



# SIGNIFICANCE OF SURVEY BENCHMARKS

The State Water Commission (SWC) and Office of the State Engineer (OSE) have employed a Survey Crew since 1937. The survey crew collects survey data statewide for a variety of purposes. The various types of data collection include ground water monitoring site locations, bathymetry, dam surveys, surface water and staff gage monitoring, river cross sections for hydraulic models, border monument surveys, historic monument surveys, and benchmark locations.

The agency is responsible for the preservation and dissemination of official government survey plats (GLOs) and notes for the State of North Dakota. Many of these documents are as old, or older, than the state itself, dating back to the late 1800s through the early 1900s. Collecting new survey data and sustaining historical data is an essential and useful service that is provided by the Water Commission.

“We cannot move forward without understanding how we formerly arrived at this point,” said SWC Survey Crew Chief Dan McDonald. “Using historical data, benchmarks, and retracing the original surveys, allows us to literally walk in the footsteps of those who came before us.”

The survey crew is also responsible for elevation surveying services. This includes working with benchmarks. Benchmarks refer to a stable object containing a marked point of known elevation with respect to datum which provides surveyors with a point of reference.

There are four different types of benchmarks available in surveying: Great Trigonometrical Survey benchmarks, permanent benchmarks, temporary benchmarks, and arbitrary benchmarks.

Former survey crew member Tom Banse and SWC Crew Chief Dan McDonald at border monument 1 near the Red River.



The Great Trigonometrical Survey, started in 1802, was a benchmark project that aimed to measure the entire Indian subcontinent with scientific precision. Permanent benchmarks are readily identifiable, relatively permanent, recoverable benchmarks that are intended to maintain its elevation without change over a long period of time. A temporary benchmark is a fixed point with a known elevation used for level control during construction works and surveys. Arbitrary benchmarks are generally assumed to be equal to 100 meters and are commonly practiced by engineering students.

The Water Commission's purpose related to benchmark surveys is defined as, "The monumentation and observation of State Engineer benchmarks; dissemination of government survey data to the public; and observation and control of survey benchmarks for the benefit of the Office of the State Engineer, the State Water Commission, National Geodetic Survey, various other government entities, and the public."

"Historically, there has been such a vast and monumentally large-scale effort to set all elevations from coast to coast," stated McDonald. "By utilizing that data, continuing to survey, and preserving these benchmarks, we are ensuring that residents, communities, and public entities will have access to this invaluable information for generations to come."

A survey benchmark generally looks like a brass or metal disk in the ground that provides latitude, longitude, or orthometric height. They indicate the height above or below sea level at that location. All construction and development needs elevation and location data, making benchmarks

extremely beneficial and valuable. Since 1963, the Water Commission has surveyed or installed over 920 benchmarks across North Dakota and has also surveyed several border monuments as well.

In 2018, SWC survey crew members Tom Banse, Dan McDonald, and James Ternes were honored for their efforts in conducting Online Positioning User Service (OPUS) observations during that field season. These observations were priority benchmark locations identified by the National Geodetic Survey to improve the accuracy and geographic coverage of GEOID18. This information will also contribute towards the creation of the North American-Pacific Geopotential Datum of 2022, which will replace the North American Vertical Datum of 1988. Each OPUS shot requires a benchmark observation of at least four hours in duration. Since 2016, the Water Commission survey crew has conducted over 200 OPUS observations and is the top contributor in the State of North Dakota.

State Engineer Garland Erbele noted, "The immense efforts and dedication by the Water Commission's survey crew will benefit the public for many years and has ensured that GPS in North Dakota is more accurate."

Survey data can be accessed through the agency's interactive mapping service at <http://survey.swc.nd.gov/>. For further information and questions, please contact the SWC's Survey Crew Chief, Dan McDonald, or GIS Coordinator, Rod Bassler, at [swcsurvey@nd.gov](mailto:swcsurvey@nd.gov).



An example of a permanent benchmark.