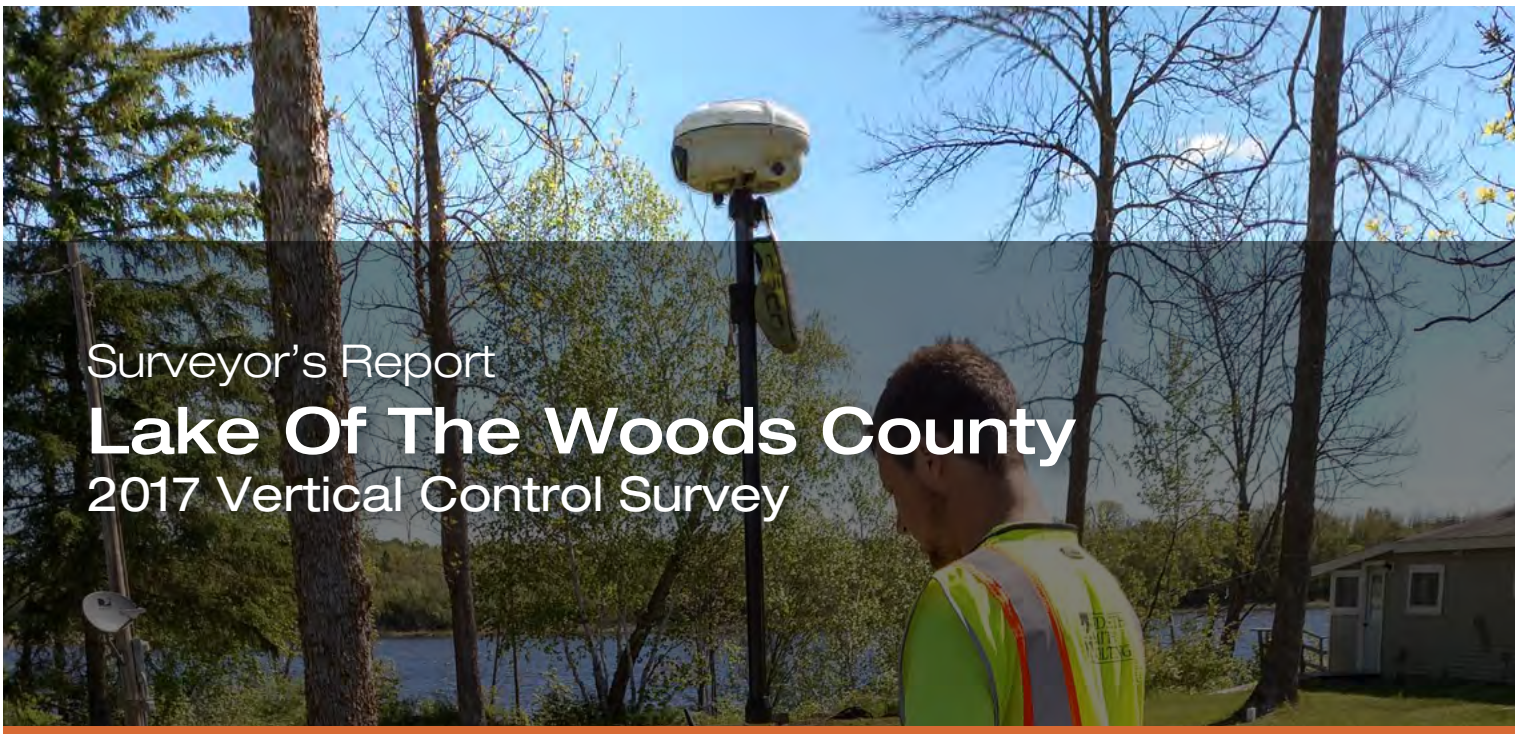


Surveyor's Report

Lake Of The Woods County

2017 Vertical Control Survey

WIDSETH SMITH NOLTING

Engineering | Architecture
Surveying | Environmental

LAKE OF THE WOODS COUNTY
MINNESOTA

2017 LAKE OF THE WOODS BENCHMARK SURVEY REPORT

In 2017 the Lake of the Woods County Survey Department and Land and Water Planning Department, in conjunction with the Soil and Water Conservation District determined that the County's existing vertical control network that was established to monitor water levels along the south shore of Lake of the Woods was no longer adequate to meet the needs of the various users of this system. After several meetings and discussions, the County Board of Commissioners authorized the Lake of the Woods County Survey Department to re-survey, update and expand this network. The following report outlines the historical background of the controlled water levels of Lake of the Woods as established by the United States and the Dominion of Canada as well as the vertical control points used to monitor these water levels along the south shore of Lake of the Woods. This report includes the requirements, procedures and results of the survey.

HISTORICAL BACKGROUND

1906-1907

The United States Coast and Geodetic Survey (USC&GS) conducted a "spirit leveling" survey in northern Minnesota. This survey commenced in Crookston, Minnesota at the USC&GS benchmark "CITY" and proceeded to and through the Minnesota cities of Middle River, Greenbush, Badger, Roseau, Warroad, Baudette and ended in International Falls, Minnesota. Precise benchmarks were established all along this route.

1914

R. B. Marshall, Chief Geographer for the United States Geological Survey published a report titled "Results of Spirit Leveling in Minnesota, 1897 to 1914, Inclusive". This report, which included the 1906-1907 survey from Crookston to International Falls, contained descriptions of the surveys and a list of the benchmarks and elevations. All elevations were based on the precise-level net adjustment of 1912 by the USC&GS.

1916

Adolph F. Meyer and Arthur V. White, consulting engineers, prepared a report titled "Report to International Joint Commission Relating to Official Reference RE Lake of the Woods Levels". This report included a detailed analysis of the Lake of the Woods water levels. Also included was a description of the 1906-1907 leveling survey along with the locations and elevations of the benchmarks established during the survey.

The report details a benchmark that was established in the City of Warroad, Minnesota that was to be hereinafter referred to as the "International Joint Commission Benchmark at Warroad". Following is the description given for this benchmark: "Top of copper plug in concrete block, carried below frost line, and located near fence, in front of and to the west of new school house. Established October 3rd, 1912. Elevation, sea Level Datum,

1068.797." The elevation for this benchmark was established in 1912 by running precise levels from B.M. 303, which was established during the USC&GS 1906-1907 survey.

1925

In 1925 the Dominion of Canada and the United States of America entered into an agreement for regulating the level of Lake of the Woods upon recommendations made by the International Joint Commission (IJC) based on Meyer's and White's 1916 report. The articles of this agreement are outlined in the 1925 "CONVENTION AND PROTOCOL" signed by the governments of Canada and the United States.

According to Article 1 of this agreement the lake levels were to be controlled by the benchmark established by the International Joint Commission in 1912 in the Town of Warroad, Minnesota. The article states that this benchmark was established on the 1912 "sea-level datum", the elevation datum adopted by the IJC for Lake of the Woods.

According to Article 4 of this agreement the level of Lake of the Woods shall ordinarily be maintained between elevations 1056 and 1061.25 feet based on the 1912 sea level datum with 1061.25 feet being established as the ordinary high level for Lake of the Woods.

According to Article 8 of this agreement a flowage easement up to elevation 1064, based on the 1912 sea level datum, was established on that portion of Lake of the Woods falling within the United States and the United States assumes all liability to the owners of such lands for the cost of such easement.

1979

In 1979 there was an exchange of correspondence between the American Ambassador to Canada and the Canadian Secretary of State for External Affairs. According to this correspondence it was noted that the 1912 IJC benchmark at Warroad, Minnesota was no longer in existence. An agreement was reached between the governments of Canada and the United States that the USC&GS Benchmark C-209 established in 1935 in Warroad would be designated to replace the old IJC benchmark. The elevation for C-209 was not noted in this report.

The US Geological Survey provided information on correspondence from 1978-1979 between the Water Survey of Canada and the US Army Corps of Engineers indicating a conversion of -0.58 foot was being used at benchmark C-209 in Warroad to convert from the 1912 datum to the 1929 datum but did not confirm how this conversion was derived. This correspondence also indicated that this conversion should continue to be used unless a change can be verified.

1997

The Lake of the Woods County Survey Department established 7 new benchmarks in Lake of the Woods County along the south shore of Lake of the Woods. A report on this survey which included the location and elevations of the benchmarks on the National

Geodetic Vertical Datum of 1929 (NGVD 29) was published. In 2003 and 2004 these benchmarks were re-visited and the report was updated. The elevations derived for these benchmarks were based on several vertical control marks listed in the Minnesota Department of Transportation (MNDOT) geodetic database and the National Geodetic Survey (NGS) database. Static GPS observations were used to establish the elevations on these benchmarks.

SURVEY REQUIREMENTS

In order to monitor the levels of Lake of the Woods and determine elevations relative to the established Ordinary High Water Line and flood elevations along Lake of the Woods and the Rainy River in Lake of the Woods County, it is necessary to have accurate vertical control benchmarks near the lake at strategic locations.

Since the lake levels are controlled by the 1925 CONVENTION AND PROTOCOL, the vertical datum for the lake elevations as published in this international agreement is the 1912 sea-level datum. The elevation for the current designated controlling benchmark C-209 in the MNDOT and NGS databases is only published on the North American Vertical Datum of 1988 (NAVD 88) and the NGVD 29 datum. No published elevation for this benchmark on the 1912 sea-level datum could be found.

Some of the benchmarks established in 1997 in Lake of the Woods County are in need of repair and two of them have since been destroyed. The elevations for these benchmarks were established by static GPS observations based on existing vertical control points listed in the Minnesota Department of Transportation's (MNDOT) geodetic control point database. The elevations were collected on the NAVD 88 datum and converted to the NGVD 29 datum as outlined in the 1997 Surveyor's Report. These benchmarks are located along the south shore of Lake of Woods in Lake of the Woods County. The 1997 survey did not establish any new benchmarks along the Rainy River.

There are currently three vertical datums being used in the vicinity of Lake of the Woods but none of the existing MNDOT and NGS vertical control point data sheets list all three datums. There has been some confusion as to which elevation and datum that has been or should be used for different projects in the area. Many of the existing vertical control points listed in the MNDOT and NGS databases have published elevations on the NAVD 88 and NGVD 29 datums. There is a program for converting elevations from the NGVD 29 datum to the NAVD 88 datum called VERTCON which makes the appropriate adjustment between these two datums. None of the MNDOT and NGS data sheets listing the NAVD 88 and NGVD 29 datums list the 1912 sea-level elevation and there is no uniform conversion to this old datum that was used in Minnesota.

In order to more accurately and consistently monitor the lake levels and avoid confusion between the various vertical datums it was determined that Lake of the Woods County's benchmark system needed to be updated and expanded and that this system should include a series of benchmarks near the shore of Lake of the Woods and the Rainy River at strategic locations in the more developed areas of the county. It was also

determined that the elevations for these benchmarks should be published in all three vertical datums (1912, 1929 and 1988). Since the 1925 CONVENTION AND PROTOCOL established the 1912 sea-level datum as the controlling datum for the lake levels, the conversion between the 1912 datum and the 1929 datum needed to be confirmed.

SURVEY PROCEDURES

As previously noted two of the seven benchmarks established in the 1997 Lake of the Woods County Vertical Control Survey have been destroyed (Benchmarks 1 and 7). The remaining five benchmarks were visited and found to be in good condition. The PVC encasement pipe at Benchmark Number 4 needed to be replaced. Benchmark Number 1 was destroyed by the construction of a new boat access ramp. It was not replaced since there are two existing benchmarks listed in MNDOT's database nearby, one of which has been included in this survey. The location of destroyed Benchmark Number 7 was re-established and a new aluminum cap was cemented into a drill hole in the granite rock at this location.

Four new benchmarks were established near the shore of Lake of the Woods and the Rainy River in Lake of the Woods County (Benchmarks 11-14). These benchmarks are similar to the previous 1997 benchmarks and consist of 5/8-inch aluminum rods with 3-1/2 inch stamped aluminum caps driven to resistance within a capped 6 inch PVC protective encasement pipe.

Several existing benchmarks listed in the MNDOT and NGS databases including C-209 were recovered.

In order to confirm the conversion between the 1912 sea-level datum and the NGVD 29 datum in this area, a search was conducted for the benchmarks established by the USC&GS in 1906-1907 between Warroad, Minnesota and the east line of Lake of the Woods County. None of the benchmarks in Warroad, including B.M. 303, could be found. A benchmark located in the City of Williams and another one at the Pitt flag station were found but they had been damaged and the caps knocked off so they could not be used. USGS Benchmark 1088 near Clementson at the east border of Lake of the Woods County was found in good condition. No other benchmarks from the 1906-1907 survey were recovered.

The current 2017 Lake of the Woods vertical control survey was conducted using static GPS observations with one half hour to one hour sessions. All stations in the survey network were connected to numerous other stations by a minimum of 4 observed baselines. Most stations averaged 5 to 6 baselines or more. The entire GPS network included the new and old recovered Lake of the Woods benchmarks, control points from the MNDOT and NGS databases and Benchmark 1088 from the 1906-1907 survey. Sufficient redundancy was built into the network to insure a high degree of reliability in the accuracy and precision of the survey results.

Fifteen vertical control points from the MNDOT and NGS databases were selected to determine the elevations on the Lake of the Woods benchmarks. These control points were located throughout the network and were selected based on the accuracy and determination methods listed on MNDOT's datasheets. Some of these control points along with a few others including MNDOT's CORS stations BAUD and RSVT were used to determine horizontal positions as well. The vertical datum used for the survey observations was NAVD 88 and the horizontal datum used was Lake of the Woods County Coordinate System (NAD 83).

RESULTS

Based on a least squares adjustment of the network, constrained to the MNDOT/NGS control points noted above, the adjusted elevations for each of the Lake of the Woods benchmarks had computed errors ranging from 0.01 to 0.04 foot. Because the constraining control points were chosen for the best vertical accuracy, the horizontal positional errors were slightly larger (approximately 0.10 foot).

The 1906-1907 USGS Benchmark 1088 and three of the Lake of the Woods benchmarks could not be directly measured with GPS observations. At these locations, a stable temporary point was established and observed with GPS. Conventional leveling methods were then used to transfer elevations to the Lake of the Woods County benchmarks and USGS Benchmark 1088 with the maximum closure error in these level loops being 0.01 foot.

The NAVD 88 elevations for the Lake of the Woods County benchmarks were converted to NGVD 29 using VERTCON. A comparison was made between the 1912 elevations at USGS Benchmarks 1084 and 1088 with MNDOT's published NGVD 29 elevations at these control points, the NGVD 29 elevations derived using VERTCON and the measured elevations at Benchmark 1088. These comparisons revealed differences of 0.52 to 0.59 foot between the two datums depending on the year of the published elevation. As previously noted in this report the Water Survey of Canada and the US Army Corps of Engineers have used a conversion 0.58 foot between the 1912 and 1929 datums. Since this conversion falls within the findings of this survey, it was determined that it should continue to be used and that 0.58 foot should be added to the NGVD 29 elevations to convert to the 1912 sea level datum in Lake of the Woods County.

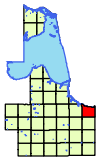
Attached are location maps of the Lake of the Woods County benchmarks and site sketches and photographs for each of the County benchmarks. The site sketches list the elevations for the benchmark on the 1912 sea level datum and the NGVD 29 and NAVD 88 datums along with a coordinate location for the control point. Also attached are copies of MNDOT's datasheets for several points from their control network that were included in this survey and have been included in the County's system of benchmarks along the shore of Lake of the Woods and the Rainy River. These MNDOT points where chosen based on the accuracy of their vertical positions and their proximity to the shoreline. Since Benchmark C-209 in Warroad is the designated controlling

benchmark for the lake, it has also been included in the survey. The elevation for C-209 obtained by observations from the Lake of the Woods survey network checked to within 0.01 foot of the published elevation for C-209.

Following is a list of additional control points from MNDOT's geodetic control point database that were included in this survey (Refer to MNDOT's geodetic database website for data sheets relating to these control points):

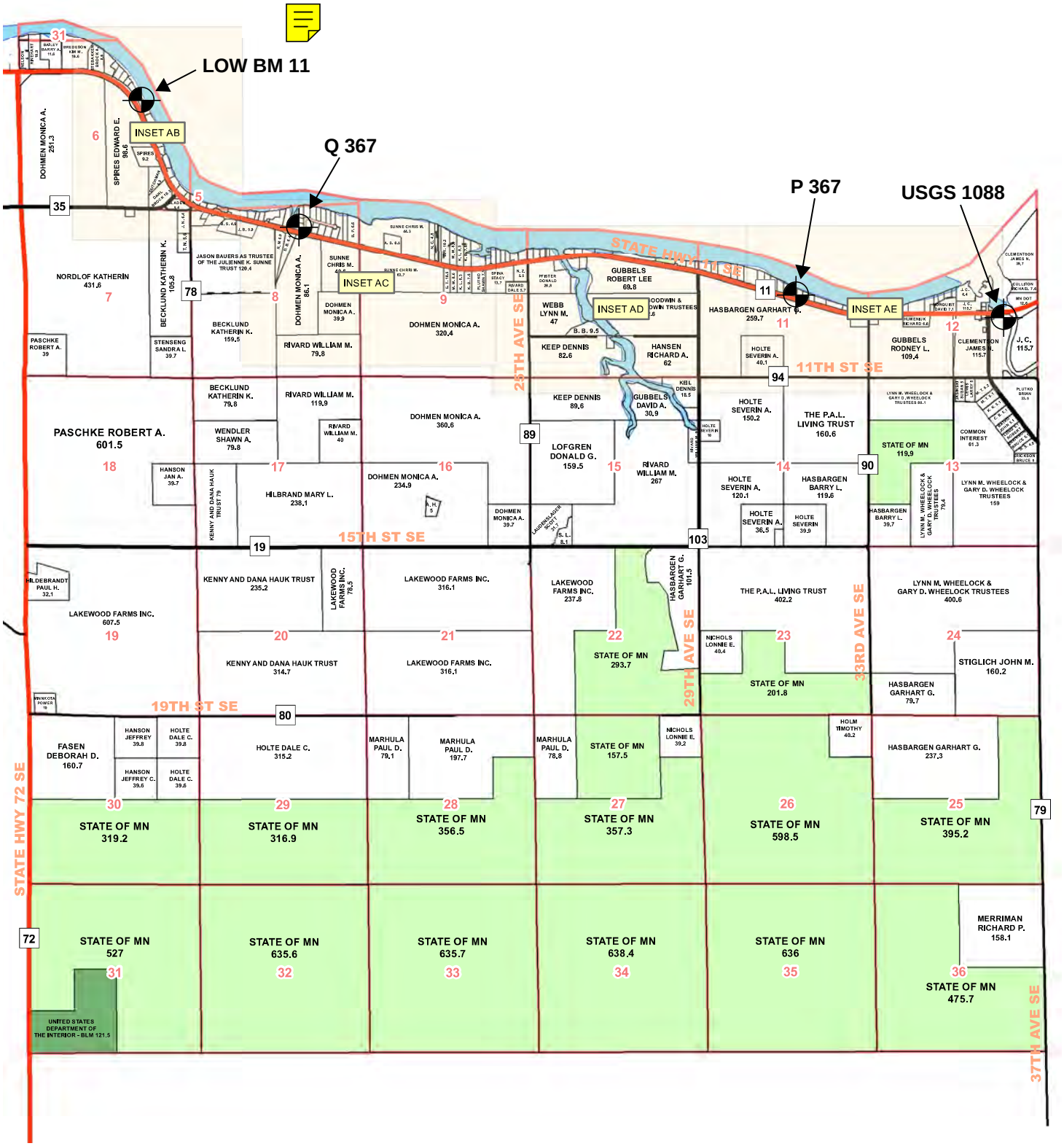
NAME	MONUMENTING AGENCY	YEAR SET
3904 G	MNDOT	2001
3904 J	MNDOT	2001
DUTCH RESET	MNDOT	2011
BETTY	MNDOT	2011
POPP	MNDOT	2009
HOOP	MNDOT	2009
3904 L	MNDOT	2009
X 223	USC&GS	1935
37 HEH	USGS	1966
MAGOON	MNDOT	1995
33 HEH	USGS	1966
MILLER 2 AZ	USC&GS	1966
ZIPPEL	IBWC	1913
3902 F	MNDOT	2014

MNDOT'S CORS stations BAUD and RSVT were also included in the survey.



BENCHMARK LOCATION MAP 1

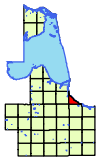
County Line



See SPOONER Page: 30

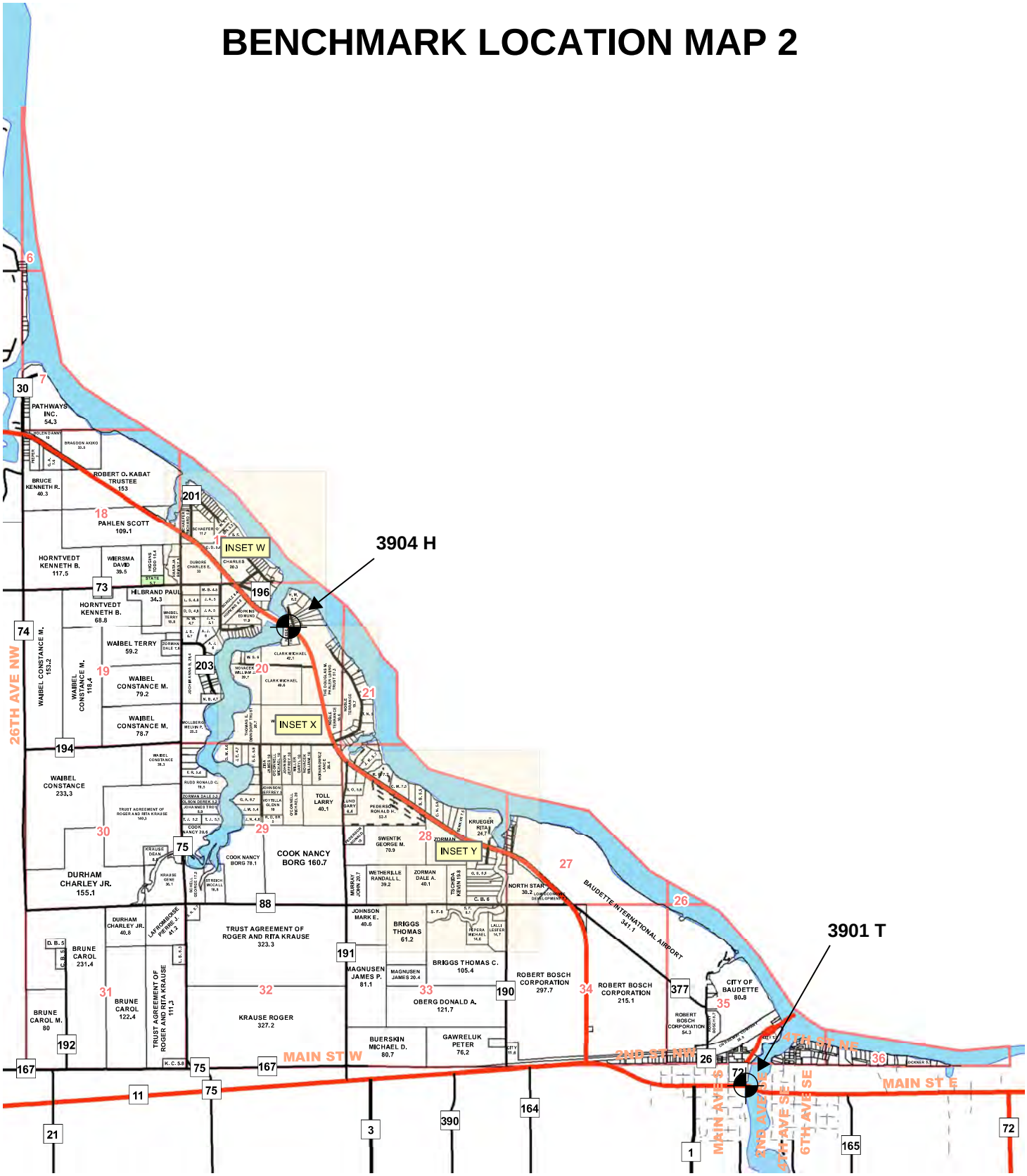
County Line

See RAPID RIVER Page: 24



County Line

BENCHMARK LOCATION MAP 2



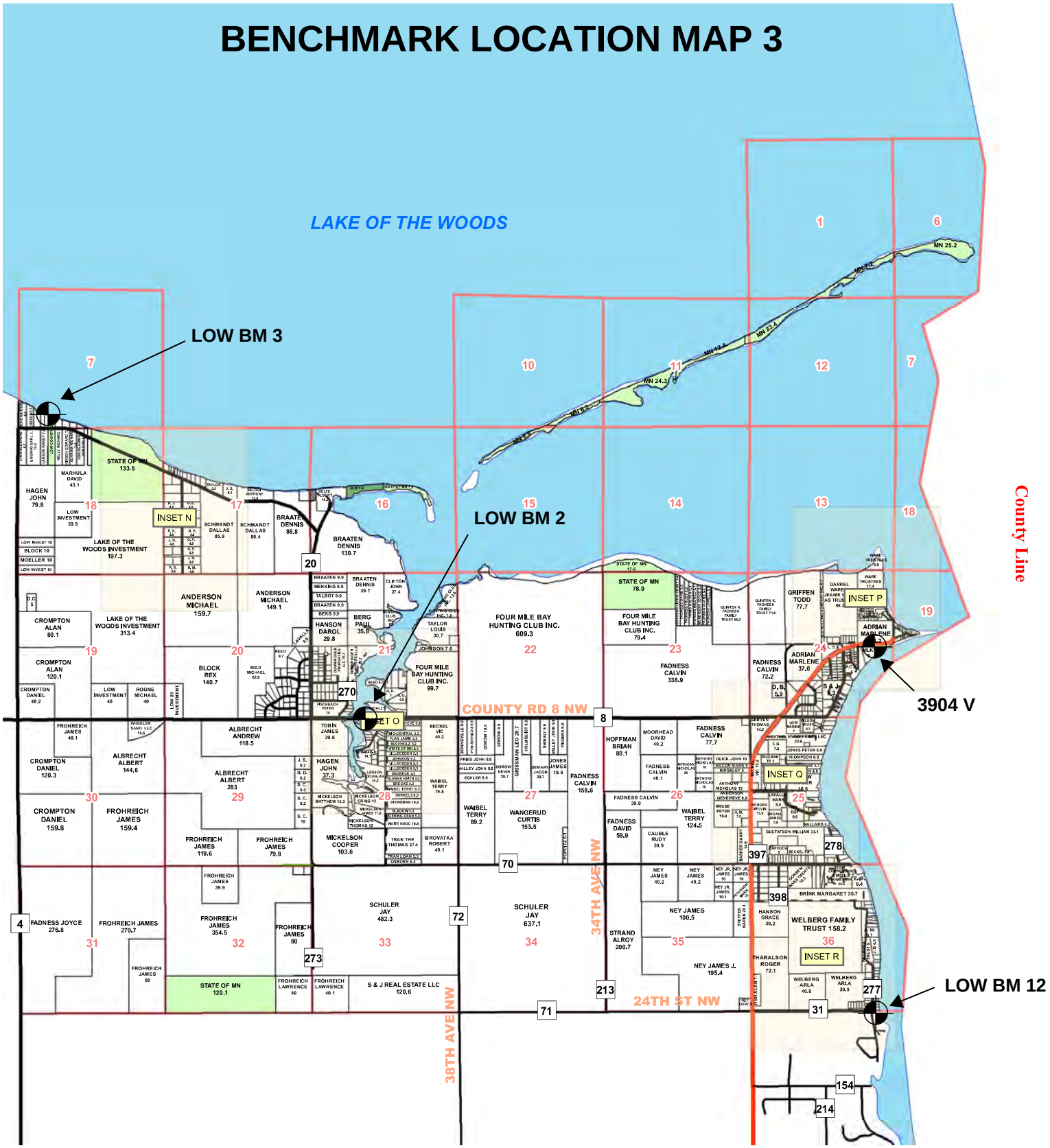
See WABANICA Page: 34

County Line

See SPOONER Page: 30

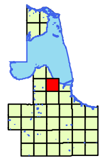
County Line

BENCHMARK LOCATION MAP 3



See ZIPPEL Page: 37

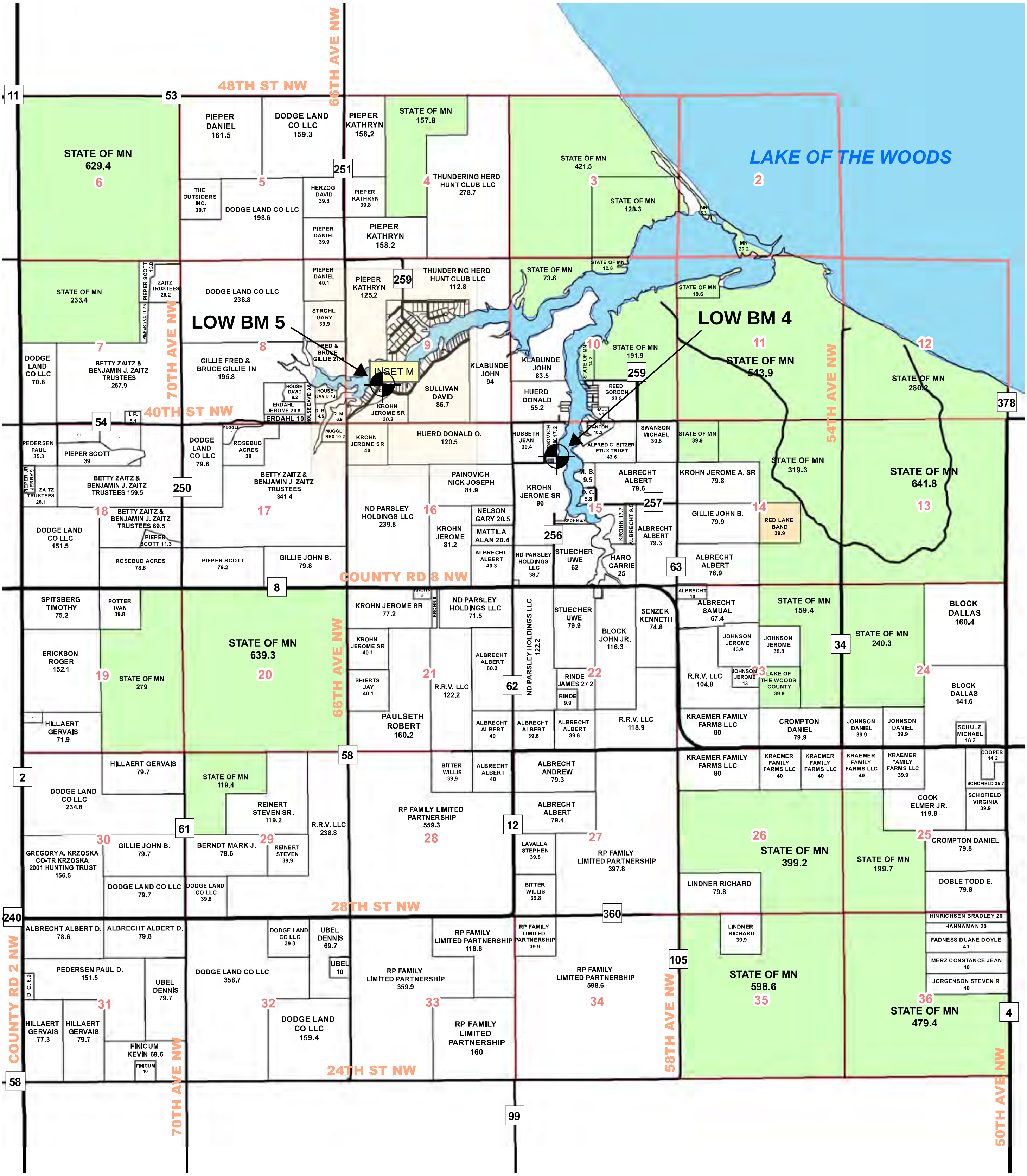
County Line



BENCHMARK LOCATION MAP 4

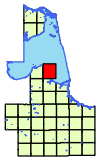
See PROSPER Page: 40

See CHILGREN Page: 36



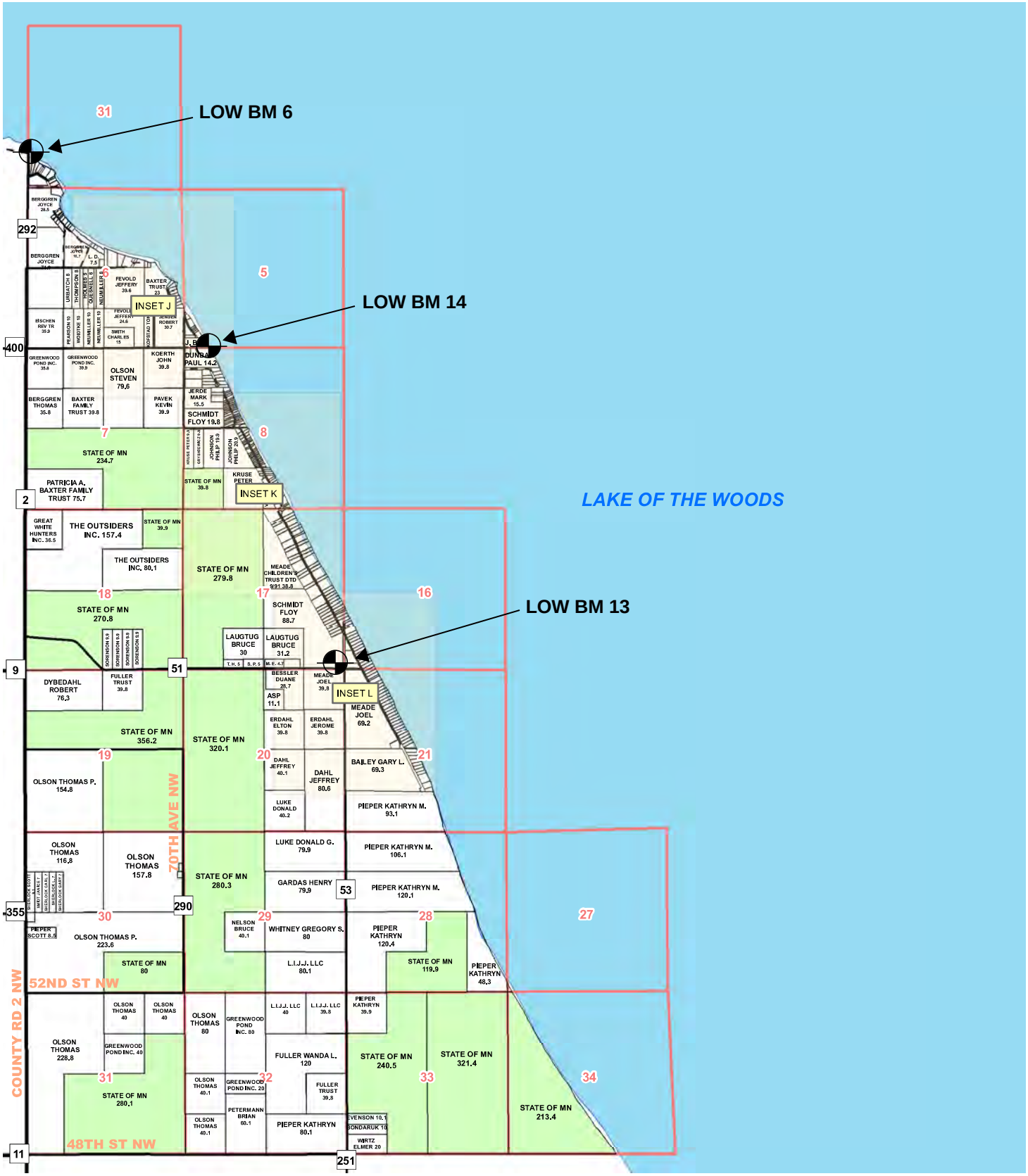
See WHEELER Page: 38

See MCDOUGALD Page: 33

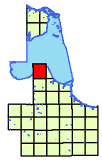


BENCHMARK LOCATION MAP 5

County Line



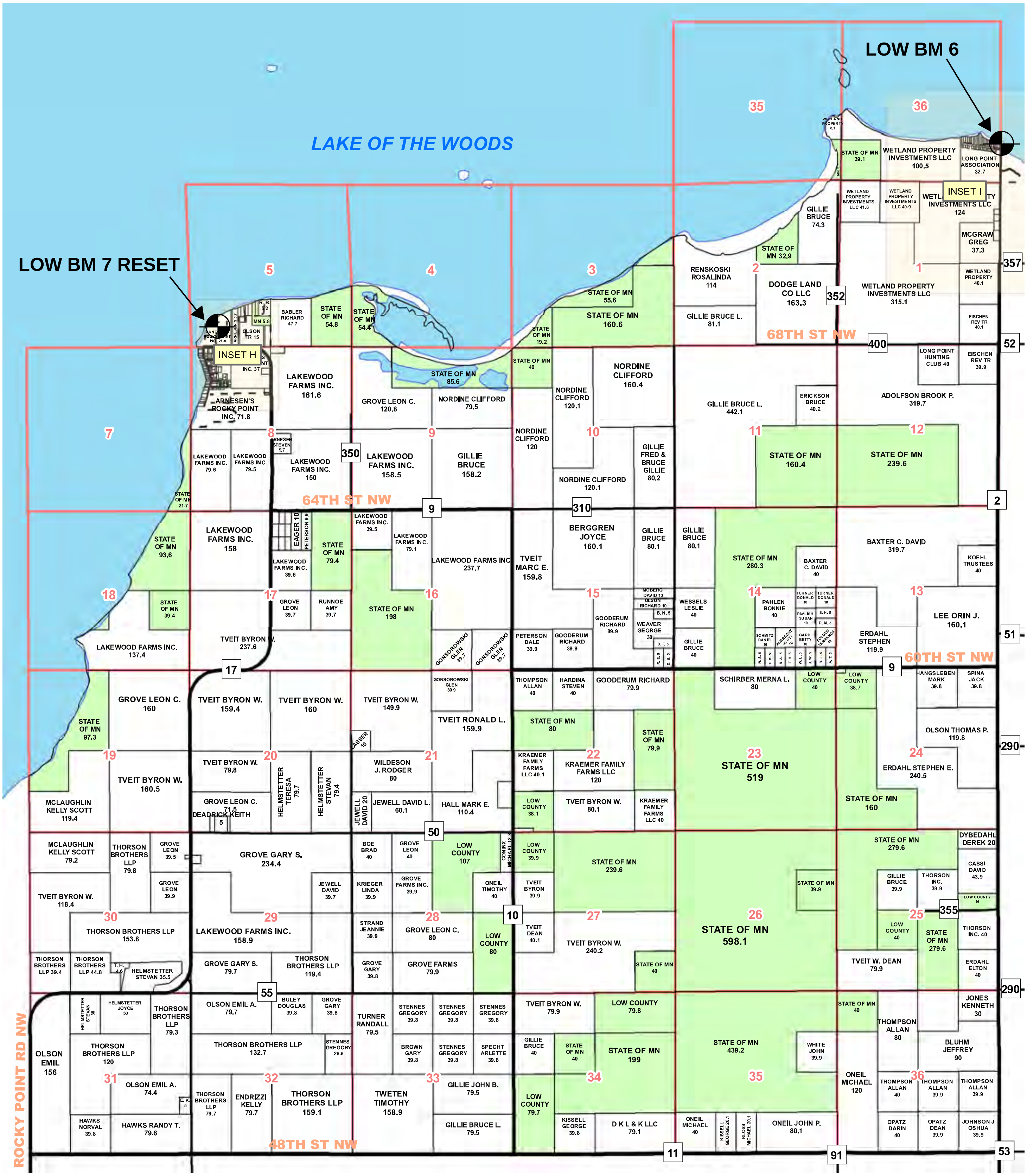
See ZIPPEL Page: 37



BENCHMARK LOCATION MAP 6

County Line

County Line



See PROSPER Page: 40

See CHILGREN Page: 36

2017 LAKE OF THE WOODS COUNTY SHORELINE BENCHMARKS

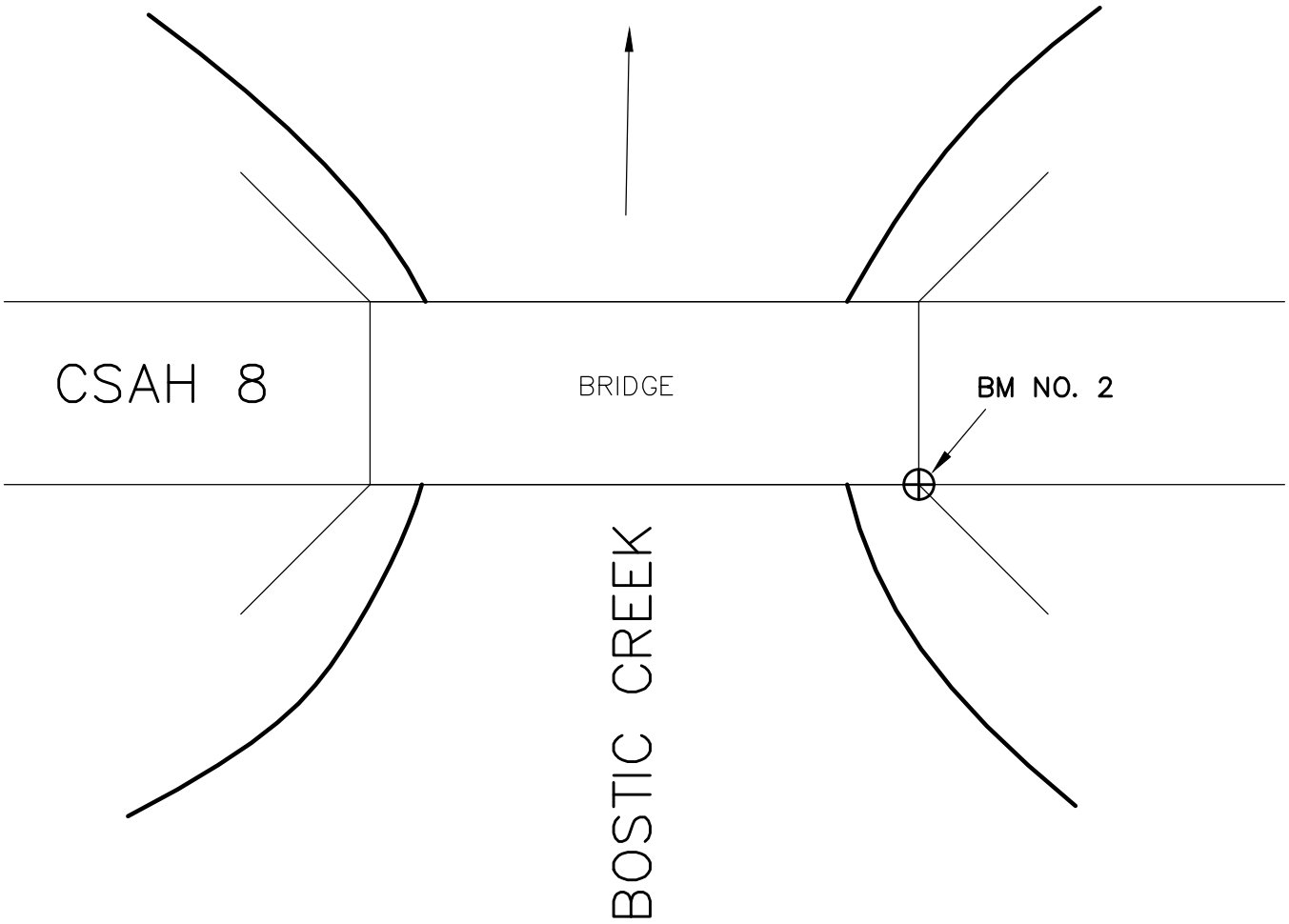
BENCHMARK	NORTHING (LOW CO. COORDINATE)	EASTING	LATITUDE	LONGITUDE	NAVD 88 ELEV.	NGVD 29 ELEV.	1912 S.L. ELEV.	MON. AGENCY AND YEAR SET
LOW BM 2	269302.1240'	525448.0810'	N48° 49' 48.32"	W94° 46' 39.69"	1068.85'	1067.50'	1068.08'	MNDOT DATE ?
LOW BM 3	280138.0810'	514586.0450'	N48° 51' 35.35"	W94° 49' 21.89"	1064.78'	1063.42'	1064.00'	LOW COUNTY 1997
LOW BM 4	278737.9640'	498941.8250'	N48° 51' 21.59"	W94° 53' 15.82"	1064.66'	1063.30'	1063.88'	LOW COUNTY 1997
LOW BM 5	280873.3150'	493701.4160'	N48° 51' 42.65"	W94° 54' 34.19"	1063.71'	1062.34'	1062.92'	LOW COUNTY 1997
LOW BM 6	323041.8460'	481654.7390'	N48° 58' 38.62"	W94° 57' 34.96"	1066.56'	1065.20'	1065.78'	LOW COUNTY 1997
LOW BM 7 RESET	316969.3290'	455826.5830'	N48° 57' 38.27"	W95° 04' 01.86"	1074.43'	1073.06'	1073.64'	LOW COUNTY 2017
LOW BM 11	225536.8770'	581313.6580'	N48° 42' 34.91"	W94° 32' 47.71"	1080.29'	1079.08'	1079.66'	LOW COUNTY 2017
LOW BM 12	256067.8030'	544152.7390'	N48° 47' 37.40"	W94° 42' 00.64"	1065.96'	1064.62'	1065.20'	LOW COUNTY 2017
LOW BM 13	306114.7760'	492476.9380'	N48° 55' 51.69"	W94° 54' 52.65"	1071.22'	1069.86'	1070.44'	LOW COUNTY 2017
LOW BM 14	316626.4250'	487495.4990'	N48° 57' 35.37"	W94° 56' 07.35"	1068.87'	1067.50'	1068.08'	LOW COUNTY 2017
3904 V	272003.0860'	544277.0430'	N48° 50' 14.62"	W94° 41' 58.21"	1068.34'	1067.00'	1067.58'	MNDOT 2012
3904 H	241733.5550'	553692.5640'	N48° 45' 15.71"	W94° 39' 38.80"	1076.14'	1074.82'	1075.40'	MNDOT 1996
3901 T	226542.4090'	568861.2200'	N48° 42' 45.33"	W94° 35' 53.30"	1083.21'	1081.98'	1082.56'	MNDOT 2012
Q 367	221337.3840'	586578.0940'	N48° 41' 53.24"	W94° 31' 29.52"	1086.43'	1085.25'	1085.83'	NGS 1981
P 367	218942.2960'	603140.5050'	N48° 41' 28.76"	W94° 27' 22.85"	1085.65'	1084.49'	1085.07'	NGS 1981
USGS 1088	218741.3580'	608502.5100'	N48° 41' 26.48"	W94° 26' 02.96"	1086.98'	1085.81'	1086.39'	USGS 1907
	(ROSEAU CO. COORDINATE)							
C 209	233251.2000'	700069.7750'	N48° 54' 21.99"	W95° 19' 05.47"	1071.16'	1069.78'	1070.36'	CGS 1935

WATER LEVELS REGULATED BY THE 1925 CONVENTION AND PROTOCOL BETWEEN THE DOMINION OF CANADA AND THE UNITED STATES FOR REGULATING THE LEVEL OF LAKE OF THE WOODS: (1912 Sea Level Datum)

ORDINARY HIGH WATER ELEVATION = 1061.25 Feet (Article 4 of the 1925 Convention and Protocol)

FLOWAGE EASEMENT = 1064 Feet (Article 8 of the 1925 Convention and Protocol)

LOW BENCHMARK NO. 2



DESCRIPTION:
MINNESOTA STATE HIGHWAY DEPT. REFERENCE MARK.
Brass disk in top of abuttment on SE wingwall of bridge along CSAH 8 over Bostic Creek.

LOW SOUTH COUNTY COORDINATE POSITION (2011 ADJ.)
N = 269302.124 E = 525448.081

ELEVATION
1068.85 Feet (NAVD 88)
1067.50 Feet (NGVD 29)
1068.08 Feet (SLD 1912)

NORTH

NOT TO SCALE

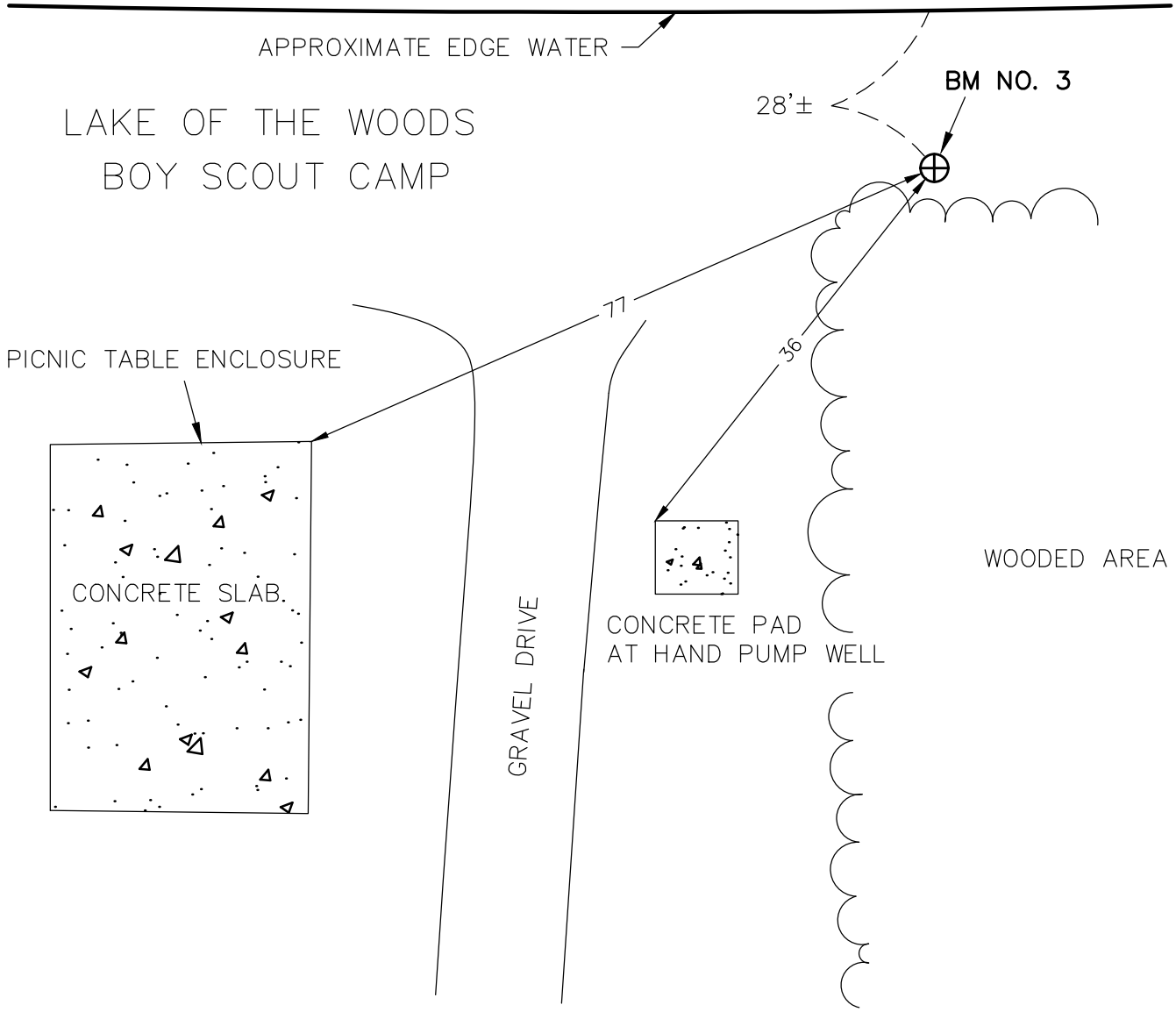
WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 2 - 14NOV2017

LOW BM 2 - 14NOV2017 (2)

LOW BENCHMARK NO. 3

LAKE OF THE WOODS



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 1997 BENCH MARK NO. 3" placed on top of a ¾" aluminum rod driven 16 feet into the ground. Monument is inside a 6" PVC casing.

LOW SOUTH COUNTY COORDINATE POSITION (2011 ADJ.)

N = 280138.081 E = 514586.045

ELEVATION

1064.78 Feet (NAVD 88)
1063.42 Feet (NGVD 29)
1064.00 Feet (SLD 1912)

NORTH

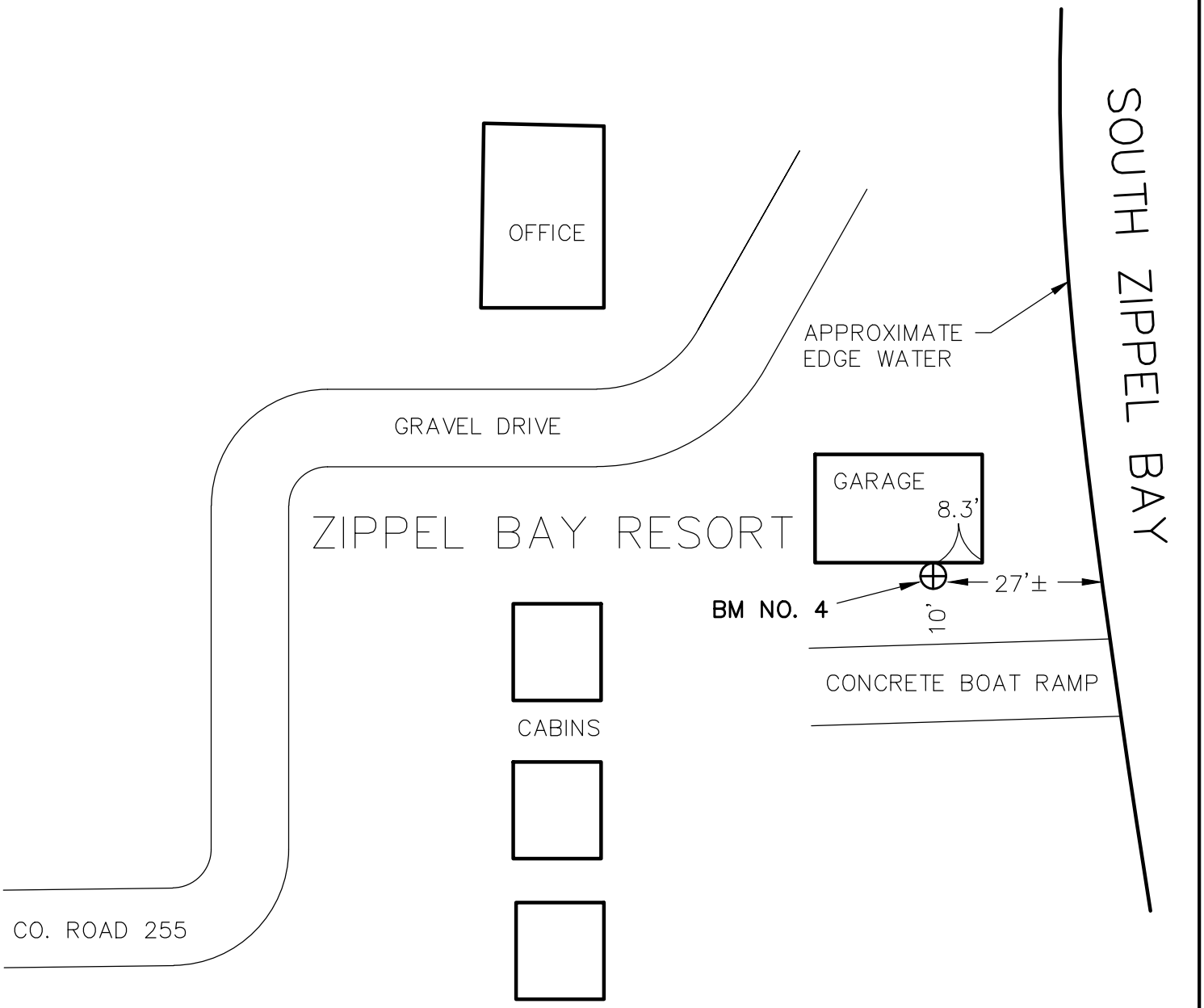
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 3 - 31MAY2017 (2)

LOW BM 3 - 31MAY2017

LOW BENCHMARK NO. 4



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 1997 BENCH MARK NO. 4" placed on top of a ¾" aluminum rod driven 12 feet into the ground, next to the south building wall of the Zippel Bay Resort garage. Monument is inside a 6" PVC casing.

LOW SOUTH COUNTY COORDINATE POSITION (2011 ADJ.)

N = 278737.964 E = 498941.825

ELEVATION

1064.66 Feet (NAVD 88)
1063.30 Feet (NGVD 29)
1063.88 Feet (SLD 1912)

NORTH

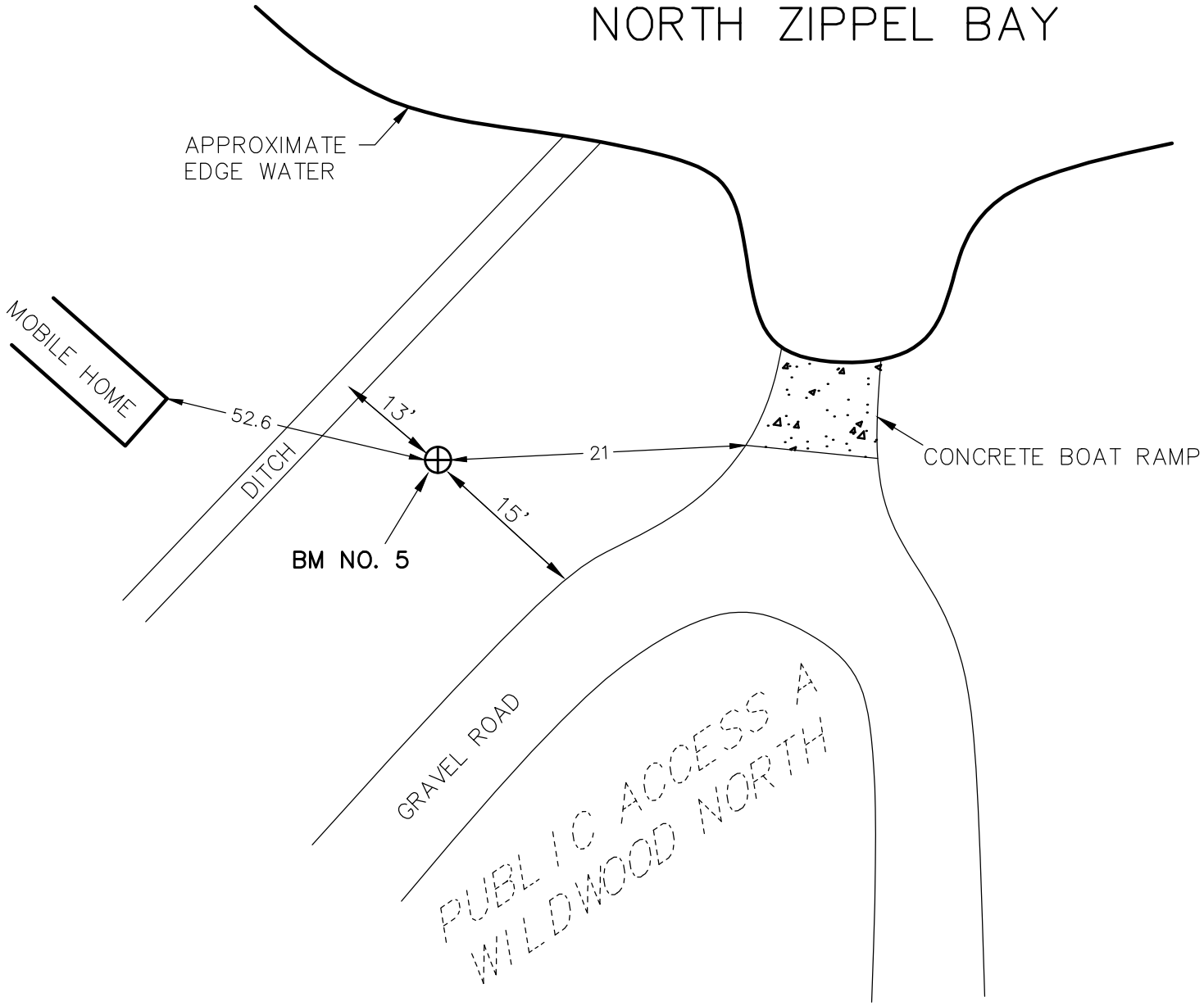
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 4 - 31MAY2017 (2)

LOW BM 4 - 31MAY2017

LOW BENCHMARK NO. 5



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 1997 BENCH MARK NO. 5" placed on top of a ¾" aluminum rod driven 12 feet into the ground. Monument is inside a 6" PVC casing and is located on PUBLIC ACCESS A, WILDWWOD NORTH.

LOW SOUTH COUNTY COORDINATE POSITION (2011 ADJ.)

N = 280873.315 E = 493701.416

ELEVATION

1063.71 Feet (NAVD 88)
1062.34 Feet (NGVD 29)
1062.92 Feet (SLD 1912)

NORTH

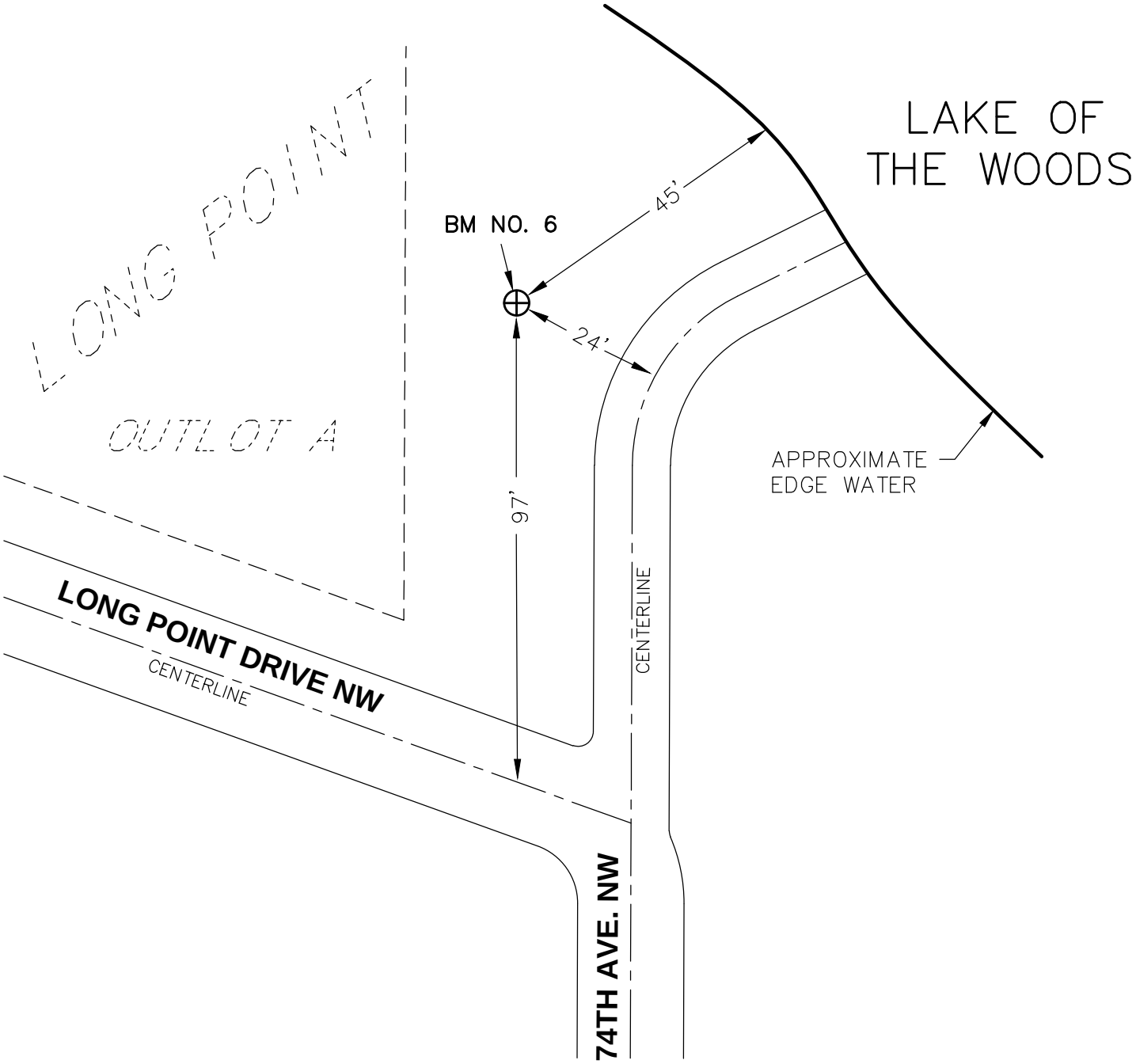
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 5 - 14NOV2017

LOW BM 5 - 31MAY2017

LOW BENCHMARK NO. 6



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 1997 BENCH MARK NO. 6" placed on top of a ¾" aluminum rod driven to bedrock. Monument is inside a 6" PVC casing.

LOW SOUTH COUNTY COORDINATE POSITION (2011 ADJ.)

N = 323041.846 E = 481654.739

ELEVATION

1066.56 Feet (NAVD 88)
1065.20 Feet (NGVD 29)
1065.78 Feet (SLD 1912)

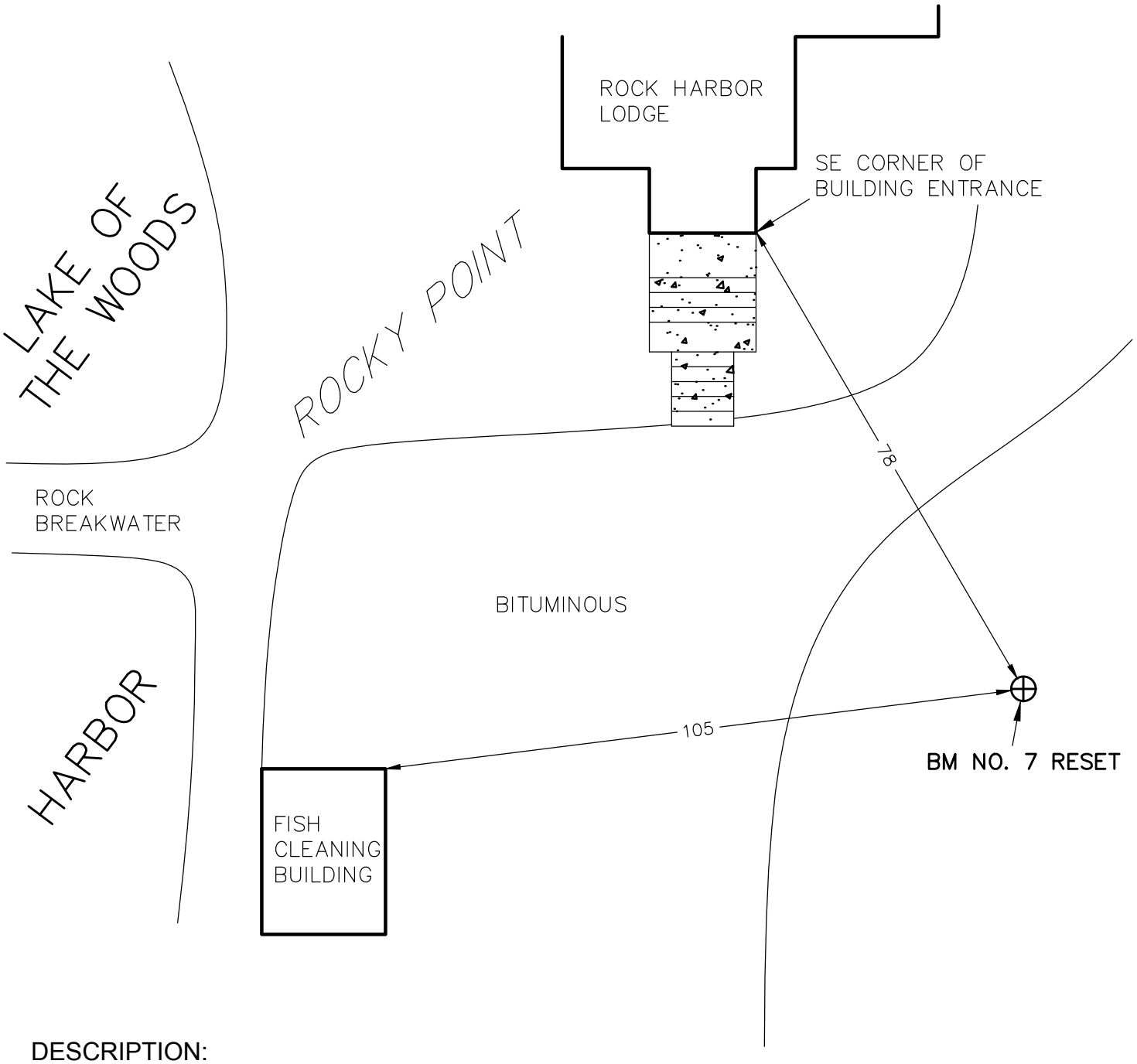
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 6 - 31MAY2017 (2)

LOW BM 6 - 31MAY2017

LOW BENCHMARK NO. 7 RESET



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 2017 BENCH MARK BM 7 RESET" drilled and cemented into top of rock outcrop SE of Rock Harbor Lodge.

LOW SOUTH COUNTY COORDINATE POSITION

N = 316969.329 E = 455826.583

ELEVATION

1074.43 Feet (NAVD 88)
1073.06 Feet (NGVD 29)
1073.64Feet (SLD 1912)

NORTH

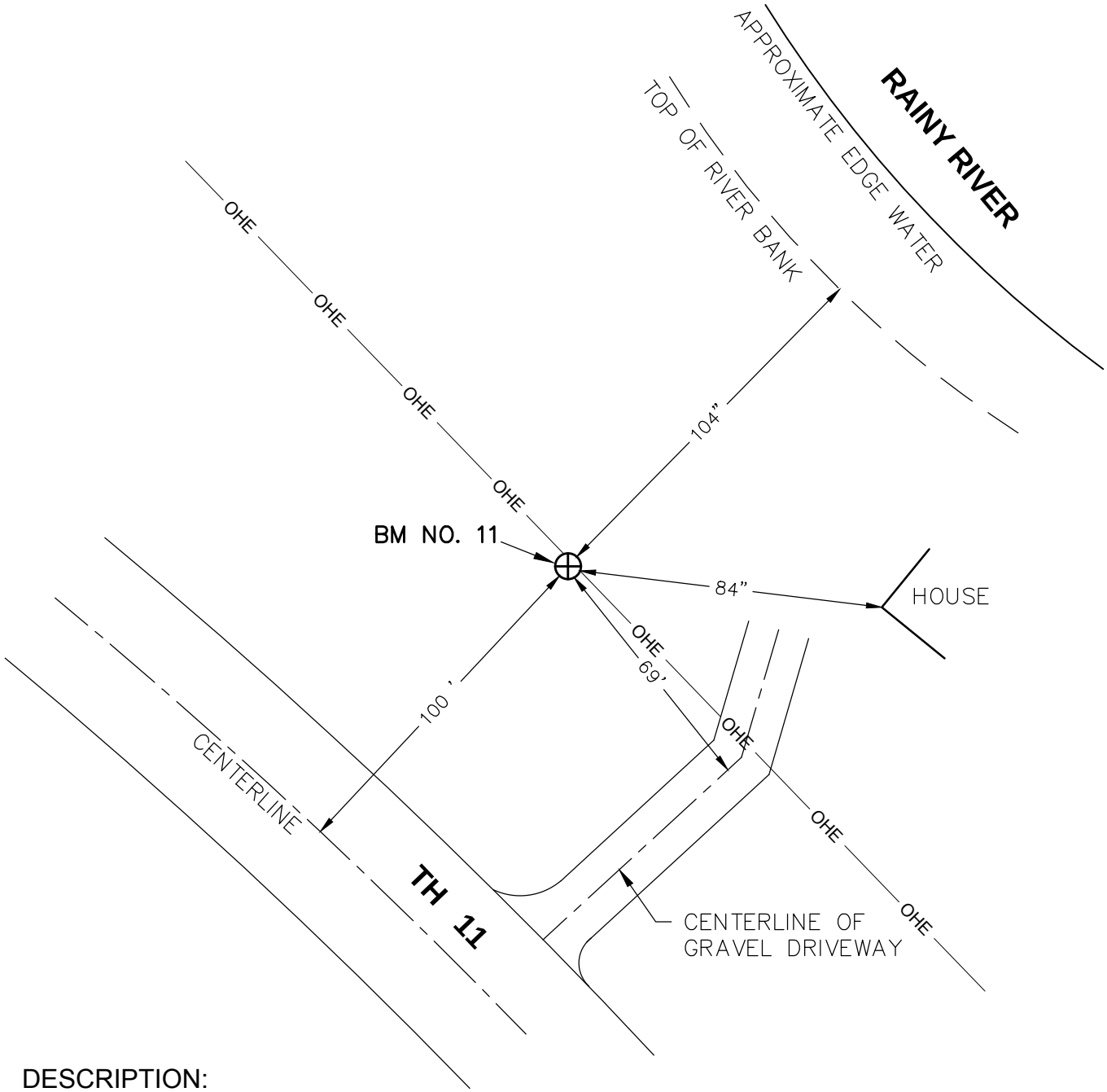
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 7 RESET - 31MAY2017

LOW BM 7 RESET - 31MAY2017 (2)

LOW BENCHMARK NO. 11



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 2017 BENCH MARK BM 11" placed on top of a ¾" aluminum rod driven 10 feet into the ground. Monument is inside a 6" PVC casing and is located at Property Address No. 1548.

LOW SOUTH COUNTY COORDINATE POSITION

N = 225536.877 E = 581313.658

ELEVATION

1080.29 Feet (NAVD 88)
1079.08 Feet (NGVD 29)
1079.66 Feet (SLD 1912)

NORTH

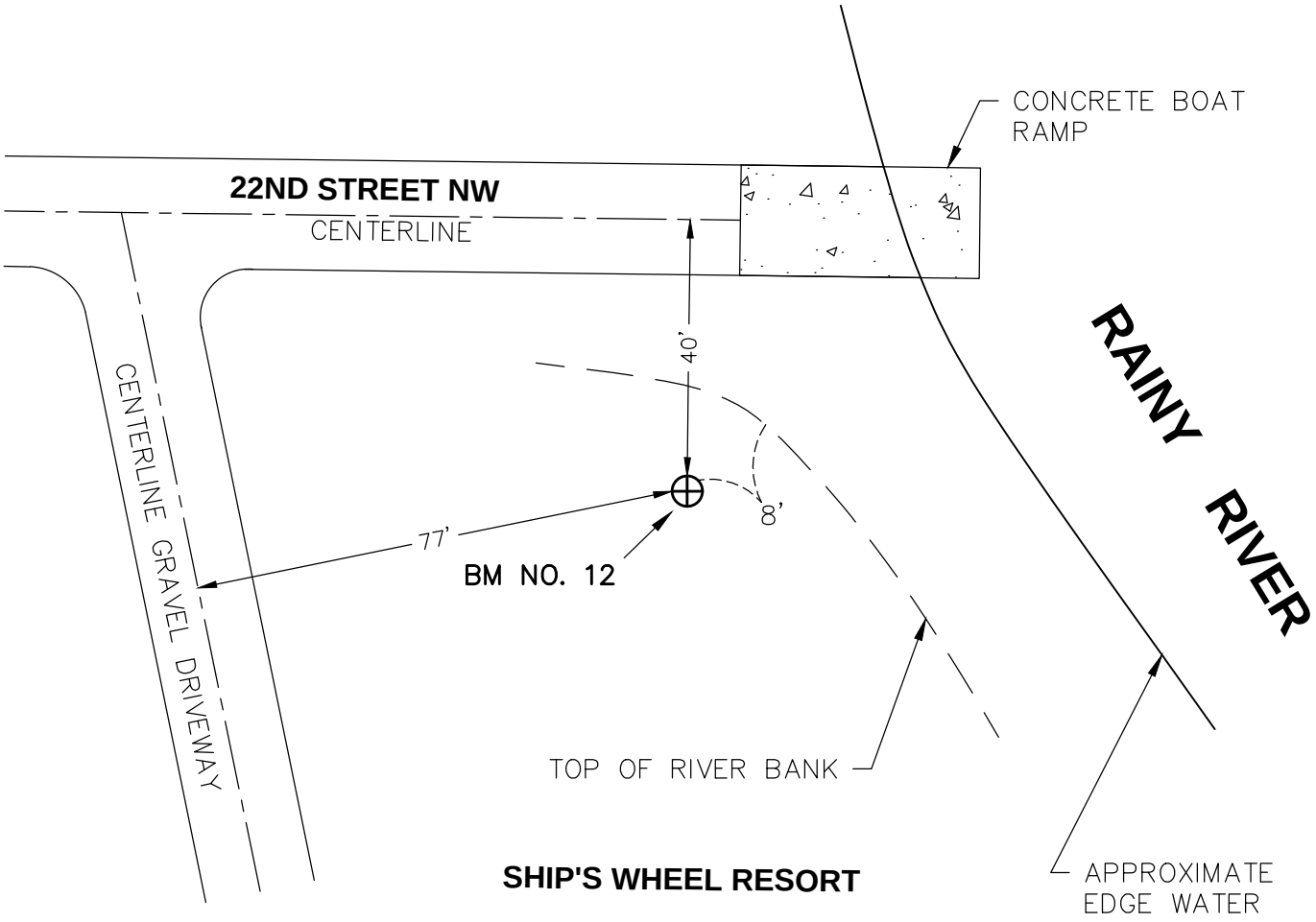
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 11 - 31MAY2017

LOW BM 11 - 31MAY2017 (2)

LOW BENCHMARK NO. 12



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 2017 BENCH MARK BM 12" placed on top of a ¾" aluminum rod driven 12 feet into the ground. Monument is inside a 6" PVC casing and is located at Ship's Wheel Resort.

LOW SOUTH COUNTY COORDINATE POSITION

N = 256067.803 E = 544152.739

ELEVATION

1065.96 Feet (NAVD 88)
1064.62 Feet (NGVD 29)
1065.20 Feet (SLD 1912)

NORTH

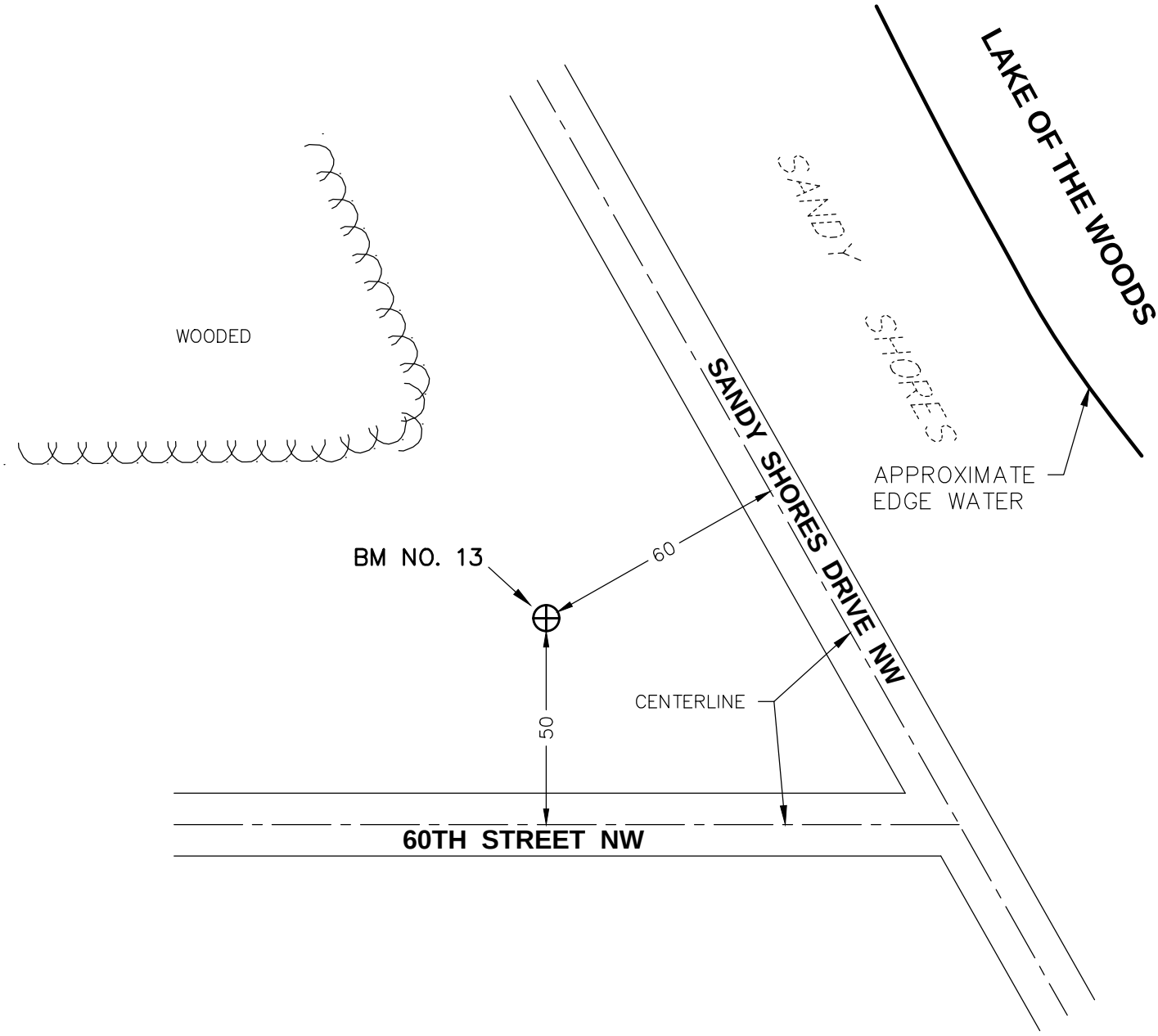
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 12 - 31MAY2017

LOW BM 12 - 31MAY2017 (2)

LOW BENCHMARK NO. 13



DESCRIPTION:

3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 2017 BENCH MARK BM 13" placed on top of a ¾" aluminum rod driven 12 feet into the ground. Monument is inside a 6" PVC casing.

LOW SOUTH COUNTY COORDINATE POSITION

N = 306114.776 E = 492476.938

ELEVATION

1071.22 Feet (NAVD 88)
1069.86 Feet (NGVD 29)
1070.44 Feet (SLD 1912)

NORTH

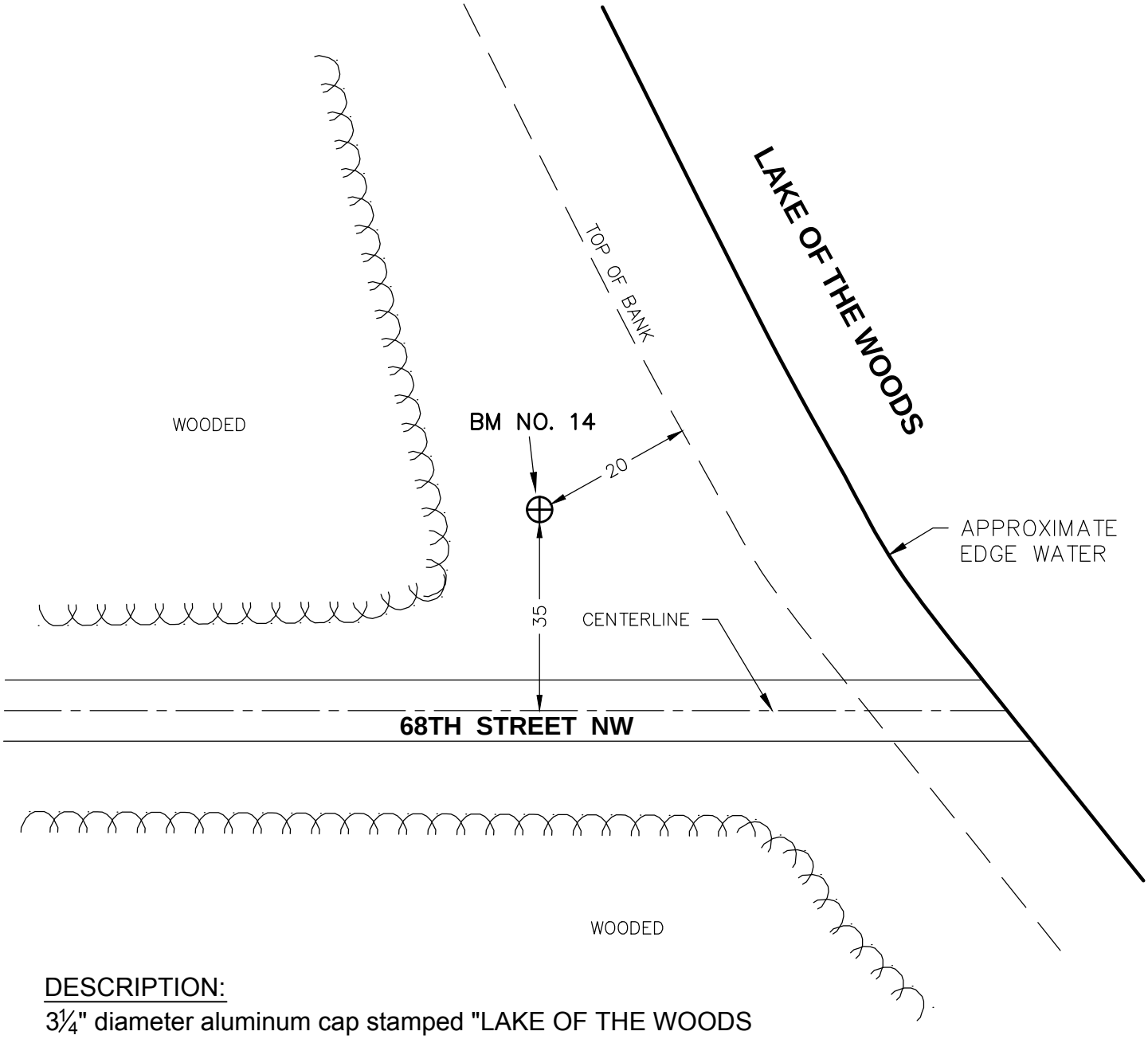
NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 13 - 31MAY2017

LOW BM 13 - 31MAY2017 (2)

LOW BENCHMARK NO. 14



DESCRIPTION:
3¼" diameter aluminum cap stamped "LAKE OF THE WOODS COUNTY 2017 BENCH MARK BM 14" placed on top of a ¾" aluminum rod driven 12 feet into the ground. Monument is inside a 6" PVC casing.

LOW SOUTH COUNTY COORDINATE POSITION
N = 316626.425 E = 487495.499

ELEVATION
1068.87 Feet (NAVD 88)
1067.50 Feet (NGVD 29)
1068.08 Feet (SLD 1912)

NORTH

NOT TO SCALE

WIDSETH SMITH NOLTING
Engineering | Architecture | Surveying | Environmental

LOW BM 14 - 31MAY2017

LOW BM 14 - 31MAY2017 (2)

I 1=1088 USGS

MnDOT Name: I 1=1088 USGS **NGS Name:** 1088

County: LAKE OF THE WOODS, MN (Sheet 2)

NGS ACRN: TC0028 Get Map
NGS Quad / Sta Num : 48094134/
USGS Quad: CLEMENTSON

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
SE	12	160 N	30 W	484126.46	942602.89	1	

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
1907	2014	GOOD	Horz=NO Vert=YES	YES		FLUSH	NO MAG MATERIAL

Monument Type	Disk Type	Mon. Agency
ROCK OUTCROP (OVER 3 METERS)	BENCH MARK DISK	USGS

Description: (1998) **Stamping:** 1088

AT CLEMENTSON, NEAR MOUTH OF RAPID RIVER, 175.0 FEET WEST OF RAPIDS, 100.0 FEET NORTHEAST OF HOUSE, 23.0 FEET SOUTHWEST OF CABLE MARKER, 54.0 FEET SOUTH OF TRUNK HIGHWAY 11, AT TRUNK HIGHWAY 11 MILEPOINT 137.25, 4.5 FEET EAST OF A WITNESS POST.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1086.983	.007	1/2				VERTICAL ADJUSTMENT	1991	00000025

NGVD29

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1085.834	.033	3				VERTICAL CONTROL SURVEY	1967	USGS-VERT
1085.834	.007	1				VERTICAL CONTROL SURVEY	1935	L56 MINN

Geoid Separations(ft): GEOID12A\12B = -95.774 GEOID09 = -95.692 GEOID03 = -95.738 More

*** No Horizontal Positions in the Database ***

Station Photos

Type	File Name	Dir	Date
Location:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/1088-TC0028-3S-30JUL2014.jpg	S	Jul 30, 2014
Monument:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/1088-TC0028-2-30JUL2014.jpg		Jul 30, 2014
Disk:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/1088-TC0028-1-30JUL2014.jpg		Jul 30, 2014

** All station images can be viewed at: ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos **

1088 - 30JUL2014 (2)

1088 - 30JUL2014

MnDOT Name: P 367 **NGS Name:** P 367

County: LAKE OF THE WOODS, MN (Sheet 2)

NGS ACRN: TC0473 Get Map
NGS Quad / Sta Num : 48094134/
USGS Quad: CLEMENTSON

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
SE	11	160 N	30 W	484128.76	942722.85	1	C

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
1981	2017	GOOD	Horz=YES Vert=YES	YES		RECESSED 1 IN.	MARKER W/BAR MAGNET

Monument Type	Disk Type	Mon. Agency
STEEL ROD (NO SLEEVE) (DEPTH 32 FT)	METAL ROD	NGS

Description: (2014) **Stamping:** P 367 1981

6.8 MILES EAST OF BAUDETTE, 5.3 MILES EAST ALONG TRUNK HIGHWAY 1 FROM THE JUNCTION OF TRUNK HIGHWAY 2 AND TRUNK HIGHWAY 72 (THE JUNCTION IS 1.5 MILES EAST OF BAUDETTE), AT TRUNK HIGHWAY 2 MILEPOINT 136.25, 52.5 FEET NORTH-NORTHEAST OF TRUNK HIGHWAY 11, 72.5 FEET WEST-SOUTHWEST OF A GARAGE, 70.0 FEET SOUTH OF THE SOUTHEAST CORNER OF A GREENHOUSE, 69.0 FEET WEST-NORTHWEST OF DRIVEWAY NUMBER 3222, 3.0 FEET WEST OF A POWER POLE WITH TRANSFORMER AND TELEPHONE JUNCTION BOX NUMBER 15093.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1085.647	.007	1/2				VERTICAL ADJUSTMENT	1991	00000025

Non Leveling-Derived Orthometric and Ellipsoid Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
			989.978	.011	2011	HORIZONTAL ADJUSTMENT	2012	GPS2800
1085.661	.131		990.106	.066	2007	HORIZONTAL ADJUSTMENT	2011	GPS2833
1085.661	.131		990.106	.066	2007	HORIZONTAL ADJUSTMENT	2011	GPS2826
1085.661	.131		990.106	.066	2007	GPS - STATIC	2011	HLOTW
1085.661	.131		990.083	.066	1996	GPS - STATIC	2011	HLOTW
1085.661	.131		990.106	.066	2007	GPS - STATIC	2011	HRAINY
1085.661	.131		990.083	.066	1996	GPS - STATIC	2011	HRAINY
			990.106	.022	2007	HORIZONTAL ADJUSTMENT	2007	GPS2300
1085.661	.131		990.083	.066	1996	HORIZONTAL ADJUSTMENT	2002	GPS1664
1085.661	.131		990.083	.066	1996	GPS - STATIC	1999	HBAUD

Geoid Separations(ft): GEOID12A\12B = -95.672 GEOID09 = -95.581 GEOID03 = -95.626 More

Lat/Lon and County Coordinates (Feet)

NAD83(2011)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 41 28.76394	94 27 22.85250	603140.505	218942.296	.010		ADJUSTMENT	2012	GPS2800

NAD83(2007)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 41 28.76407	94 27 22.85313	603140.463	218942.309	.033	C	ADJUSTMENT	2011	GPS2833
48 41 28.76407	94 27 22.85313	603140.463	218942.309	.033	C	ADJUSTMENT	2011	GPS2826
48 41 28.76407	94 27 22.85313	603140.463	218942.309	.033	C	GPS - STATIC	2011	HLOTW
48 41 28.76407	94 27 22.85313	603140.463	218942.309	.033	C	GPS - STATIC	2011	HRAINY
48 41 28.76407	94 27 22.85313	603140.463	218942.309	.020		ADJUSTMENT	2007	GPS2300

NAD83(1996)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 41 28.76427	94 27 22.85337	603140.446	218942.330	.033	C	GPS - STATIC	2011	HLOTW
48 41 28.76427	94 27 22.85337	603140.446	218942.330	.033	C	GPS - STATIC	2011	HRAINY
48 41 28.76427	94 27 22.85337	603140.446	218942.330	.033	C	ADJUSTMENT	2002	GPS1664
48 41 28.76427	94 27 22.85337	603140.447	218942.331	.033	C	GPS - STATIC	1999	HBAUD

P 367 - 28JUL2014 (2)

P 367 - 28JUL2014

MnDOT Name: Q 367 **NGS Name:** Q 367

County: LAKE OF THE WOODS, MN (Sheet 2)

NGS ACRN: TC0474 Get Map
NGS Quad / Sta Num : 48094421/
USGS Quad: BAUDETTE

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
NE	8	160 N	30 W	484153.24	943129.52	1	C

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
1981	2017	GOOD	Horz=YES Vert=YES	YES		RECESSED 3 IN.	MARKER IS STEEL ROD

Monument Type	Disk Type	Mon. Agency
STEEL ROD (NO SLEEVE) (DEPTH 32 FT)	METAL ROD	NGS

Description: (2014) **Stamping:** Q 367 1981

3.6 MILES EAST OF BAUDETTE, 3.95 MILES EAST ALONG TRUNK HIGHWAY 11 FROM THE JUNCTION OF TRUNK HIGHWAY 11 AND TRUNK HIGHWAY 72 NORTH IN BAUDETTE, AT TRUNK HIGHWAY 11 MILEPOINT 133.05, 76.0 FEET NORTH OF TRUNK HIGHWAY 11, 29.0 FEET WEST OF COUNTY ROAD 107, 52.5 FEET WEST-NORTHWEST OF TELEPHONE JUNCTION BOX NUMBER 15021, 12.0 FEET NORTHWEST OF A GUY WIRE ANCHOR, 3.5 FEET EAST-SOUTHWEST OF A POWER POLE WITH GUY WIRE, 0.5 FOOT NORTHEAST OF A WITNESS POST.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1086.428	.007	1/2				VERTICAL ADJUSTMENT	1991	00000025

Non Leveling-Derived Orthometric and Ellipsoid Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1086.264	.262		990.953	.197	2007	GPS - RTRN	2012	RTRN2012
			991.022	.008	2011	HORIZONTAL ADJUSTMENT	2012	GPS2800
1086.415	.131		991.146	.066	2007	HORIZONTAL ADJUSTMENT	2011	GPS2833
1086.415	.131		991.146	.066	2007	HORIZONTAL ADJUSTMENT	2011	GPS2826
1086.415	.131		991.146	.066	2007	GPS - STATIC	2011	HLOTW
1086.415	.131		991.143	.066	1996	GPS - STATIC	2011	HLOTW
1086.415	.131		991.146	.066	2007	GPS - STATIC	2011	HRAINY
1086.415	.131		991.143	.066	1996	GPS - STATIC	2011	HRAINY
			991.146	.023	2007	HORIZONTAL ADJUSTMENT	2007	GPS2300
1086.415	.131		991.143	.066	1996	HORIZONTAL ADJUSTMENT	2002	GPS1664
1086.415	.131		991.143	.066	1996	GPS - STATIC	1999	HBAUD

Geoid Separations(ft): GEOID12A\12B = -95.410 GEOID09 = -95.311 GEOID03 = -95.357 More

Lat/Lon and County Coordinates (Feet)

NAD83(2011)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 41 53.23661	94 31 29.51760	586578.094	221337.384	.007		ADJUSTMENT	2012	GPS2800

NAD83(2007)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 41 53.23660	94 31 29.51888	586578.008	221337.383	.131	3	GPS - RTRN	2012	RTRN2012
48 41 53.23667	94 31 29.51814	586578.057	221337.390	.033	C	ADJUSTMENT	2011	GPS2833
48 41 53.23667	94 31 29.51814	586578.057	221337.390	.033	C	ADJUSTMENT	2011	GPS2826
48 41 53.23667	94 31 29.51814	586578.057	221337.390	.033	C	GPS - STATIC	2011	HLOTW
48 41 53.23667	94 31 29.51814	586578.057	221337.390	.033	C	GPS - STATIC	2011	HRAINY
48 41 53.23667	94 31 29.51814	586578.057	221337.390	.023		ADJUSTMENT	2007	GPS2300

NAD83(1996)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 41 53.23675	94 31 29.51827	586578.049	221337.398	.033	C	GPS - STATIC	2011	HLOTW
48 41 53.23675	94 31 29.51827	586578.049	221337.398	.033	C	GPS - STATIC	2011	HRAINY
48 41 53.23675	94 31 29.51827	586578.049	221337.398	.033	C	ADJUSTMENT	2002	GPS1664
48 41 53.23675	94 31 29.51827	586578.049	221337.399	.033	C	GPS - STATIC	1999	HBAUD

Q 367 - 09JUN2009

Q 367 - 24OCT2012

MnDOT Name: 3901 T **NGS Name:** 3901 T

County: LAKE OF THE WOODS, MN (Sheet 2)

NGS ACRN: DP0951 Get Map
NGS Quad / Sta Num : 48094421/
USGS Quad: BAUDETTE

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
NW	2	160 N	31 W	484245.33	943553.30	2	3

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
2012	2017	GOOD	Horz=YES Vert=YES	YES		RECESSED 2 IN.	BAR MAG IN DRILL HOLE

Monument Type	Disk Type	Mon. Agency
ALUMINUM ALLOY ROD (NO SLEEVE) (DEPTH 40 FT)	METAL ROD (WITH REMOVABLE ID DISK)	MNDT

Description: (2012) **Stamping:** 3901 T 2012

IN BAUDETTE, AT THE JUNCTION OF TRUNK HIGHWAY 11 AND TRUNK HIGHWAY 72 NORTH IN BAUDETTE, AT TRUNK HIGHWAY 11 MILEPOINT 129.15, 142.1 FEET EAST OF TRUNK HIGHWAY 72, 52.6 FEET NORTHWEST OF THE NORTHWEST CORNER OF A BRIDGE OVER BAUDETTE BAY, 44.1 FEET NORTH OF TRUNK HIGHWAY 11, 20.9 FEET WEST OF A WITNESS POST.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1083.213	.016	2/1				VERTICAL ADJUSTMENT	2014	00000828
1083.223	.016	2/1				VERTICAL CONTROL SURVEY	2013	VHACK

Non Leveling-Derived Orthometric and Ellipsoid Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1083.049	.262		987.852	.197	2007	GPS - RTRN	2012	RTRN2012

Geoid Separations(ft): GEOID12A\12B = -95.262 GEOID09 = -95.197 GEOID03 = -95.226 More

Lat/Lon and County Coordinates (Feet)

NAD83(2007)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 42 45.33035	94 35 53.30304	568861.164	226542.405	.131	3	GPS - RTRN	2012	RTRN2012

State Plane and UTM Coordinates (Feet)

NAD83(2007)

MN State Plane - North Zone		UTM - Zone 15					Project Info	
X	Y	X	Y	Acc	Order	Determination Method	Year	Reference
2262967.068	1138657.202	1254718.256	17705800.868	.131	3	GPS - RTRN	2012	RTRN2012

Station Photos

Type	File Name	Dir	Date
Location:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3901_T-DP0951-3E-28NOV2012.jpg	E	Nov 28, 2012
Monument:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3901_T-DP0951-2-28NOV2012.jpg		Nov 28, 2012
Disk:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3901_T-DP0951-1-28NOV2012.jpg		Nov 28, 2012

** All station images can be viewed at: ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos **

3901 T - 28NOV2012 (2)

3901 T - 28NOV2012

MnDOT Name: 3904 H **NGS Name:** 3904 H

County: LAKE OF THE WOODS, MN (Sheet 2)

NGS ACRN: DP0942 Get Map
NGS Quad / Sta Num : 48094413/
USGS Quad: WHEELERS POINT

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
NE	20	161 N	31 W	484515.71	943938.80	2	3

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
1996	2012	GOOD	Horz=NO Vert=YES	YES	39010	FLUSH	NO MAG MATERIAL

Monument Type	Disk Type	Mon. Agency
BRIDGE RAILING	VERTICAL CONTROL DISK	MNDT

Description: (1996) **Stamping:** 3904 H 1996

5.5 MILES NORTHWEST OF BAUDETTE, IN BRIDGE RAILING IN THE SOUTHEAST CORNER OF TRUNK HIGHWAY 172 BRIDGE NUMBER 39010 OVER WINTER ROAD RIVER, 3.75 MILES NORTH-NORTHWEST ALONG TRUNK HIGHWAY 172 FROM THE JUNCTION OF TRUNK HIGHWAY 172 AND TRUNK HIGHWAY 11 AT WEST EDGE OF BAUDETTE, AT TRUNK HIGHWAY 172 MILEPOINT 3.75, 20.5 FEET SOUTHWEST OF TRUNK HIGHWAY 172.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1076.143	.016	2/1				VERTICAL ADJUSTMENT	2014	00000828
1076.159	.016	2/1				VERTICAL CONTROL SURVEY	2013	VHACK

Non Leveling-Derived Orthometric and Ellipsoid Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1076.021	.262		980.680	.197	2007	GPS - RTRN	2012	RTRN2012

Geoid Separations(ft): GEOID12A\12B = -95.416 GEOID09 = -95.341 GEOID03 = -95.344 More

Lat/Lon and County Coordinates (Feet)

NAD83(2007)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 45 15.71437	94 39 38.80191	553692.418	241733.519	.131	3	GPS - RTRN	2012	RTRN2012

State Plane and UTM Coordinates (Feet)

NAD83(2007)

MN State Plane - North Zone		UTM - Zone 15					Project Info	
X	Y	X	Y	Acc	Order	Determination Method	Year	Reference
2248153.813	1154194.456	1239933.461	17721357.812	.131	3	GPS - RTRN	2012	RTRN2012

Station Photos

Type	File Name	Dir	Date
Location:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3904_H-DP0942-3NW-23OCT2012.jpg	NW	Oct 23, 2012
Monument:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3904_H-DP0942-2-23OCT2012.jpg		Oct 23, 2012
Disk:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3904_H-DP0942-1-23OCT2012.jpg		Oct 23, 2012

** All station images can be viewed at: ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos **

3904 H - 23OCT2012

3904_H-DP0942-2-23OCT2012

MnDOT Name: 3904 V **NGS Name:** 3904 V

County: LAKE OF THE WOODS, MN (Sheet 2)

NGS ACRN: DP0950 Get Map
NGS Quad / Sta Num : 48094413/
USGS Quad: WHEELERS POINT

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
SE	24	162 N	32 W	485014.62	944158.21	2	3

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
2012	2017	GOOD	Horz=YES Vert=YES	YES		RECESSED 2 IN.	BAR MAG IN DRILL HOLE

Monument Type	Disk Type	Mon. Agency
ALUMINUM ALLOY ROD (NO SLEEVE) (DEPTH 45 FT)	METAL ROD (WITH REMOVABLE ID DISK)	MNDT

Description: (2012) **Stamping:** 3904 V 2012

9.5 MILES NORTHWEST OF BAUDETTE, 11.55 MILES NORTHWEST ALONG TRUNK HIGHWAY 172 FROM THE JUNCTION OF TRUNK HIGHWAY 172 AND TRUNK HIGHWAY 11 IN BAUDETTE, AT TRUNK HIGHWAY 172 MILEPOINT 11.55, 45.2 FEET SOUTH OF TRUNK HIGHWAY 172, 65.7 FEET EAST OF THE WEST ENTRANCE TO WHEELERS POINT PUBLIC WATER ACCESS, 1.5 FEET WEST OF A WITNESS POST.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1068.338	.016	2/1				VERTICAL ADJUSTMENT	2014	00000828
1068.354	.016	2/1				VERTICAL CONTROL SURVEY	2013	VHACK

Non Leveling-Derived Orthometric and Ellipsoid Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1068.167	.262		972.255	.197	2007	GPS - RTRN	2012	RTRN2012

Geoid Separations(ft): GEOID12A\12B = -96.030 GEOID09 = -95.909 GEOID03 = -95.853 More

Lat/Lon and County Coordinates (Feet)

NAD83(2007)

Geodetic Position		Lake of the Woods County - South Zone					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 50 14.61883	94 41 58.21040	544276.971	272003.065	.131	3	GPS - RTRN	2012	RTRN2012

State Plane and UTM Coordinates (Feet)

NAD83(2007)

MN State Plane - North Zone		UTM - Zone 15					Project Info	
X	Y	X	Y	Acc	Order	Determination Method	Year	Reference
2239440.257	1184673.201	1231271.621	17751842.832	.131	3	GPS - RTRN	2012	RTRN2012

Station Photos

Type	File Name	Dir	Date
Location:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3904_V-DP0950-3S-28NOV2012.jpg	S	Nov 28, 2012
Monument:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3904_V-DP0950-2-28NOV2012.jpg		Nov 28, 2012
Disk:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/lake_of_the_woods/3904_V-DP0950-1-28NOV2012.jpg		Nov 28, 2012

** All station images can be viewed at: ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos **

3904 V - 28NOV2012 (2)

3904 V - 28NOV2012

MnDOT Name: C 209 **NGS Name:** C 209

County: ROSEAU, MN (Sheet 2)

NGS ACRN: TC0348 Get Map
NGS Quad / Sta Num : 48095141/
USGS Quad: WARROAD

1/4	Sec	Twp	Rng	Reference Latitude	Reference Longitude	Vert Order	Horz Order
SE	29	163 N	36 W	485421.99	951905.47	2	3

Year Set	Last Recovery	Condition	Geodetic Usability	Photos	Bridge Num	F/P/R	Magnetic Properties
1935	2012	GOOD	Horz=NO Vert=YES	YES		FLUSH	STEEL ROD IMBED IN MON

Monument Type	Disk Type	Mon. Agency
CONCRETE MONUMENT (CAST-IN-PLACE)	BENCH MARK DISK	CGS

Description: (2009) **Stamping:** C 209 1935

AT WARROAD, 0.1 MILE EAST ALONG COUNTY ROAD 74 (LAKE STREET NORTHEAST) FROM THE JUNCTION OF COUNTY ROAD 74 (LAKE STREET NORTHEAST) AND TRUNK HIGHWAY 11 IN WARROAD, THEN 0.1 MILE NORTH ON MAIN AVENUE NORTHEAST, 39.0 FEET SOUTH OF SOUTHWEST CORNER OF FORMER RAILROAD STATION (NOW CITY OFFICE 121ST MAIN AVENUE NORTHEAST), 16.6 FEET EAST OF EAST RAIL OF RAILROAD TRACKS, AT RAILROAD MILEPOST 38, 24.5 FEET SOUTHWEST OF ALUMINUM FLAG POLE, 6.5 FEET EAST OF CYCLONE FENCE AND A WITNESS POST.

Leveling-Derived Orthometric Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1071.156	.016	2/1				VERTICAL ADJUSTMENT	2014	00000828
1071.156	.016	2/1				VERTICAL CONTROL SURVEY	2013	VHACK
1071.156	.016	2/1				VERTICAL ADJUSTMENT	2000	00000365
1071.156	.016	2/1				VERTICAL CONTROL SURVEY	1998	VWARR
1071.156	.007	1/2				VERTICAL ADJUSTMENT	1991	00000025

NGVD29

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1069.778	.016	2/1				VERTICAL CONTROL SURVEY	1999	VWARR
1069.778	.033	3				VERTICAL CONTROL SURVEY	1987	CS6803
1069.794	.033	3				VERTICAL CONTROL SURVEY	1974	USGS-VERT
1069.794	.007	1				VERTICAL CONTROL SURVEY	1973	Q480951
1069.794	.007	1				VERTICAL CONTROL SURVEY	1973	L22862
1069.794	.007	1				VERTICAL CONTROL SURVEY	1941	Q480951
1069.794	.007	1				VERTICAL CONTROL SURVEY	1935	L56 MINN

Non Leveling-Derived Orthometric and Ellipsoid Heights (Feet)

NAVD88

Orthometric Height			Ellipsoid (NAD83)				Project Info	
Height	Acc	Order (/Class)	Height	Acc	Adj	Determination Method	Year	Reference
1071.189	.262		977.701	.197	2007	GPS - RTRN	2012	RTRN2012

Geoid Separations(ft): GEOID12A\12B = -93.543 GEOID09 = -93.487 GEOID03 = -93.468 More

Lat/Lon and County Coordinates (Feet)

NAD83(2007)

Geodetic Position		Roseau County					Project Info	
Latitude	Longitude	X	Y	Acc	Order	Determination Method	Year	Reference
48 54 21.98577	95 19 05.46749	700069.775	233251.200	.131	3	GPS - RTRN	2012	RTRN2012

State Plane and UTM Coordinates (Feet)

NAD83(2007)

MN State Plane - North Zone		UTM - Zone 15					Project Info	
X	Y	X	Y	Acc	Order	Determination Method	Year	Reference
2091190.492	1213414.101	1083100.956	17780833.028	.131	3	GPS - RTRN	2012	RTRN2012

Station Photos

Type	File Name	Dir	Date
Location:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/roseau/C_209-TC0348-3W-09OCT2012.jpg	W	Oct 9, 2012
Monument:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/roseau/C_209-TC0348-2-09OCT2012.jpg		Oct 9, 2012
Disk:	ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos/roseau/C_209-TC0348-1-09OCT2012.jpg		Oct 9, 2012

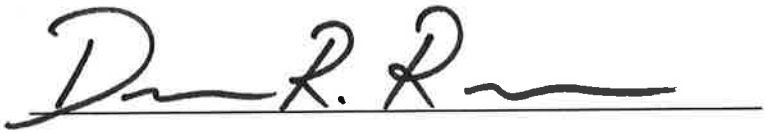
** All station images can be viewed at: ftp://ftp.olmweb.dot.state.mn.us/geod/StationPhotos **

C_209 - 09OCT2012 (2)

C_209 - 09OCT2012

This report was prepared by Widseth Smith Nolting for Lake of the Woods County in 2017, in conjunction with the Lake of the Woods County Land and Water Planning Department and Soil and Water Conservation District. The report is based on field surveys conducted during the months of June through October, 2017. Extensive research was done to determine the historical levels of Lake of the Woods and the reference marks established to monitor these elevations. For more detailed information regarding this survey, contact the offices of Widseth Smith Nolting.

I hereby certify that this report was prepared under my direct supervision and that I am a duly licensed Land Surveyor under the laws of the State of Minnesota.



Donn R. Rasmussen , L.S. 16102

Lake of the Woods County Surveyor

WIDSETH SMITH NOLTING

Engineering | Architecture
Surveying | Environmental