

STATE OF DELAWARE
UNIVERSITY OF DELAWARE
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A GUIDE TO INFORMATION ON
BENCHMARKS IN DELAWARE

BY

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A Guide to Information on Benchmarks in Delaware by William S. Schenck (March 1982).

Page 2, 3rd paragraph

The DCSP benchmarks were established by the U. S. Army Corps of Engineers for the State of Delaware.

Page 6, Appendix A

The National Geodetic Survey Information Center telephone number is:

(301) 443-8631

A GUIDE TO INFORMATION ON BENCHMARKS IN DELAWARE

William S. Schenck

INTRODUCTION

To conduct an elevation survey, a surveyor needs a starting point for which the exact elevation above mean sea level is known. These starting points are called benchmarks.

State and federal agencies install benchmarks throughout every State, creating a network of elevation points which covers the entire continental United States. These benchmarks are considered to be permanent, and usually consist of a brass, bronze, or aluminum disc about 4 inches in diameter mounted in a cement post or in a drill hole in a permanent foundation. Each benchmark also has the installing agency's name and an identification number stamped into it.

In December of 1980 the Federal Emergency Management Agency (FEMA) allotted the State of Delaware funds to determine the number and condition of federal benchmarks and other elevation reference control points. The National Flood Insurance Program (NFIP), contained within FEMA, requires accurate flood surveys of property in flood-prone areas. An extensive and accurate benchmark network throughout the State is needed to help meet these needs.

Agencies Establishing Benchmarks in Delaware

Although several agencies have installed benchmarks in Delaware, the most extensive network was established by the National Geodetic Survey (NGS). The NGS is a branch of the National Ocean Survey (NOS) which is within the Commerce Department's National Oceanographic and Atmospheric Administration (NOAA). Although the NGS (and its predecessor, The Coast and Geodetic Survey) has been establishing benchmarks since 1877, only those dating from 1931 to the present are

kept on file for Delaware. These benchmarks are part of a nationwide vertical control network consisting of about 500,000 benchmarks that provide the basis for all elevations utilized in mapping, surveying, and engineering/construction projects in the United States. These benchmarks are based on the National Geodetic Vertical Datum of 1929 (NGVD, 1929), formerly known as Mean Sea Level.

The U. S. Geological Survey (USGS) is the second major source of vertical leveling data in Delaware. USGS benchmarks are concentrated in Sussex and northwestern New Castle counties because of mapping projects done in those areas. USGS benchmarks on record for Delaware date from the early 1900's to the mid-1950's, the earliest being part of a plan to establish an elevation point in every town in every State. These earliest benchmarks are called isolated benchmarks and many are now missing or destroyed. USGS benchmarks are tied into the NGS benchmark network, thereby sharing the mean sea level datum.

In the 1970's a network of permanent benchmarks called Delaware Coast Storm Protection (DCSP) benchmarks was established by the State. These benchmarks extend along Delaware's coast from Cape Henlopen to Fenwick Island and are also tied into the NGS network.

FEMA has elevation reference marks in every town participating in the National Flood Insurance Program (NFIP). These reference marks are either actual monumented benchmarks belonging to one of the aforementioned agencies or chiseled marks with assigned elevations surveyed in from a NGS benchmark.

Finally, there are many permanent and temporary benchmarks that belong to other agencies and to land surveying companies in Delaware that are either not expected to last longer than the construction of the project with which they are concerned or are regarded as proprietary information and not available to the public.

Addresses of federal and State agencies which have benchmarks in Delaware are given in Appendix A at the end of this report.

Published Information on Benchmarks

Federal benchmarks are usually installed along roads or railroads so that they may be located and accessed easily. As they are being installed, precise notes concerning their locations are kept. These notes are reworded as descriptions and published under the heading of vertical control data. The NGS and the USGS have divided the State into quadrants, each having vertical control data for the benchmarks contained within each quadrant. These data can be ordered from either agency (see Appendix A for addresses).

FEMA has Flood Insurance Rate Maps for every town in Delaware participating in the NFIP. These maps have elevation reference marks printed on them along with the location description for each one. The maps are available from FEMA or the FEMA representative in Dover (see Appendix A for addresses).

The State, through the Department of Natural Resources and Environmental Control (DNREC), has written, unpublished descriptions for the location of the coastal benchmarks. These descriptions, along with the information on the federal agency's benchmarks, will be included in the benchmark repository now being created at the Delaware Geological Survey (DGS).

Delaware Geological Survey Benchmark Repository Plans

During the summer of 1981, the author conducted an inventory to determine the condition of the federal (NGS and USGS) vertical benchmarks in the State. An inventory of the DCSP benchmarks was conducted during the spring of 1982. A statistical summary of the federal benchmark inventory is given in Appendix B.

The DGS, under contract to the DNREC and FEMA, will become a repository for benchmark information in the State by the fall of 1982. The central repository will consist of a set of base maps in microfisch and a computer-based data retrieval program that will be available at the DGS offices at the University of Delaware.

The locations of all existing and usable vertical benchmarks in the State have been located on mylar base maps. These (plus corresponding vertical control data) will be microfished and distributed to the major libraries throughout the State. This will give people in all three

counties access to the data available in Delaware. It will also be possible to purchase microfisch copies of these data directly from the State Archives.

The computer program will serve as a means of storing the location descriptions, elevation and current status of the benchmarks. Using this in conjunction with a microfisch reader/printer, a map of an area, and a printout of location and relevant information for the benchmarks in that area may be obtained.

At the present time the DGS can answer questions concerning the location and condition of the vertical benchmarks associated with the agencies mentioned in this report.

REFERENCES

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- Rapple, Howard, S., 1979, Manual of geodetic leveling: U. S. Dept. of Commerce, Special Publication No. 239, 94 p.
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- Whalen, C. T. and Balazs, E., 1977, Test results of first order class III leveling: National Geodetic Survey, 28 p.
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APPENDIX A

AGENCY ADDRESSES

FEDERAL AGENCIES

National Geodetic Survey

The Director
National Geodetic Survey
National Geodetic Information Center, C185
Rockville, Maryland 20852
Phone: (301)433-8531

U. S. Geological Survey

NCIC-Eastern
536 National Center
Reston, Virginia 22092
Phone: (703)860-6336

U. S. Army Corps of Engineers

Survey Division
U. S. Customs House
2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106
Phone: (215)597-4746

Federal Emergency Management Agency

FEMA Region 3
Curtis Building
6th and Walnut Streets
Philadelphia, Pennsylvania 19106
Phone: (215)597-9581

STATE AGENCIES

Department of Natural Resources and Environmental Control

DNREC
Division of Soil and Water Conservation
Beach Preservation Branch
P.O. Box 1401
Dover, Delaware 19901
Phone: (302)736-4411

STATE AGENCIES (continued)

Delaware Geological Survey

Delaware Geological Survey
University of Delaware
Newark, Delaware 19711
Attn: W. S. Schenck
Phone: (302)738-2833

FEMA Flood Insurance Contact Person in Delaware

Lee Emmons
Division of Soil and Water Conservation
P.O. Box 1401
Dover, Delaware 19901
Phone: (302)736-4411

APPENDIX B

DEFINITION OF TERMS USED ON NGS/USGS
BENCHMARK INVENTORY RESULT SHEETS
FOR 1981 INVENTORY

During April through September of 1981 an inventory of the federal (NGS and USGS) benchmarks was completed. The following pages show the results statewide and by county. A maximum of 20 minutes was spent searching for each monument; most were found in that amount of time. The terms for describing the condition of the benchmarks are defined:

- NOT FOUND - these were not found after a 20-minute, thorough search.
- DESTROYED - evidence of the destruction present at the benchmark location.
- DAMAGED - signs of movement or mutilation by natural causes or by man. They should not be used because their elevations are no longer credible.
- USABLE - found in good condition.
- UNUSABLE - term used in the inventory for benchmarks defined as not found, destroyed, and/or damaged.

Appendix B (continued)

Inventory of Benchmarks

	<u>NGS</u>	<u>STATE</u>	<u>USGS</u>
NOT FOUND	264 (30%)	NOT FOUND	66 (32%)
DESTROYED	163 (19%)	DESTROYED	90 (43%)
DAMAGED	22 (3%)	DAMAGED	5 (2%)
FOUND USABLE	417 (48%)	FOUND USABLE	49 (23%)
TOTAL	<u>866 (100%)</u>	TOTAL	<u>210 (100%)</u>

NGS/USGS

NOT FOUND	330 (31%)
DESTROYED	253 (34%)
DAMAGED	27 (2%)
FOUND USABLE	466 (43%)
TOTAL	<u>1,076 (100%)</u>

NGS - 52% are unusable, 48% are usable.

USGS - 77% are unusable, 23% are usable.

NGS/USGS for State - 57% of all vertical federal benchmarks are unusable and 43% are usable.

Appendix B (continued)

NEW CASTLE COUNTY

	<u>NGS</u>		<u>USGS</u>
NOT FOUND	110 (30%)	NOT FOUND	10 (20%)
DESTROYED	72 (20%)	DESTROYED	25 (51%)
DAMAGED	5 (1%)	DAMAGED	1 (2%)
FOUND USABLE	176 (49%)	FOUND USABLE	13 (27%)
TOTAL	<u>363 (100%)</u>	TOTAL	<u>49 (100%)</u>

NGS/USGS

NOT FOUND	120 (29%)
DESTROYED	97 (24%)
DAMAGED	6 (1%)
FOUND USABLE	189 (46%)
TOTAL	<u>412 (100%)</u>

NGS - 51% unusable, 49% usable.

USGS - 73% unusable, 47% usable.

NGS/USGS for County - 54% unusable, 46% usable.

Appendix B (continued)

KENT COUNTY

	<u>NGS</u>		<u>USGS</u>
NOT FOUND	53 (25%)	NOT FOUND	22 (32%)
DESTROYED	51 (25%)	DESTROYED	32 (47%)
DAMAGED	6 (3%)	DAMAGED	2 (3%)
FOUND USABLE	97 (47%)	FOUND USABLE	12 (18%)
TOTAL	<u>207 (100%)</u>	TOTAL	<u>68 (100%)</u>

NGS/USGS

NOT FOUND	75 (27%)
DESTROYED	83 (30%)
DAMAGED	8 (3%)
FOUND USABLE	109 (40%)
TOTAL	<u>275 (100%)</u>

NGS - 53% unusable, 47% usable.

USGS - 82% unusable, 17% usable.

NGS/USGS for County - 60% unusable, 40% usable.

Appendix B (continued)

SUSSEX COUNTY

	<u>NGS</u>		<u>USGS</u>
NOT FOUND	101 (34%)	NOT FOUND	34 (37%)
DESTROYED	40 (14%)	DESTROYED	33 (35%)
DAMAGED	11 (4%)	DAMAGED	2 (2%)
FOUND USABLE	144 (48%)	FOUND USABLE	24 (26%)

NGS/USGS

NOT FOUND	135 (35%)
DESTROYED	73 (19%)
DAMAGED	13 (3%)
FOUND USABLE	168 (43%)
TOTAL	<u>389 (100%)</u>

NGS - 51% unusable, 49% usable.

USGS - 74% unusable, 26% usable.

NGS/USGS for County - 56% unusable, 44% usable.