Disk VM#: 3564  
AGENCY: PID#: AC7539  
SETTING CLASSIFICATION: Copper-clad Steel Rod

The bench mark is at the SW corner of Henderson Boulevard and Raleigh Road, 34.0 feet (10.4 m) west of the centerline of Henderson Boulevard, 26.0 feet (7.9 m) south of the centerline of Raleigh Road, and 1.4 feet (0.4 m) north of a wooden street marker. The bench mark is crimped to a copper-clad steel rod driven an unspecified depth, and surrounded by concrete.

BENCH MARK STAMPING: NO 4 1960

MONUMENTATION: Survey Disk VM#: 3561  
AGENCY: PID#: EA0180  
SETTING CLASSIFICATION: Concrete Apron

The bench mark is set in the concrete apron surrounding the Triple S Pier snack bar building, 33.5 feet (10.2 m) west of the extended centerline of Henderson Boulevard, 31.0 feet (9.4 m) east of the NW corner of the attached garage, and 0.4 foot (0.1 m) north of the building.

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BENCH MARK STAMPING: NO 5 1960

MONUMENTATION: Survey Disk VM#: 3562  
AGENCY: PID#: EA0179  
SETTING CLASSIFICATION: Concrete Slab

The bench mark is on the east side of Henderson Boulevard, 550 feet (168 m) north of Triple S Pier, 81 feet (25 m) south of the centerline of Raleigh Avenue, 49.4 feet (15.1 m) east of the centerline of Henderson Boulevard, 1 foot (0.3 m) west of a pink cinder block building, and 0.3 foot (0.1 m) below the surface of the patio.

BENCH MARK STAMPING: NO 6 1960

MONUMENTATION: Survey Disk VM#: 3563  
AGENCY: PID#: EA0177  
SETTING CLASSIFICATION: Concrete Slab

The bench mark is set in a concrete slab beneath a second story overhang on the east side of Henderson Boulevard, 0.15 mile (0.24 km) north of Triple S Pier, 113 feet (34 m) south of the centerline of Winston Avenue, and 46 feet (14 m) east of the centerline of Henderson Boulevard.

BENCH MARK STAMPING: 6590 C 1976

MONUMENTATION: Survey Disk VM#: 3565  
AGENCY: PID#: AC7488  
SETTING CLASSIFICATION: Copper-clad Steel Rod

The bench mark is on the west side of Henderson Boulevard between Fort Macon and Raleigh Roads, 32.5 feet (9.9 m) west of the centerline of Henderson Boulevard, 24.4 feet (7.4 m) south of an east-west tar and gravel road, and 1.3 feet (0.4 m) east of a wooden street marker. The bench mark is crimped to a copper-clad steel rod driven 45 feet (14 m), and surrounded by concrete.

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T I D A L B E N C H M A R K S

BENCH MARK STAMPING: 6590 D 1976

MONUMENTATION: Survey Disk VM#: 3566  
AGENCY: PID#: AC7538  
SETTING CLASSIFICATION: Copper-clad Steel Rod

The bench mark is at the SE intersection of Henderson Boulevard and Fort Macon Road, 49.6 feet (15.1 m) south of the centerline of Fort Macon Road, 32.3 feet (9.8 m) east of the centerline of Henderson Boulevard, and 10.5 feet (3.2 m) NW of the NW corner of a building. The bench mark is crimped to a copper-clad steel rod driven 35 feet (11 m), and surrounded by concrete.

BENCH MARK STAMPING: 6590 E 1981

MONUMENTATION: Survey Disk VM#: 3567  
AGENCY: PID:  
SETTING CLASSIFICATION: Concrete Sea Wall

The bench mark is set flush in a concrete sea wall near the Triple S Marina at the north end of Henderson Boulevard, 62.9 feet (19.2 m) NE of the centerline of the road leading around the west side of the marina, 39.0 feet (11.9 m) west of the center of the fuel dock, and 6.1 feet (1.9 m) north of the NW corner of the addition to the store.

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T I D A L D A T U M S

Tidal datums at ATLANTIC BEACH, ATLANTIC OCEAN based on:

LENGTH OF SERIES: 14 MONTHS  
TIME PERIOD: APRIL 1982-NOVEMBER 1983  
TIDAL EPOCH: 1960-1978  
CONTROL TIDE STATION: 8656483 BEAUFORT

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in FEET:

HIGHEST OBSERVED WATER LEVEL (11/13/1981) = 6.84  
MEAN HIGHER HIGH WATER (MHHW) = 4.28  
MEAN HIGH WATER (MHW) = 3.96  
MEAN TIDE LEVEL (MTL) = 2.10  
\* NATIONAL GEODETIC VERTICAL DATUM-1929 (NGVD) = 1.75  
MEAN LOW WATER (MLW) = 0.25  
MEAN LOWER LOW WATER (MLLW) = 0.00  
LOWEST OBSERVED WATER LEVEL (01/14/1982) = -2.11

\* NGVD reference based on elevations published in Quad 340764, 1964, and NOS leveling of 1985.

Bench Mark Elevation Information	In FEET above:	
	MLLW	MHW
Stamping or Designation		
6590 B 1976	12.06	8.10
NO 4 1960	13.66	9.70
NO 5 1960	12.88	8.92
NO 6 1960	15.74	11.78
6590 C 1976	13.48	9.52
6590 D 1976	8.58	4.62
6590 E 1981	6.99	3.03

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D E F I N I T I O N S

Mean Sea Level (MSL) is a tidal datum determined over a 19-year National Tidal Datum Epoch. It pertains to local mean sea level and should not be confused with the fixed datums of North American Vertical Datum of 1988 (NAVD 88).

NGVD 29 is a fixed datum adopted as a national standard geodetic reference for heights but is now considered superseded. NGVD 29 is sometimes referred to as Sea Level Datum of 1929 or as Mean Sea Level on some early issues of Geological Survey Topographic Quads. NGVD 29 was originally derived from a general adjustment of the first-order leveling networks of the U.S. and Canada after holding mean sea level observed at 26 long term tide stations as fixed. Numerous local and wide-spread adjustments have been made since establishment in 1929. Bench mark elevations relative to NGVD 29 are available from the National Geodetic Survey (NGS) data base via the World Wide Web at National Geodetic Survey.

NAVD 88 is a fixed datum derived from a simultaneous, least squares, minimum constraint adjustment of Canadian/Mexican/United States leveling observations. Local mean sea level observed at Father Point/Rimouski, Canada was held fixed as the single initial constraint. NAVD 88 replaces NGVD 29 as the national standard geodetic reference for heights. Bench mark elevations relative to NAVD 88 are available from NGS through the World Wide Web at National Geodetic Survey.

NGVD 29 and NAVD 88 are fixed geodetic datums whose elevation relationships to local MSL and other tidal datums may not be consistent from one location to another.

The Vertical Mark Number (VM#) and PID# shown on the bench mark sheet are unique identifiers for bench marks in the tidal and geodetic databases, respectively. Each bench mark in either database has a single, unique VM# and/or PID# assigned. Where both VM# and PID# are indicated, both tidal and geodetic elevations are available for the bench mark listed.

The NAVD 88 elevation is shown on the Elevations of Tidal Datums Table Referred to MLLW only when two or more of the bench marks listed have NAVD 88 elevations. The NAVD 88 elevation relationship shown in the table is derived from an average of several bench mark elevations relative to tide station datum. As a result of this averaging, NAVD 88 bench mark elevations computed indirectly from the tidal datums elevation table may differ slightly from NAVD 88 elevations listed for each bench mark in the NGS database.