USH 2 – Bad River Flood Impacts

Odanah – Ashland Conty

Existing Conditions

WisDOT Project 1180-00-04

July 24, 2026

kapur

Table of Contents

Overview

Kapur & Associates has been retained by the Wisconsin Department of Transportation Northwest Region (NWR) to complete a planning study related to flooding on the Bad River on or around US 2 in Odanah in Ashland County within the Bad River Reservation. The purpose will be evaluating existing conditions and developing mitigation alternatives to flooding impacts for 0.67 mile of US 2 from Old Odanah Road to Government Road (Figure 1). This study is being funded under a US Department of Transportation - Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT) grant.

This study will evaluate alternatives to make US 2 more resilient to flooding including existing preliminary hydraulic analysis, preliminary engineering, and cost-benefit analysis. Alternatives to investigate may include increasing the elevation of US 2 and the bridge and providing alternative routes across the Bad River when the US 2 structure or alignment is overtopped. Results of the report may be used to support future grant applications for design or construction. Coordination for this study includes outreach to the Bad River Band of Lake Superior Chippewa Tribe.

Figure 1 – US 2 Odanah – Ashland County

Study Area

The Bad River, in the vicinity of US 2 at Odanah, has a long-documented history of flooding. Notable historic floods on the Bad River include:

- June 1946: Torrential rains of over 9 inches sent three feet of water roaring through Odanah and washing away numerous bridges and railroad grades. This event was large and of an unknown recurrence Interval[1].
- July 1949: Flood that caused severe damage 10 miles south of US 2 in Mellen. The 1949 event does not have a known recurrence Interval.
- April 1960: Event that was noted as the third largest event with an associated 200-year recurrence Interval.
- July 11–12, 2016: The most catastrophic flood on record where rainfall of 8–12 inches fell in less than 24 hours, causing the river at Odanah to skyrocket from 300 to a record 40,000 cubic feet per second with an associated 500-year recurrence Interval.

The 2016 flood destroyed local road networks, including damage to US 2. In 2018 there was an additional flood event on the Bad River that was consistent with a 10-year reccurrence Interval.

Crossings of the Bad River at Odanah were established in 1923 by the State Highway Commission at the current State Street Road on the west across the Bad River to Miller Road on the east, 640 feet downstream of the existing structure B-02-05. This is what may be referred to as "Old US 2". There is also a remnant Chicago & Northwestern railroad bed that crosses the flood plain just south of New Odanah (Figure 1).

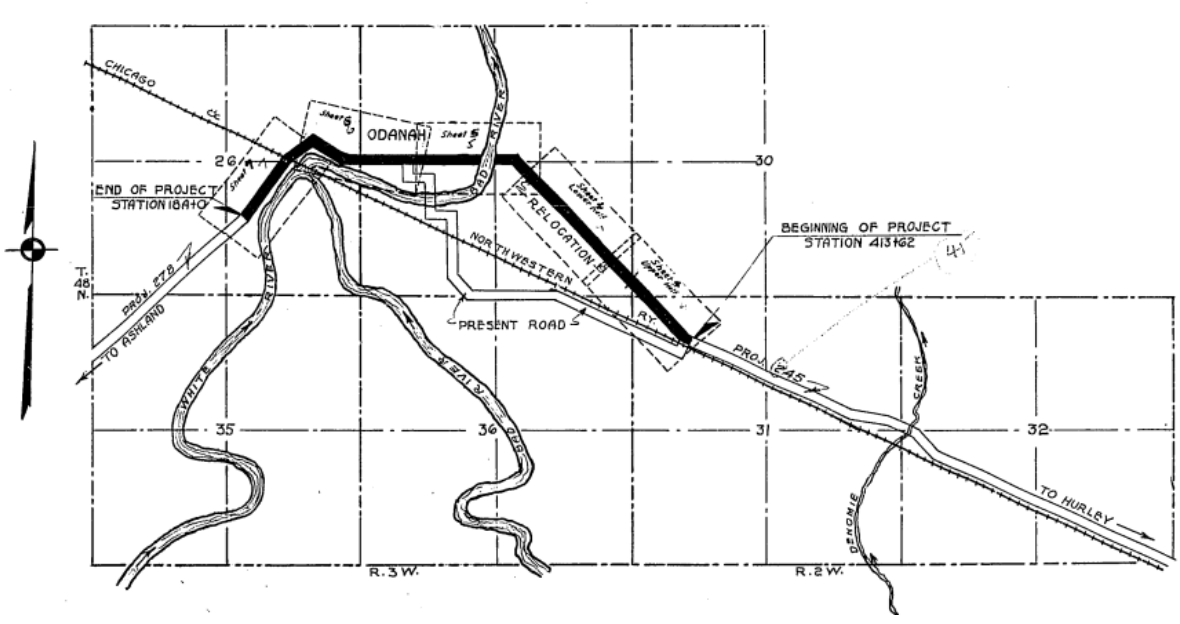


Figure 1 – 1923 crossing of Bad River - Odanah

[1] The recurrence interval is the average interval of time within which the given flood will be equaled or exceeded once.

The current US 2 alignment, Bad River Bridge B-02-005, and Kakagon Slough Bridge B-02-006 (east side of intersection of US 2 & Old Odanah Road that serves as an overflow/supplemental structure for the Bad River) were constructed in 1960. The 1960 US 2 alignment, grade and structures significantly increased the roadway grades across the wide Bad River floodplain provided two bridges to convey flow. (Figure 2).

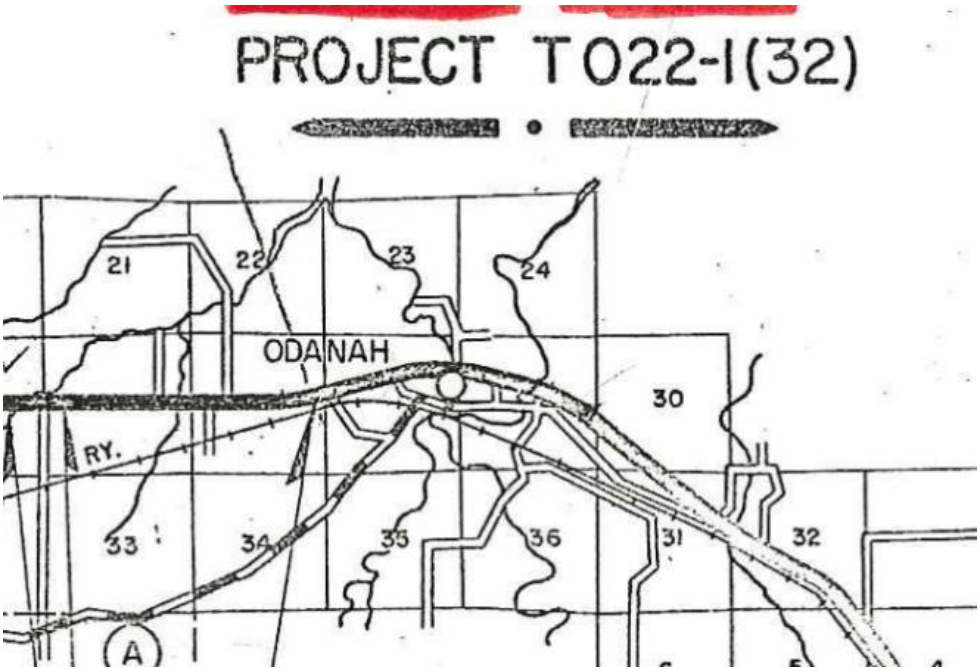


Figure 2 – 1960's crossing of Bad River

Near US 2 and south of Odanah, there is a confluence of the White River with the Bad River along the south side of Old US 2. In addition to the Bad and White River, the floodplain incorporates waters from the smaller Kakagon River, also known as "Sucker Creek," by local residents, on the far eastern edges near the intersection of Caville Road and US 2.

The areas of New Odanah near the confluence and around the Bad River Tribal grounds are predominantly low-lying areas prone to inundation from the 2-year & 5-year flood waters of both the Bad and White Rivers. Local roads and properties are often inundated by flooding. The lands upstream of New Odanah are predominantly low-lying densely vegetated/wooded forests with sporadic residences along various local roads. The areas downstream of the US 2 alignment are lowland areas of the Bad River estuary and Kakagon Slough that are often inundated and drain to Lake Superior two miles downstream of USH 2.

September 2025 discussions with both Bad River Tribal representatives and Ashland County Highway Department staff indicate that various roads within the state and local system require closures and repairs because of frequent flooding. The July 2016 flood event within the Bad and White River drainage basin was an extreme event characterized as a 500-year recurrence interval. There is a detailed U.S. Geological Survey (USGS) report that has examined the extent of the 2016 flood and documented numerous highwater marks from that event (Ref. 1).

Roadways that have been inundated and damaged by various historic flood waters in the vicinity of New Odanah include:

- US 2 between Caville Road (west) and Reservation Highway 4 (east)
- Government Road between US 2 (north) and Government Road Bridge (south)
- Caville Road, Old US 2, Old Odanah Road, State Street, Reservation Highway 3, and other local roads in New Odanah.

Table 6 provides details on specific roads, limits of flood overtopping, and recurrence interval of flooding.

The 2016 flood event caused six days of closure to US 2, damage to the US 2 Kakagon Slough Bridge B-02-006, shoulder damage to US 2 west and east of the Bad River, damage and closure to three BIA bridges and damage to two town road bridges. In all it was estimated that there was $2.6 million in damage to BIA, Tribal, and town roads and bridges[2].

Engineering

Hydrology

The Bad River drainage basin at the US 2 project site is mainly within the Lake Superior Lowland regions. In general, the area consists of relatively flat plains underlain by varying thickness of red clay and sloping to the north toward Lake Superior. The Bad River starts in the Northern Highland Region and cuts through steep escarpments associated with relict shorelines of ancient Lake Superior. An extensive wetland complex extends northward of Odanah toward Lake Superior (1). The White River has a confluence with the Bad River approximately 0.75 mile upstream of the US 2 Bad River crossing. The Kakagon River (Sucker Creek) enters the Bad River basins on the upstream side of US 2 on the western fringe of the floodplain near the intersection of Caville Road (Figure 2a). Kakagon Slough that flows through Structure B-02-006 is an overflow channel of the Bad River.

The U.S. Geological Survey StreamStats hydrologic analytical tool was used to determine drainage basin characteristics for the White River, Bad River, and combined basin. Peak flow discharge estimates were developed using methods presented in the USGS publication "Estimating Flood Magnitude and Frequency for Unregulated Streams in Wisconsin", Scientific Investigations Report 2022–5118(2). This publication presents regional regression equations for estimating peak discharges for a range of recurrence intervals. The historic gaged flood discharges estimate and basin characteristics are used to develop regression equations relating basin characteristics to flood magnitudes. These regression equations can then be used to estimate probable flood discharges at ungaged locations (2). Comparison of upstream gage stations to project sites was conducted with procedures as outlined in reference (2).

[2] (Ref 3) Bad River Band of Lake Superior Chippewa – Flood Damage July 2016 (Presentation slides). No estimate of US repair cost for 2016 event is available.

The locations of the waterways are shown in Figure 2A, and the drainage areas of the Kakagon, White, and Bad Rivers are shown in Table 1.

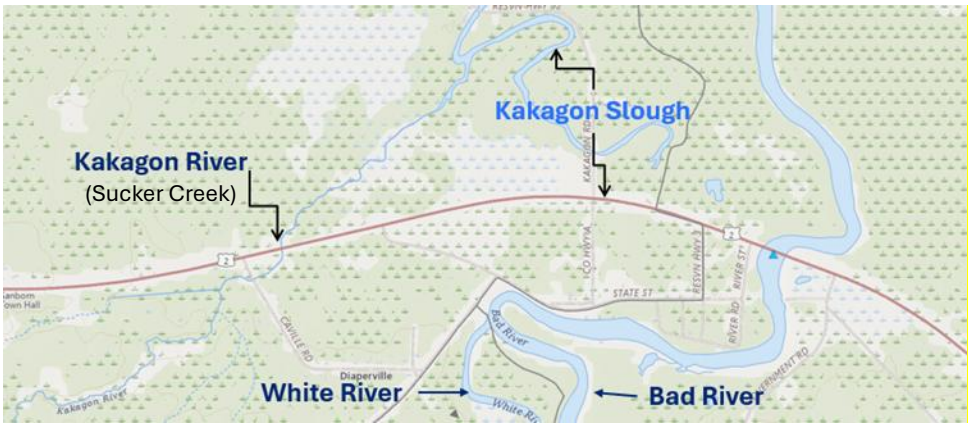


Figure 2A – River Reaches at Odanah

River Reach	Drainage Area (SQ. MI.)
Kakagon River (Sucker Creek) at US 2	2.83
White River at mouth	334
Bad River at confluence of White River	626
Bad River at US 2	960

Table 1 – Basin Drainage Areas

Upstream of the project, the Bad River at Odanah (USGS Gage 04027000) and the White River near Ashland (USGS Gage 04027500) shown in Figure 3 are both long record gages with Bad River data going back to 1915 and the White River data going back to 1949. These two gages provide excellent coverage of the basin with 90% of the basin drainage area with long-term gage records.

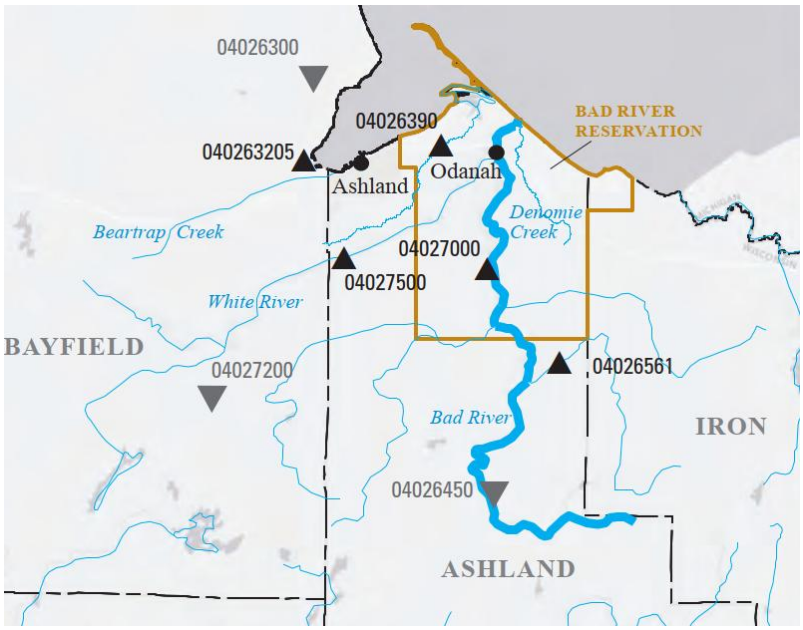


Figure 3 – USGS Upstream Gage Locations

Heavy rain fell across northern Wisconsin and the Bad River Reservation on July 11, 2016, because of several rounds of thunderstorms. The storms caused major flooding in the Bad River basin and nearby tributaries along the south shore of Lake Superior. Rainfall totals were 8–10 inches or more, and most of the rain fell in an eight-hour period. The stream gage on the Bad River near Odanah (USGS 04027000) rose from 300 cubic feet per second (CFS) to a record peak streamflow of 40,000 CFS in only 15 hours [2] while the streamgage on the White River (USGS Gage 04027500) rose from 250 CFS to 8600 CFS. The timing of the peak discharges at each gage on July 12, 2016, was close and approximately seven hours apart with the White River peaking earlier than Bad River. The flood events of July 2016 have been characterized as more than a 500-year event on the Bad River gage (USGS 0402700) (AEP<0.002) and the event on the White River gage (USGS 04027500) was characterized as between a 100-year and 200-year event (AEP 0.005-0.01) [1].

The estimate of peak flows at the project site is the combination of the weighted flood discharge estimate from the regional regression equation. The regression equations were combined with the weighted-average flood discharge estimate and the regression-based flood discharge estimate from the upstream gages to produce an improved estimate as outlined in reference (2). Table 2 shows a summary of the recurrence intervals and discharges used for the hydraulic analysis.

Recurrence Interval (years)	Bad River (CFS)	White River (CFS)	Total Flow (CFS)
2-Year	6842	1855	8697
5-Year	10523	2927	13450
10-Year	13509	3701	17210
25-Year	17660	4769	22429
50-Year	21380	5618	26997
100-Year	25224	6491	31715
200-Year	29585	7408	36992
500-Year	36108	8697	44806

Table 2 – Flood Recurrence Interval Flows

Hydrological analysis of the Kakagon River (Sucker Creek) basin indicates the Kakagon River is a minor contributor to the overall flood flows of the Bad River floodplain with a drainage area of only 2.83 sq. mi. and estimated Q100 Regression flow of 149 CFS. Given that the drainage area of the Kakagon (Sucker Creek) basin upstream of US 2 is only 0.3% of the overall basin and the peak discharge would occur long in advance of the Bad River peak discharges, this flow was deemed negligible in the hydraulic analysis of the Bad River floodplain at US 2. Refer to Appendix B-Hydrology for more details. The Kakagon Slough, that flows beneath structure B-02-006, serves as overflow from the Bad River during flood events and has no unique drainage area of its own.

Existing Hydraulics

The geometric information used in the hydraulic analysis is based on Lidar topographic mapping that was obtained from the Bad River Band of Lake Superior Chippewa Tribal Planning Department (Figure 4). WisDOT Northwest Region provided additional field surveys of roadways, structures, and stream cross sections that were collected in September 2025. Kapur did site review in September 2025 to examine structures, roadways, and river conditions.

Hydraulic analysis was done using the U.S. Army Corps of Engineers HEC-RAS River Analysis System, version 6.6.[5] The analysis of the Bad River floodplain in the project area encompassed floodplain reaches 3,200 feet downstream of US 2 and 12,400 feet upstream of the US 2 bridge beyond the Government Road Bridge over the Bad River. The White River was also included in the analysis of the floodplain from northern confluence with the Bad River and 2,200 feet upstream (Figure 4).

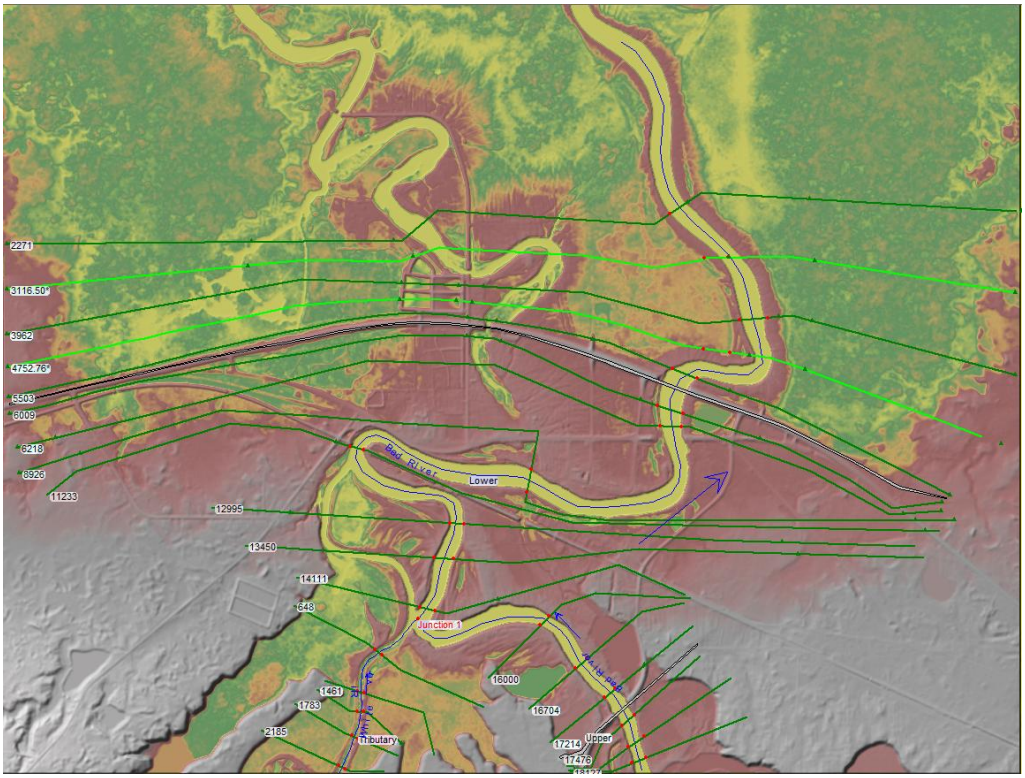


Figure 4 – Lidar Coverage and Limits of Hydraulic Analysis

Downstream Bad River boundary conditions for the hydraulic analysis were based on slope conveyance with examination of survey data and historic 2016 river profiles of the Bad River as presented in Reference (1). Field survey reflected a very flat normal flow energy gradient. Manning roughness coefficients were assigned based on field review and reflect the meandering nature of the main channel and very dense vegetation of overbanks and floodplain areas.

The HEC-RAS model was set up with four conveyance sections modeled as multiple opening routine for the US 2 alignment and bridges. These conveyance sections represented:

- Potential US 2 roadway overflows between Caville Road and Old Odanah Road
- US 2 bridge B-02-006 over Kakagon Slough (overflow from the Bad River)
- US 2 bridge B-02-005 over Bad River main channel
- Potential US 2 roadway overflow section east of Government Road intersection

The model runs continuous water surface profiles from the reaches downstream of US 2 up through the confluence with the White River and upstream of the confluence with both the White River and the Bad River past the Government Road Bridge. Water surface profiles were developed for the 2-year through 500-year event (Appendix C1).

Historic Flood Information

The 2017 USGS report - Flood of July 2016 in Northern Wisconsin and the Bad River Reservation characterized the 2016 event at the upstream Bad River Gage (0427000) as having a recurrence Interval of a 500-year flood event. This 2017 USGS report also provides many 2016 flood high-water marks that were used to compare HEC-RAS hydraulic model performance to historic observations.

In addition to the USGS 2017 report, we discussed US 2 roadway overtopping observations with Matt Erickson, Ashland County Highway Department commissioner, and Tribal/local road observations with Ben Connors Sr., Bad River Band of Lake Superior Tribe of the Chippewa Indians Tribal road manager. Matt indicated the county has responded to several overtopping events over the past decade in the area east of the main channel and US 2-Government Road intersection. Matt also shared pictures and comments about the scour damage that occurred at the Kakagon Slough Bridge, B-02-006, during the 2016 flood (Figure-5).

Figure 5 – 2016 Scour damage at B-02-006, Kakagon Slough

Existing Flooding Characteristics – 2016 Flood

The 2016 flood event (500-year event) exceeded a 100-year design event storm; however, the 2016 event is of similar infrequent magnitude and provides a wealth of information about how this complex floodplain behaves hydraulically. The 2016 event was modeled to calibrate the hydraulic model given the abundance of available data about that event. The HEC-RAS model was run with the 500-year event flow values for the Bad River and White River tributary splitting flow at the junction of the White River and Bad River. The HEC-RAS model was refined and calibrated to generally reflect the results of the observed 2016 high-water marks for the 500-year event flow values. Calibration included additional cross sections, adjustment of effective flow areas, review of Manning roughness values and expansion/contraction coefficients. The HEC-RAS Model produced reasonably close calculated results as compared to the 2016 event (Table 3). The 2016 high-water marks varied by more than a foot and extended distances downstream of the US 2 alignment. This may be due to fewer observations in this downstream reach as well as measurement difficulties. Near the US 2 alignment, the historic high-water marks were in much better alignment with the results of the HEC-RAS model generally being within 0.50 feet (+/-).

Bad River Reach	HEC-RAS River Sta	W.S. Elev (ft.)	**2016 USGS (ft)**	**2016 USGS HWM_ID**
Lower	2271	610.41		
Lower	3116.50*	610.74	609.32	16125
Lower	3962	610.83		
Lower	4752.76*	610.92		
Lower	5503	611.09	611.39	16068
Lower	5756	US 2 & B-02-05 & B-02-06		
Lower	6009	612.48	611.61	16043
Lower	6218	612.55	611.97	16066
Lower	8926	612.92	613.27	16053
Lower	11233	613.28		

Table 3 – Comparison of HEC-RAS 500-Year Profile to 2016 USGS High-water Marks

The layout of the HEC-RAS cross sections fo the Lower Bad River (below confluence with the White River), Upper Bad River (above the confluence with the White River) and the White River (above the confluence with the Bad River) are shown in Appendix C1. A table of water surface profile results for flood recurrence intervals from two-year to 500-year are presented in Appendix C2.

Results of the floodplain analysis provide insight into locations of vulnerability of both the state highway system (US 2) as well as local and tribal roadways withing the Bad River floodplain and Reservation. The vulnerability of various sections of the road and structures varies by location and storm frequency (Table 6). From the analysis, the Tribal and local roads are much more vulnerable to inundation and damage at more frequent events as

compared to the US 2 alignment and structures that become vulnerable at less frequent events.

US 2 Roadway and Structures – 2016 Flood (500-year event)

The profile of US 2 has two distinct areas of flood overtopping (Figure 6). The first overflow section is located on the west side of the floodplain between Caville Road and Old Odanah Road. The west approach is a major overflow section that overflows approximately 4700 feet of US 2 (STA. 356+00 to STA. 403+00). The low point of the road between Caville Road and Old Odanah Road is 609.66 ft. at Station 369+72 as shown on recent US 2 as-built plans. For the 2016 flood, the depth of flow along this 5000-foot overflow section ranged from 0 to 2.72 feet (at 500-year event). Refer to Appendix A for detailed inundation mapping.

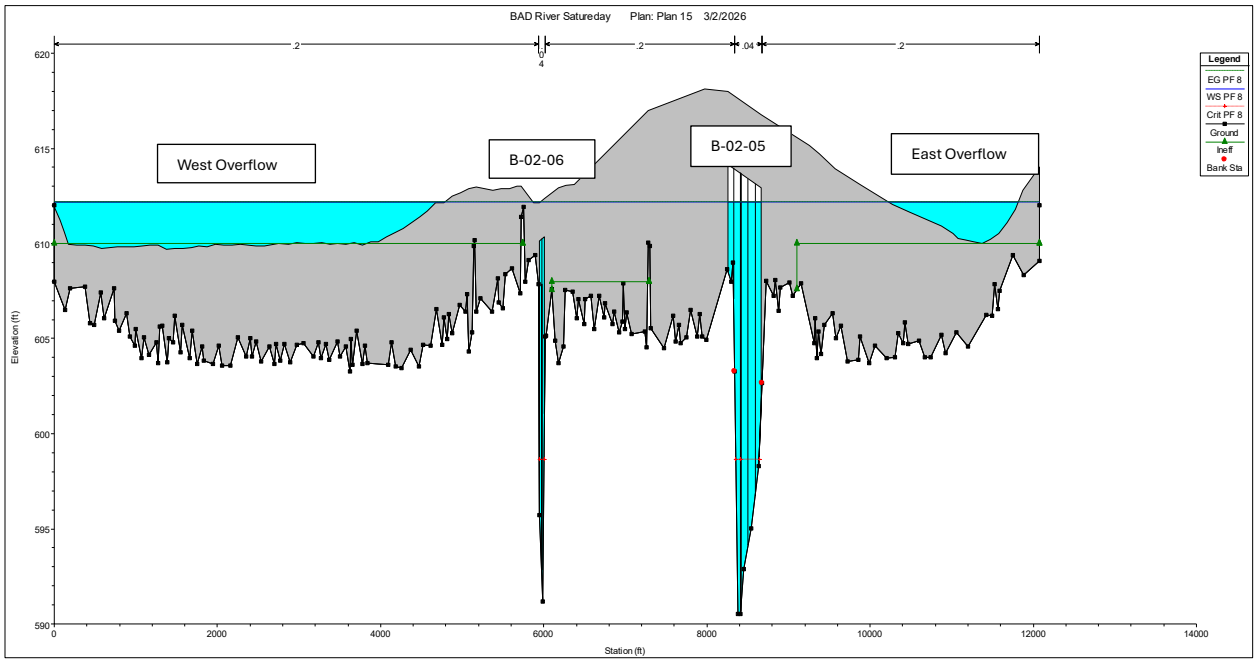


Figure 6 – USH 2 Overflow Sections

The second overflow section is located on the east side of the flood plain east of the intersection of Government Road. This east overflow section overflows approximately 1600 feet of US 2 (STA. 459+00 to STA. 475+00). The low point of the road on the east approach is 610.02 ft. at Station 470+00 as shown on recent US 2 as-built plans. For the 2016 flood, the depth of flow along this 1600-foot overflow section ranged from 0 to 2.62 feet (at 500-year event).

There are two bridges on this stretch of US 2 over the Bad River floodplain. Structure B-02-006 over Kakagon Slough is a two-span concrete slab that is 60 feet between centerline of abutments supported 75-foot 14-inch CIP piles. Structure B-02-005 over the Bad River main channel is a five-span steel multi-girder bridge that is 409 feet between centerlines of abutments supported on large concrete substructure and 12-inch CIP piles that are 65 feet long (Figure 7). There are various other small culverts along US 2 in the vicinity of Caville Road conveying the Kakagon River (Sucker Creek) as well as at US 2 east overflow section. Efforts to include these in the model presented stability problems to the calculations and preliminary results indicated at best they carried 100-200 CFS (0.63%) of the flow. .It was decided to omit these culverts as being inconsequential to the infrequent flood events of this study.

Figure 7 – B-02-006 over Kakagon Slough & B-02-005 over the Bad River main channel

For the 500-year event, the two US 2 bridges perform reasonably well with the exception that B-02-006 over Kakagon Slough experiences high velocities as the stage of the floodplain comes up and did experience a large scour event during 2016 that required repairs to the channel below the structure (Figure 5). The Kakagon Slough Bridge was inundated by flood flows and pressure flow. The water passing through the B-02-006, Kakagon Slough, are the result of overbank flow from the Bad River. The main Bad River Bridge, B-02-005, is in low flow with high water below the girders during the same event. The US 2 embankment and structures collectively create about 1.10 ft. of backwater for the 500-year event when compared to the water surface on the downstream side of the embankment.

Overflow of the US 2 embankment starts to occur at events slightly greater than a 25-year flood when the energy grade line of the upstream water surface reached elevation 609.66 ft. at Station 369+72. Refer to Appendix A for detailed inundation mapping.

Tribal Roadways and Structures – 2016 Flood (500-year event)

Most all the Tribal and local roads within and south of Odanah were inundated by the 2016 flood event (Figure 8).

The segments of Tribal and local roads that were inundated by the 2016 flood and 500-year hydraulic analysis:

- **Caville Road** - Intersection with US 2 to 1700 feet south at curve to the east
- **Old US Hwy 2** – From west intersection with US 2 transitioning into State Street to intersection with Odanah Road
- **Old Odanah Road** - From intersection with US 2 to Caville Road
- **Reservation Highway 3** - From intersection with US 2 south (all segments)
- **Odanah Street and River Road** - From the intersection of US 2 south (all segments)
- **Government Road** - From the intersection of US 2 south (all segments)
- **Miller Road** – From the intersection with Government Road to 2300 feet southeast.
- **Reservation Highway 4 (Dock Road)** – Just localized at the intersection with Government Road

Figure 8 – Inundation of Tribal & Local Roads (500-year event)

100-Year Flood Design Event

US 2 - 100-Year Flood Design Event

In Wisconsin, bridges are designed based on the 100-year flood event. For the Bad River at US 2, the Q100 design flow is 31,715 CFS. The US 2 existing conditions analysis indicates that the 100-year high-water elevation of 611.52 feet on the upstream side of the US 2 embankment. This corresponds to river station 6009. The US 2 100-year tailwater elevation on the downstream side of the embankment is 609.91 feet. The backwater caused by the US 2 embankment and bridges is roughly the difference between the upstream and downstream water surface elevations and equals 1.61 feet. Generally, the more backwater that exists, the more upstream high water may be influenced by increases in structure size (additional flow area through bridges). For the 100-year flood event, the water is conveyed though/over US 2 at four distinct locations, (1) the west approach US 2 overflow section, (2) Kakagon Slough Bridge B-02-006, (3) Bad River main channel bridge B-02-005, and (4) the east overflow section of US 2. Initial models included the Kakagon River (Sucker Creek) culvert at Caville Road; however, the smaller culverts did not appear to convey significant quantities of flood flows (< 150 CFS) and introduced calculation instability to the hydraulic model. Due to the minimal benefit for large flood events (100-year and 500-year) and calculational instability, the small culverts were omitted from the analysis of the four major conveyance sections. The flow distribution of these four conveyance sections is shown in Table 4.

Q100 = 31,715 (CFS)	US 2 West	B-02-006	B-02-005	US 2 East
Flow (CFS)	5,679	3,577	21,685	792
% Q100 Flow	17.8%	11.3%	68.4%	2.5%
Area (SF)	1,578	478	4,890	227
Velocity (FPS)	3.58	7.48	4.43	3.49
Depth (ft.)	1.85	N/A	N/A	1.71

Table 4 – 100-year event conveyance at US 2

Table 4, 100-year event conveyance at US 2 has notable characteristics that include:

- The main channel Bad River Bridge, B-02-005, carries 68.4% of the 100-year flood flow.
- The US 2 west approach overflow section conveys nearly the same amount of flow as the Kakagon Slough "relief" bridge, B-02-006.
- The depth of roadway overtopping is 1.85 feet in the west and 1.71 feet in the east US 2 approaches.

The US 2 100-year existing conditions results provide some insights into the areas of vulnerability and point to potential areas of opportunity for improvement. Combined roadway

overtopping represents only 20.3% of theflood flows conveyed at US 2. This coupled with the depth of overtopping ranging from 1.71 to 1.85 feet may lead to examination of minor grade increases to decrease frequency of overtopping. Given the 1.61 feet of backwater of this conveyance system, additional capacity at the current bridges locations (longer bridges) may reduce highwaters and the roadway overtopping frequency (from 25-year event to something less frequent).

Tribal/Local Roads - 100-Year Flood Design Event

On the upper reach of the Bad River south of the confluence with the White River, the 100-year design flow of the Upper Bad River of 25,224 CFS. Government Road Bridge (P-02-31) is in a combination of pressure flow with overtopping of the roadway (weir flow). The 100-year high-water elevation is 616.92 feet with a downstream water elevation of 615.19 feet resulting in a backwater of 1.73 feet. The velocity through the structure is 8.83 fps. The portion of Government Road south of the intersection of Reservation Highway 4 (Dock Road) that includes the bridge does not have roadway overtopping for events slightly less than a 100-year event. Summary of the segment of Government Road south of Dock Road is shown in Table 5.

Q100 = 25,224 CFS	P-02-31	Government Road
Flow (CFS)	24,486	738
% Q100 Flow	97.1%	2.9%
Area (sf)	2856	86
Velocity (fps)	8.83	-
Depth	N/A	0.66

Table 5 – 100-year event conveyance at Government Road Bridge (P-02-30)

Tribal/Local Roads – Roadway overtopping frequencies

One of the primary issues facing the Tribal and local roads in and surrounding Odanah is frequent and widespread flooding and inundation. Many of these local roads were constructed well below frequent flood elevations. As the Bad River floodplain experiences increased flood flows, the local roads progressively become inundated and damaged.

Table 6 shows roadways' inundation vulnerability, the frequency of flood event that overtops the roadway and general locations of the initial overtopping. Once overtopping has been initiated, the extent (length along the road and depth of overtopping) progressively increases. In many instances as shown by the flood inundation maps in Appendix A, the roads become completely inundated under flood waters.

Inundation Location & Frequency of roads around Odanah

Roadway	Location of initial overtopping	Overtopping Frequency
US 2 West	Overflow of the US 2 embankment starts to occur at events slightly greater than a 25-year flood when the energy grade line of the upstream water surface reached elevation **609.66 feet at Station 369+72**[3].	Between 25-Year & 50-Year Event Slightly less frequent than 25-Year event
Caville Road	Overtopping Caville Road starts **900 feet south of intersection of US 2 and Caville Road** when upstream water surface reached low point in road elevation **609.60 feet**	Between 10-Year and 25-Year Event Slightly less frequent than 10-Year event
Old US 2 (west) Between US 2 and Old Odanah Road	Overtopping Old US 2 starts **550 feet south of intersection of US 2** when upstream water surface reached low point in road elevation **605.40 feet**	2-Year Event
Old Odanah Road (N/S) Between Caville Road and Old US 2	Overtopping Old Odanah (N/S) starts **900 feet northeast s of intersection with Caville** when upstream water surface reached low point in road elevation **613.17 feet**	500-Year Event
State Street Between Old Odanah Road and Odanah Street	Overtopping State Street **between the intersection of Reservation Highway 3 and Odanah Street** when upstream water surface reached low point in road elevation **609.36 ft.**	25-Year Event
Government Road Between US 2 intersection and Reservation Highway 4 (Dock Road)	Overtopping of Government Road starts 334 feet south of intersection with Miller Road when upstream water surface reached low point in road elevation **608.73 feet**	10-Year Event
Miller Road	Overtopping of Miller Road starts 130 feet south of intersection with Government Road when upstream water surface reached low point in road elevation **607.35 feet**	5-Year Event
Reservation Highway 4 from intersection of Government. Road and East	Only at intersection of Government Road when water surface reached low point in intersection elevation **615.41** feet	250-Year Event
US 2 East	The low point of the road on the east approach is **610.02 feet at Station 469 +00** of recent US 2 as-built plans.	Between 25-Year & 50-Year event Slightly Less frequent than 50-Year Event

Table 6 – Inundation Location & Frequency of Roads Around Odanah

[3] US 2 Existing Plan and Profiles Sheets with alignments and Stationing - Appendix D

Key observation from existing conditions

- The low point of the US 2 roadway between Caville Road and Old Odanah Road is 609.66 feet at Station 369+72. This would begin to inundate because of downstream flood elevations for the 100-year event of 609.91 and be in danger of shoulder inundation due to the 50-year tailwater of 609.27 feet. Both downstream tailwater and upstream backwater are concerns for the west approach.
- The low point of the road on the east approach is 609.83 feet at Station 469+00. This is above the 100-year tailwater elevation of 609.91 feet. Backwater effects are the primary issue for overtopping on the east approach.
- Combined roadway overtopping represents only 20.3% of the 100-year flood flows conveyed at US 2. This coupled with the depth of overtopping ranging from 1.71 to 1.85 feet may lead to examination of minor grade increases to decrease frequency of overtopping.
- There is 1.61 feet of backwater for the 100-year event. This indicated that increasing the capacity of the bridges may help reduce upstream flood elevations and roadway overflow frequency for the 100-year event.
    - Examination of additional structure flow capacity (length of bridge) should be considered at both Kakagon Slough, B-02-006 and Bad River Bridge, B-02-005 as alternatives that could reduce upstream backwater and flood elevations.
- The Tribal route along Old US 2 through Old Odanah Road to State Street is mostly out of the 10-year flood. This could be a good candidate route of a new crossing of the Bad River upstream of US 2.
- The portion of Government Road south of the intersection of Reservation Highway 4 (Dock Road) that includes the bridge does not have roadway overtopping for events slightly less than a 100-year event.

References:

(1) Flood of July 2016 in Northern Wisconsin and the Bad River Reservation, Scientific Investigations Report 2017–5029, U.S. Department of the Interior, U.S. Geological Survey (2017) - Scientific Investigations Report 2017–5029.

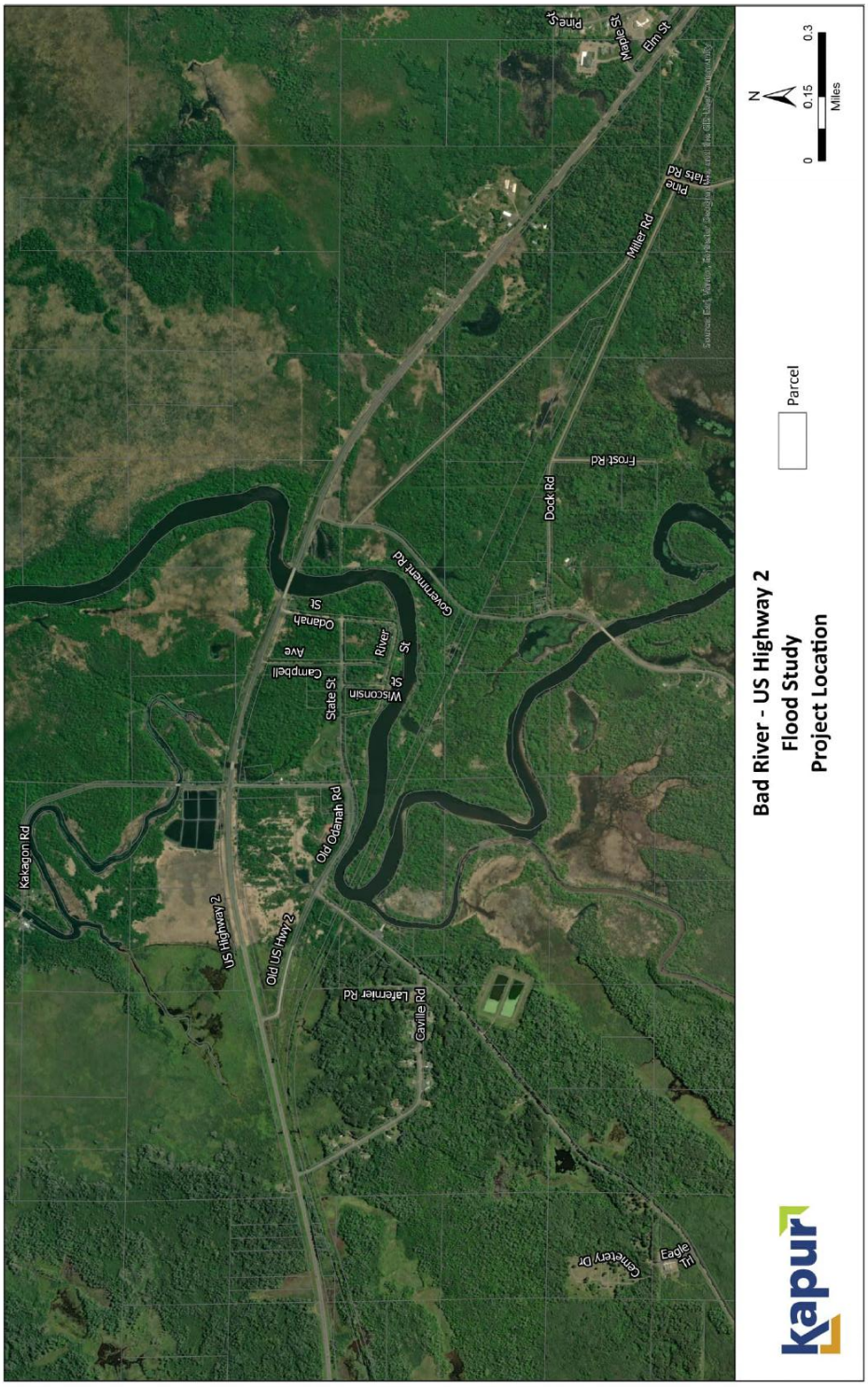
(2) "Estimating Flood Magnitude and Frequency for Unregulated Streams in Wisconsin", USGS Scientific Investigations Report 2022–5118

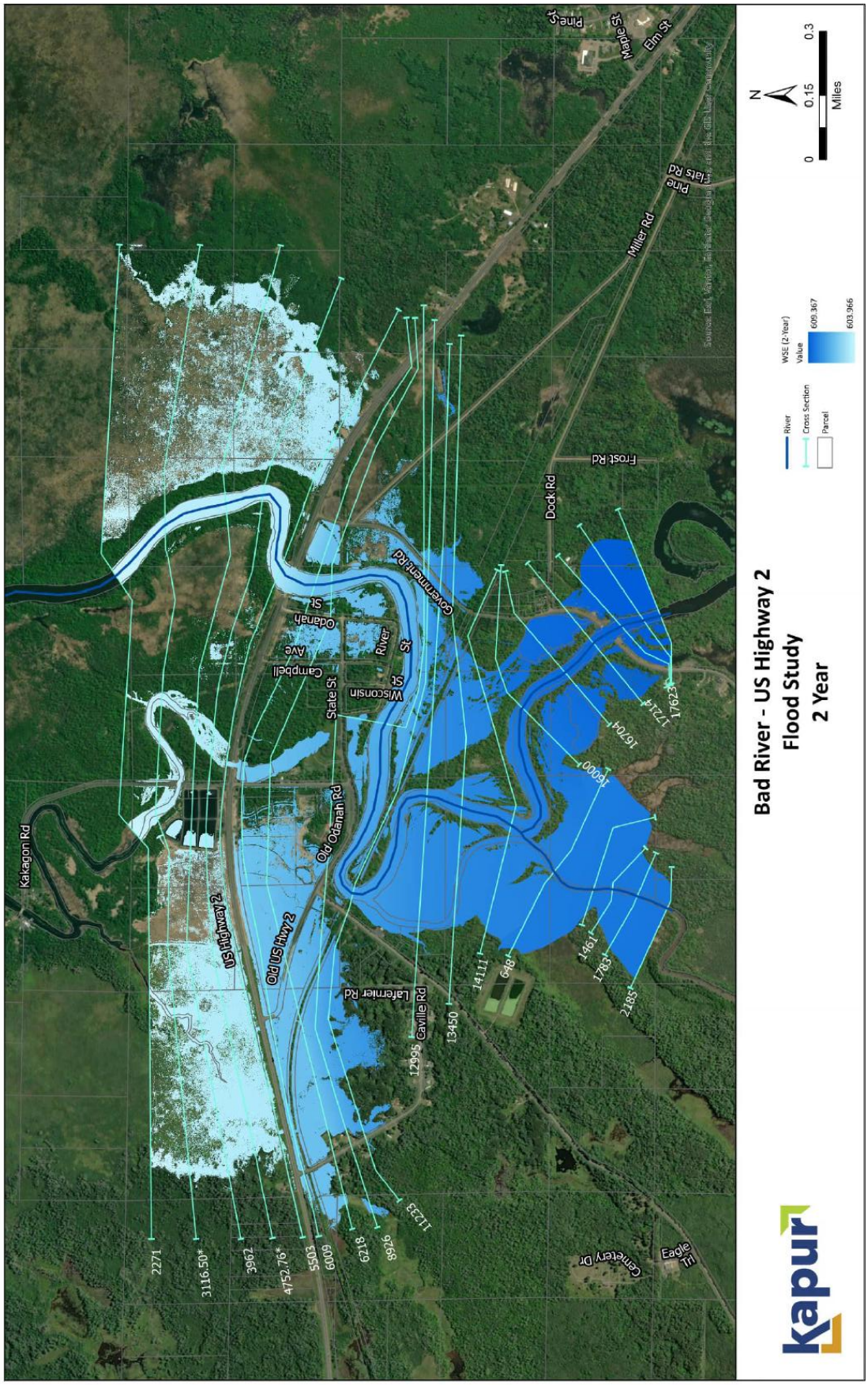
(3) Bad River Band of Lake Superior Chippewa – Flood Damage July 2016 (Presentation)

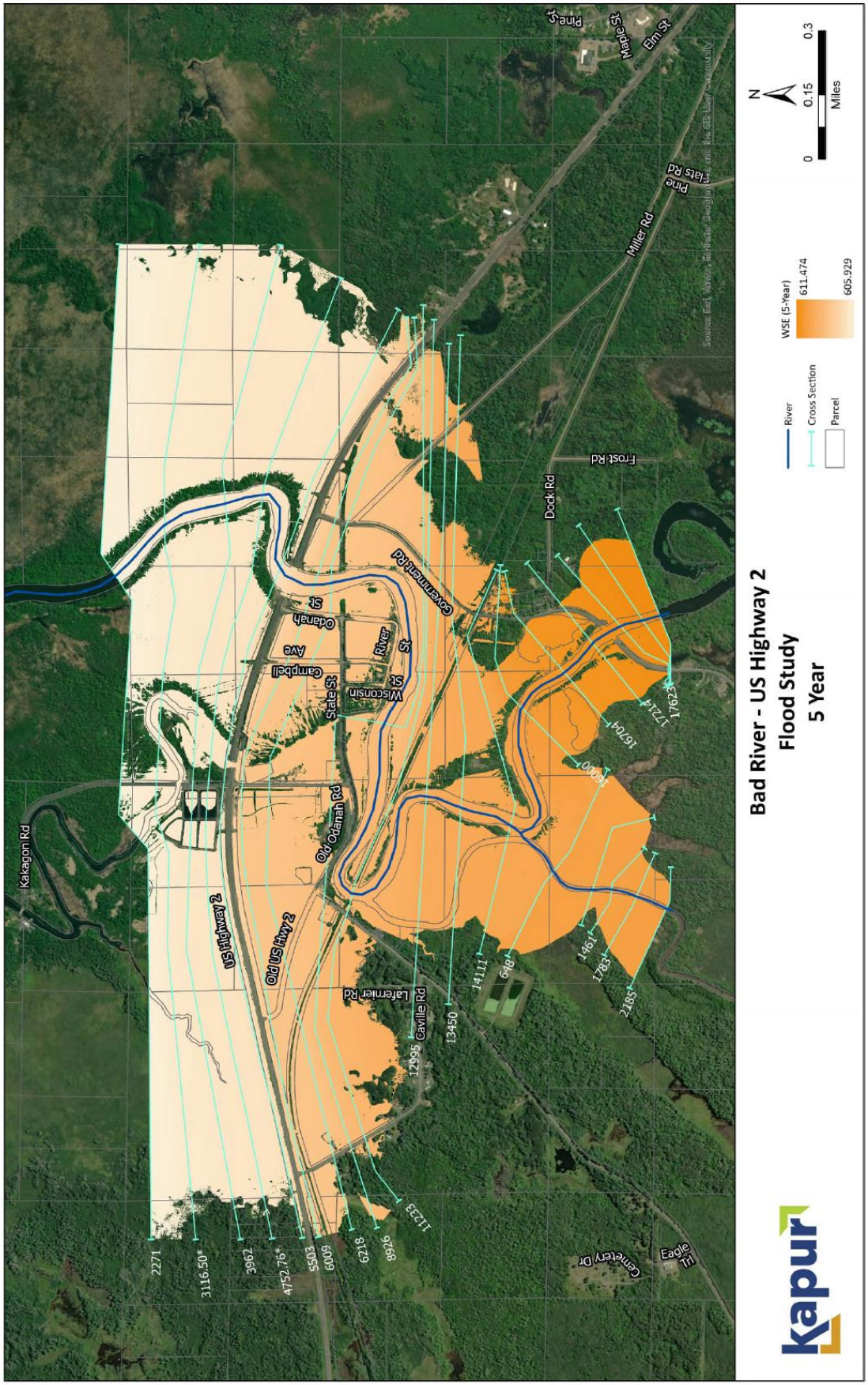
(4) Common Ground, Bad River Natural Resources, Naomi Tillison – 2016

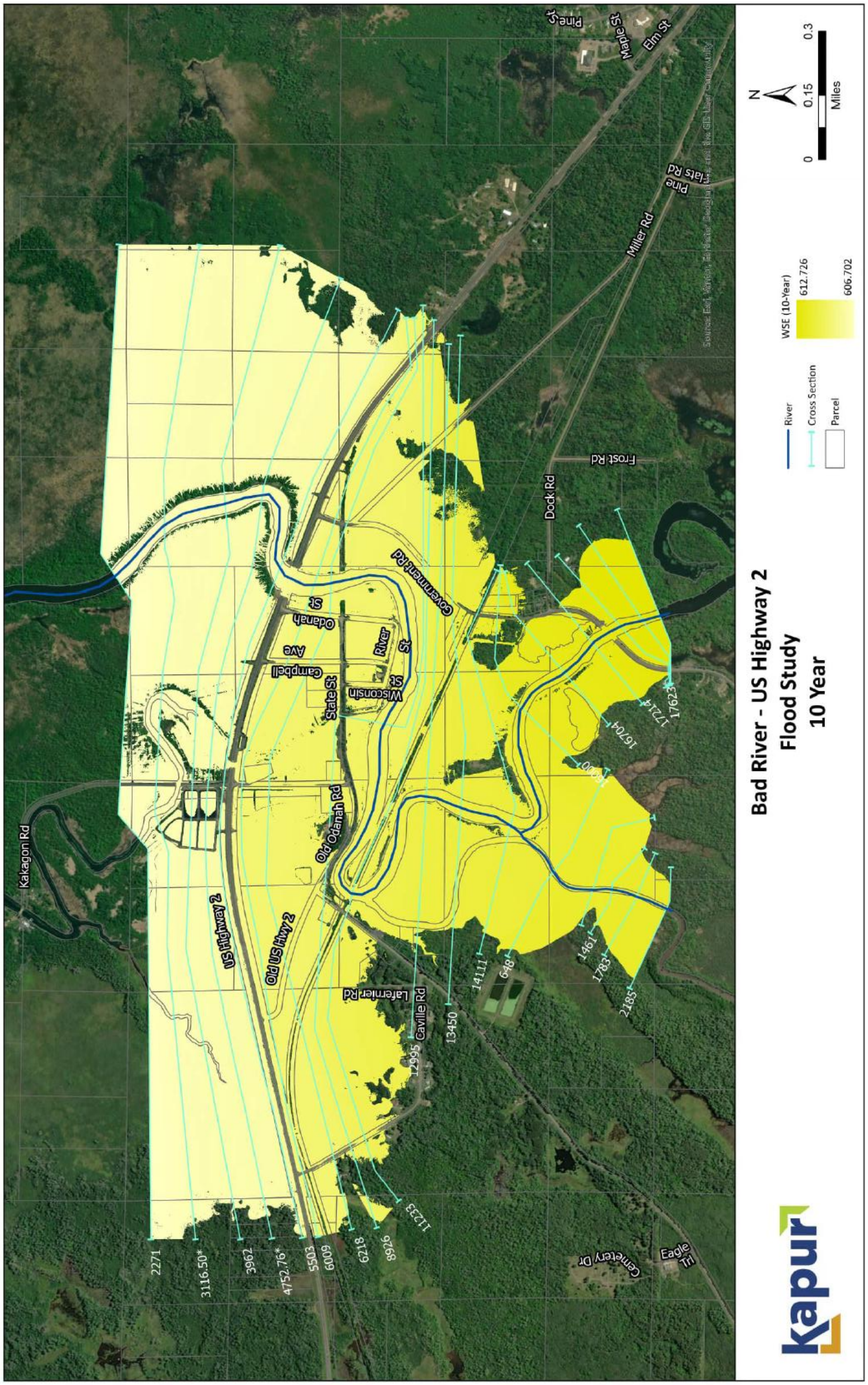
(5) US Army Corps of Engineers, Hydraulic Engineering Center – HEC-RAS River Analysis System Version 6.6 – September 20245

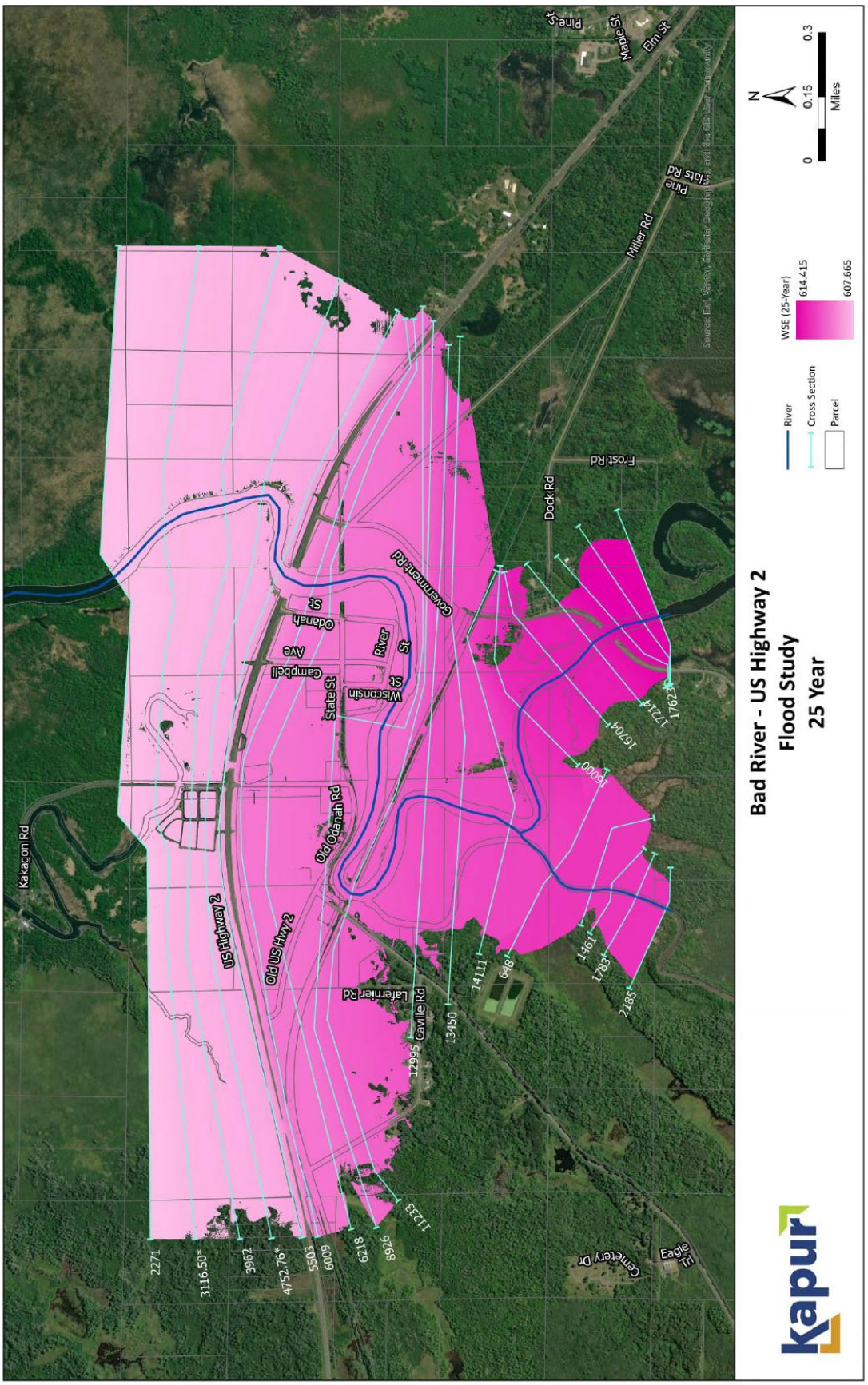
Appendix A – Flood Inundation Maps

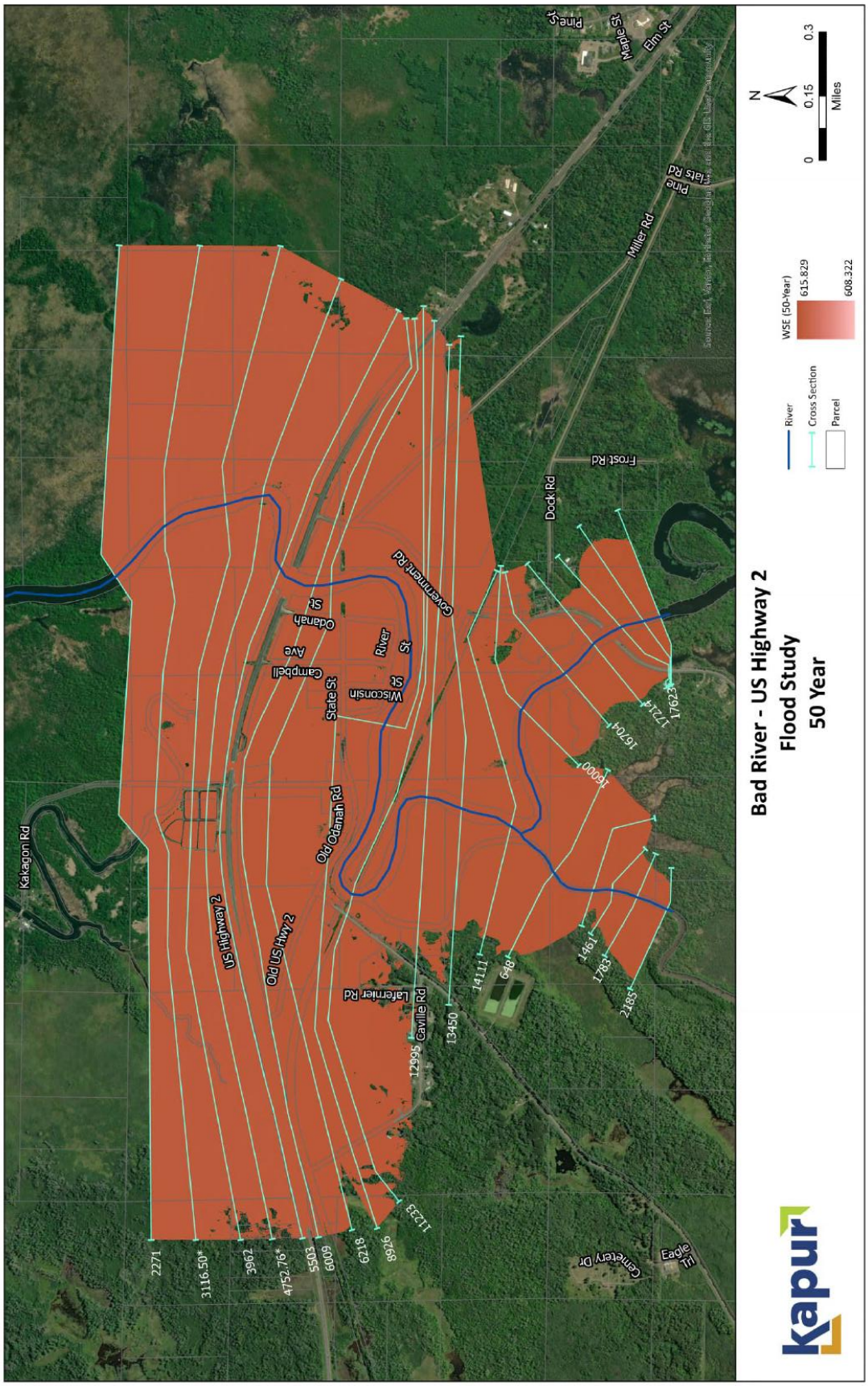


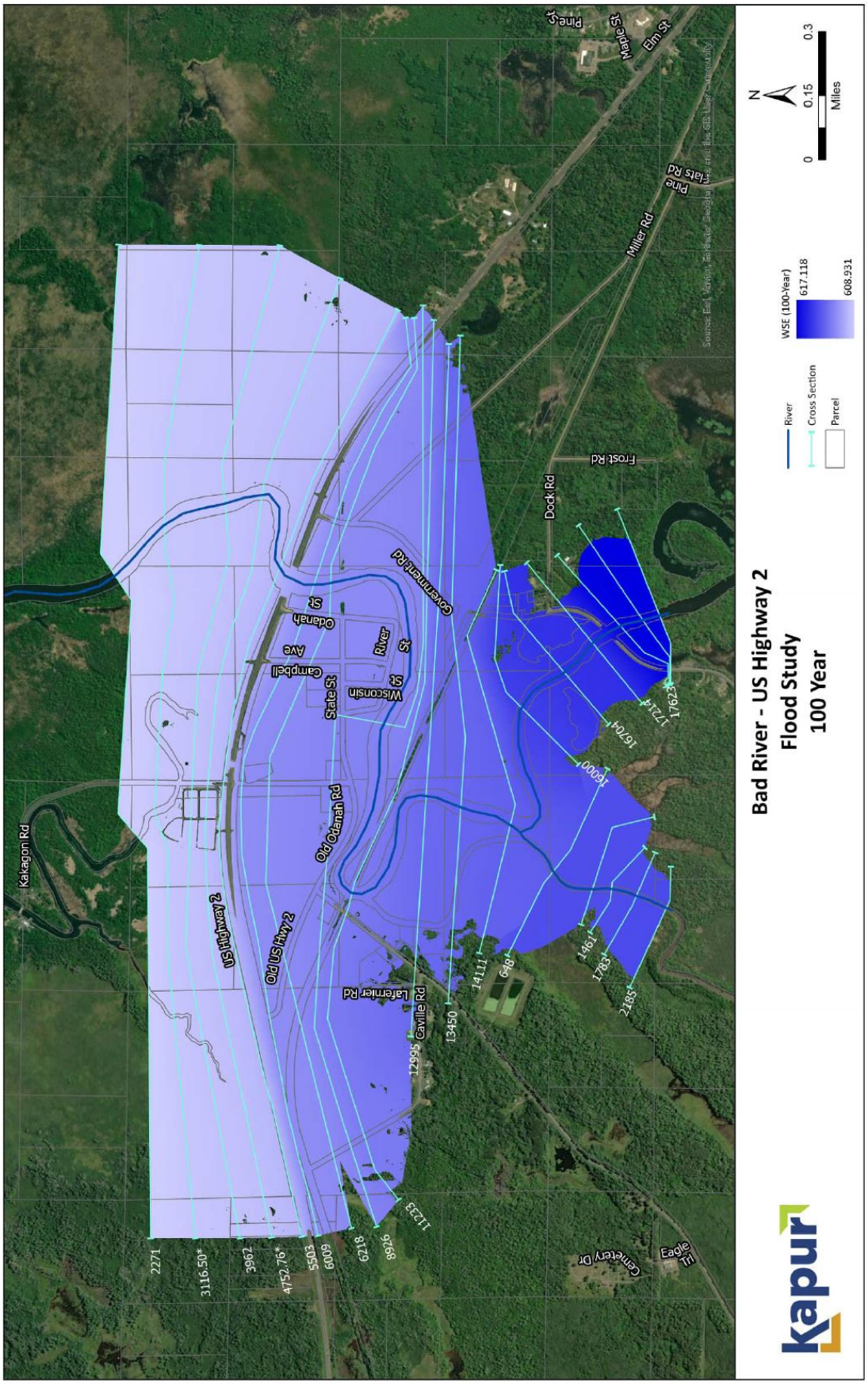

Bad River - US Highway 2
Flood Study
2 Year
N
0
0.15
0.3
Miles
River
Cross Section
Parcel
WSE (2-Year)
Value
609.367
603.966
Kakagon Rd
US Highway 2
Old US Hwy 2
Old Odanah Rd
Lafernier Rd
Caville Rd
Odanah St
Campbell Ave
State St
Wisconsin St
River St
Government Rd
Dock Rd
Frost Rd
Miller Rd
Pine Tabs Rd
Maple St
Elm St
Pine St
Cemetery Dr
Eagle Trl
2271
3116.50*
3962
4752.76*
5503
6009
6218
8926
11233
12995
13450
14111
648
1461
1783
2185
16000
16704
17224
17623

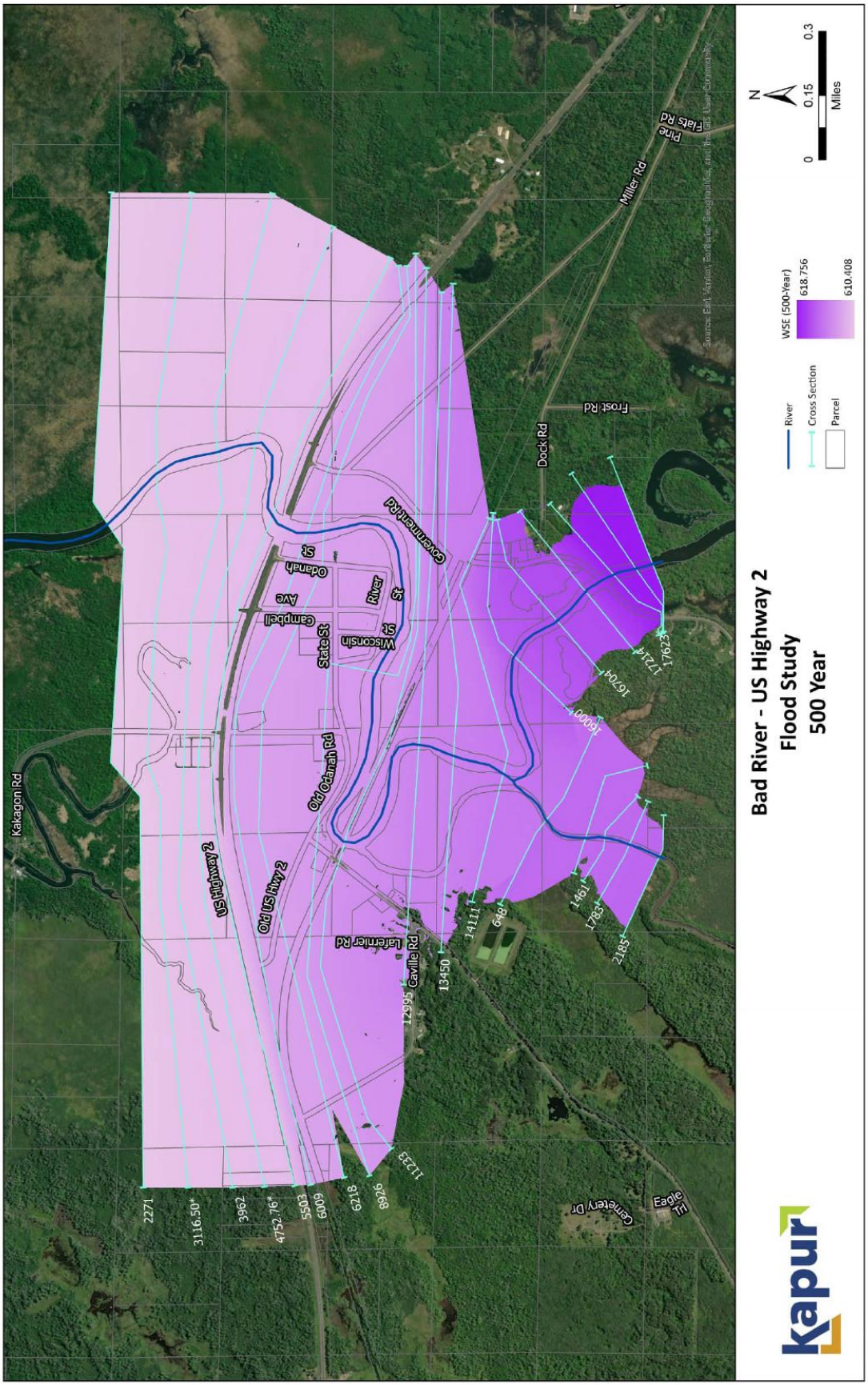

Bad River - US Highway 2
Flood Study
5 Year
WSE (5-Year)
611.474
605.929
River
Cross Section
Parcel
N
0
0.15
0.3
Miles
Kakagon Rd
US Highway 2
Old US Hwy 2
Old Odanah Rd
State St
Wisconsin St
Campbell Ave
Odanah St
River St
Government Rd
Dock Rd
Frost Rd
Miller Rd
Pine Flats Rd
Maple St
Elm St
Pine St
Laframier Rd
Caville Rd
Cemetery Dr
Eagle Tri
2271
3116.50*
3962
4752.76*
5503
6009
6218
6926
11233
12995
13450
14111
648
1461
1783
2185
16704
17243
17623


Bad River - US Highway 2
Flood Study
10 Year
River
Cross Section
Parcel
WSE (10-Year)
612.726
606.702
0
0.15
0.3
Miles
N
US Highway 2
Old US Hwy 2
Old Odanah Rd
State St
Campbell Ave
Odanah St
River St
Wisconsin St
Government Rd
Laferrier Rd
Caville Rd
Dock Rd
Frost Rd
Miller Rd
Pine Flats Rd
Pine St
Maple St
Elm St
Kakagon Rd
Cemetery Dr
Eagle Trl
2271
3116.50*
3962
4752.76*
5503
6009
6218
8926
11233
12995
13450
14111
648
1461
1783
2185
16000
16704
17214
17623


Bad River - US Highway 2
Flood Study
25 Year
WSE (25-Year)
614.415
607.665
River
Cross Section
Parcel
N
0
0.15
0.3
Miles
Kakagon Rd
US Highway 2
Old US Hwy 2
Old Odanah Rd
Lafernier Rd
Caville Rd
Government Rd
Odanah St
Ave
Campbell
State St
Wisconsin St
River St
Dock Rd
Frost Rd
Miller Rd
Pine Tars Rd
Pine St
Maple St
Elm St
Cemetery Dr
Eagle Trl
2271
3116.50*
3962
4752.76*
5503
6009
8178
8968
11233
12695
13450
14111
G48
14611
17831
21851
16104
16000
17224
17623


Bad River - US Highway 2
Flood Study
50 Year
WSE (50-Year)
615.829
608.322
River
Cross Section
Parcel
N
0
0.15
0.3
Miles
Kakagon Rd
US Highway 2
Old US Hwy 2
Old Odanah Rd
Government Rd
Odanah St
Campbell Ave
State St
Wisconsin St
River St
Dock Rd
Frost Rd
Miller Rd
Pine Flats Rd
Maple St
Elm St
Pine St
Lafernier Rd
Caville Rd
Cemetery Dr
Eagle Trl
2271
3116.50*
3962
4752.76*
5503
6009
6218
9268
11233
12995
13450
14111
648
14611
17837
21857
16704
16000
17623
17214


Bad River - US Highway 2
Flood Study
100 Year
N
0
0.15
0.3
Miles
WSE (100-Year)
617.118
608.931
River
Cross Section
Parcel
Pine St
Maple St
Elm St
Miller Rd
Pine Flats Rd
Frost Rd
Dock Rd
Government Rd
Odanah St
Campbell Ave
River St
Wisconsin St
State St
Old Odanah Rd
US Highway 2
Old US Hwy 2
Kakagon Rd
Lafernier Rd
Caville Rd
Cemetery Dr
Eagle Trl
17623
17124
16704
16000
14611
14461
13450
12995
11233
9238
6718
6009
5503
4752.76*
3962
3116.50*
2271
2185
1783
648


Bad River - US Highway 2
Flood Study
500 Year
WSE (500-Year)
618.756
610.408
River
Cross Section
Parcel
N
0
0.15
0.3
Miles
Kakagon Rd
US Highway 2
Old US Hwy 2
Old Odanah Rd
Larsen Rd
Caville Rd
Cemetery Dr
Eagle Trl
Frost Rd
Dock Rd
Miller Rd
Pine Flats Rd
Government Rd
Odanah St
Campbell Ave
State St
Wisconsin St
River St
2271
3116.50*
3962
4752.76*
5503
6009
6218
6968
11233
12995
13450
14111
648
14611
17834
2185
16000*
16704
17214
17623

Appendix B – Hydrology

Hydrologic Investigation

The Bad River drainage basin at the US 2 project site in Ashland County is mainly within the Lake Superior Lowland Regions (Figure B1). In general, the area consists of relatively flat plains underlain by varying thickness of red clay and sloping to the north toward Lake Superior. The Bad River starts in the Northern Highland Region and cuts through steep escarpments associated with relict shorelines of ancient Lake Superior. An extensive wetland complex extends northward of Odanah toward Lake Superior[1].

The White River has a confluence with the Bad River approximately 0.75 mile upstream of the US 2 Bad River crossing.

The Bad River has as well documented history of high-flow events that frequently overtop US 2 in the vicinity of the US 2 and Government Road intersection east of the existing bridge. In 2016 there is a well-documented high-flow event that resulted in multiple locations of US 2 and other surrounding roadways overflow with documented high-water marks.

Both the Bad River at Odanah (USGS Gage 0402700) and the White River near Ashland (USGS Gage 04027500) are both long record gages with Bad River data going back to 1915 and the White River data going back to 1949. These two gages provide excellent coverage of the basin with 90% of the basin drainage area with long term gage records (Figure B2).

Heavy rain fell across northern Wisconsin and the Bad River Reservation on July 11, 2016, because of several rounds of thunderstorms. The storms caused major flooding in the Bad River Basin and nearby tributaries along the south shore of Lake Superior. Rainfall totals were 8–10 inches or more and most of the rain fell in an eight-hour period. A stream gage on the Bad River near Odanah (USGS 04027000) rose from 300 cubic feet per second to a record peak streamflow of 40,000 cubic feet per second in only 15 hours [(1)]. Peak discharges at both stream gages occurred within six hours of each other on July 12.

Peak flow discharge estimates were developed using methods presented in the USGS publication “Estimating Flood Magnitude and Frequency for Unregulated Streams in Wisconsin”, Scientific Investigations Report 2022–5118[(2)]. This publication presents regional regression equations for estimating peak discharges for a range of annual exceedance probability (AEP) and recurrence intervals. Annual peak streamflow collected at U.S. Geological Survey (USGS) stream gages (U.S. Geological Survey, 2022) are used to estimate flood discharges at specific annual exceedance probabilities (AEPs). The estimated flood discharges at gaged locations are used to develop regression equations relating physical basin characteristics to flood magnitudes.

These regression equations can then be used to estimate probable flood discharges at ungagged locations. (2)

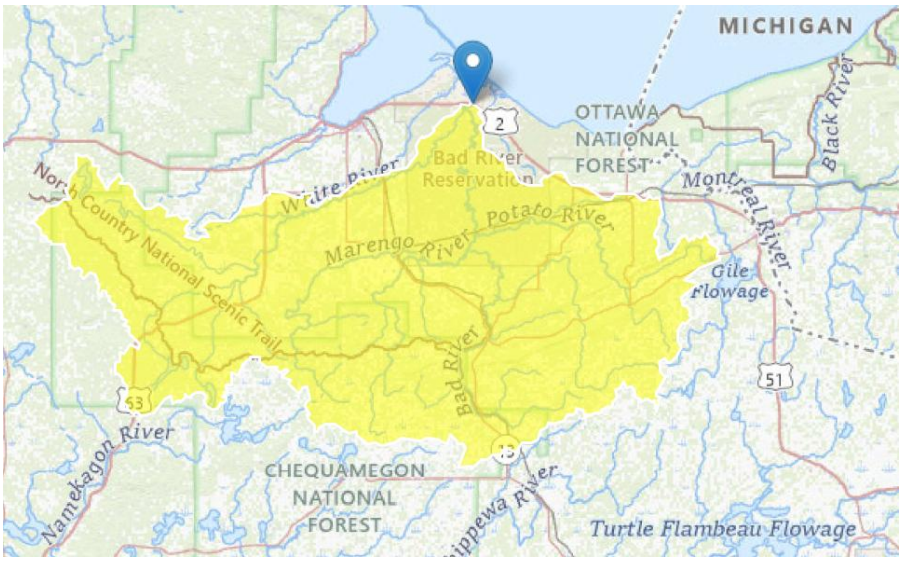


Figure B1 – Bad River at USH 2 – Contributing Drainage Area

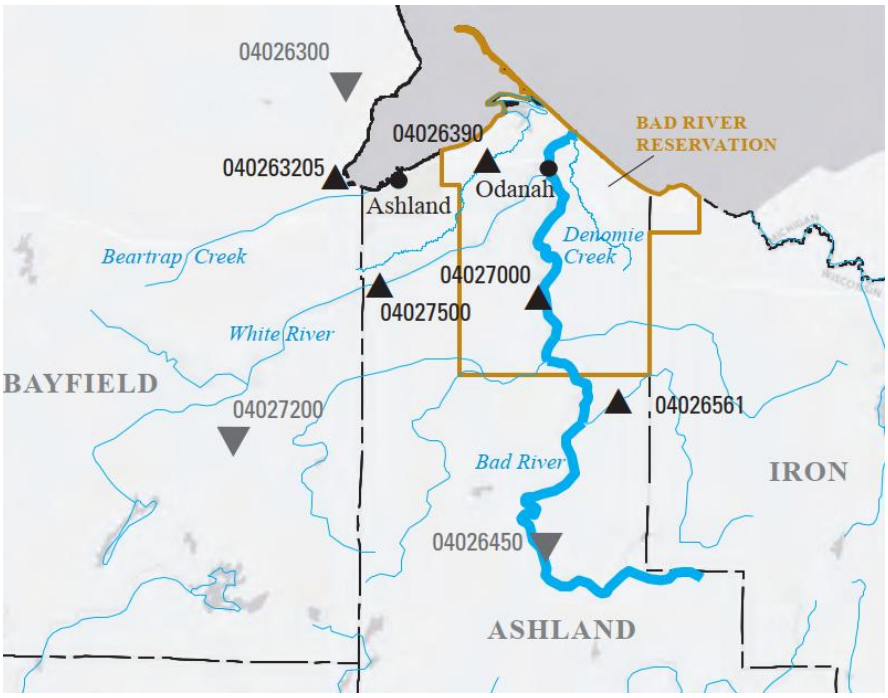


Figure B2 – Stream Gage Locations

Basin characteristics (Table B1) were developed from USGS publication "Estimating Flood Magnitude and Frequency for Unregulated Streams in Wisconsin", Scientific Investigations Report 2022–5118(2). Checks on drainage area were performed with other USGS published reports.

Location	Drainage Area (sq. mi.)	Percent Forest (%)	24 hr. – 10yr Precipitation (in.)	LC01 Water (%)	Percent Wetlands (%)
Bad River at US 2	960	71.85	3.998	2.07	13.69
Bad River at confluence of White River	625	72.29	3.997	1.31	14.65
Bad River Gage at Odanah (04027000)	597	72.04	3.997	1.21	14.63
White River at confluence with Bad River	334	71.11	4	3.43	11.85
White River Gage Near Ashland (04027500)	268	69.72	4.000	3.92	12.44

Table B1 - Basin Characteristics

StreamStats was used to develop estimates of the 2-year through 500-year flood recurrence interval events for each key location that included Bad River at US 2, White River at its confluence with Bad River, Bad River at its confluence with White River, and both upstream gage stations. The focus of the hydrologic analysis was the confluence of the Bad and White rivers three-quarters of a mile upstream of US 2 bridge.

Regression equations yielded flows at the confluence of the White and Bad rivers. Upstream gages at both the White River and Bad River were also compared to regression results (Table B2 & B3).

Final combined flow used in this study was the combination of regression and gage comparison at the confluence of the White and Black rivers. These flows appear consistent with historic floods (2016) and the slight attenuation of flow from the White River being slightly out of phase with the peak on the Bad River.

Table B4 and Figure B3 has a summary of design flows used for this study.

Bad River	regression-weighted estimate of flood discharge for the P-percent AEP at an ungaged location									
			2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	200-Year	500-Year
Regression of Bad River at Confluence with White River	QP(u)r	is the regression-weighted estimate of flood discharge for the P-percent AEP at an ungaged location, u, in ft3/s; Bad River Confluence DA = 625	6370	9990	12800	16700	20100	23300	27000	32700
Gage 04027000 Regression Value (Bad River at Odanah)	QP(g)r	is the flood discharge estimate for the P-percent AEP at a streamgage from the appropriate regression equation (from table 2), in ft3/s; (Gage 04027000) DA = 597	6320	9950	12700	16700	20000	23300	27000	32700
Gage 0427000 (LPIII)	QP(g)s	AEP at a streamgage, g, computed from the at-site LP3 analysis (from Levin, 2023, table 1) (Gage 04027000) DA = 597	7529	11630	14900	19720	23850	28470	33650	41480
	VP(g)s	variance of prediction for the at-site LP3 analysis VP	7e-04	0.001	0.0015	0.0028	0.0041	0.0059	0.0082	0.0118
	VP(g)r	the regression-based variance of prediction	0.028738	0.032673	0.035481	0.039805	0.04418	0.04866	0.053259	0.059596
Gage Area	Ag	is the drainage area associated with the streamgage, in square miles; and	596.77	596.77	596.77	596.77	596.77	596.77	596.77	596.77
Bad Confluence	Au	is the drainage area associated with the ungaged location, in square miles.	625	625	625	625	625	625	625	625
Equation (5) - Step 1		$\log Q_{n,y,p} = \frac{V_{g,y,p} \times \log Q_{g,y,p} + V_{r,y,p} \times \log Q_{r,y,p}}{V_{g,y,p} + V_{r,y,p}}$,(5)	3.87493	4.063568	4.170372	4.290163	4.370995	4.444976	4.514227	4.600767
Equation (5)	QP(g)w	is the weighted-average flood discharge estimate for the P-percent AEP at streamgage, g, (from eq. 5), in ft3/s;	7498	11576	14804	19506	23496	27860	32676	39881
		$\left(\frac{2A_g - A_u}{A_g}\right)$	0.094609	0.094609	0.094609	0.094609	0.094609	0.094609	0.094609	0.094609
		$\left(1 - \frac{2A_g - A_u}{A_g}\right)$	0.905391	0.905391	0.905391	0.905391	0.905391	0.905391	0.905391	0.905391
Equation (8) - Weighted Transfer of Gage to Mouth	QP(u)w	$Q_{u,y,p} = \left(\frac{2A_g - A_u}{A_g}\right) + \left(1 - \frac{2A_g - A_u}{A_g}\right)\left(\frac{Q_{g,y,p}}{Q_{r,y,p}}\right) \times Q_{r,y,p}$, (8)	6842	10523	13509	17660	21380	25224	29585	36108

Table B2 – Bad River regression & weighted Gage 04027000 at Confluence of White River

White River	regression-weighted estimate of flood discharge for the P-percent AEP at an ungaged location									
			2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	200-Year	500-Year
Regression of White River at Confluence with Bad River	QP(u)r	is the regression-weighted estimate of flood discharge for the P-percent AEP at an ungaged location, u, in ft3/s; White River Confluence DA = 334	2370	3640	4610	5960	7120	8220	9480	11400
Gage 04027500 Regression Value	QP(g)r	is the flood discharge estimate for the P-percent AEP at a streamgage from the appropriate regression equation (from table 2), in ft3/s; (Gage 04027500) DA = 268	1810	2760	3500	4510	5370	6190	7130	8570
Gage 0427500 (LPIII)	QP(g)s	AEP at a streamgage, g, computed from the at-site LP3 analysis (from Levin, 2023, table 1) (Gage 04027500) DA = 268	2826	4444	5650	7317	8659	10090	11600	13770
	VP(g)s	variance of prediction for the at-site LP3 analysis VP	8e-04	0.0011	0.0015	0.0024	0.0035	0.0049	0.0065	0.0093
	VP(g)r	the regression-based variance of prediction	0.027589	0.03135	0.03402	0.038132	0.042301	0.046569	0.050951	0.056988
Gage Area	Ag	is the drainage area associated with the streamgage, in square miles; and	268	268	268	268	268	268	268	268
White Confluence	Au	is the drainage area associated with the ungaged location, in square miles.	334	334	334	334	334	334	334	334
Equation (5) - Step 1		$\log Q_{n,y,p} = \frac{V_{g,y,p} \times \log Q_{g,y,p} + V_{r,y,p} \times \log Q_{r,y,p}}{V_{g,y,p} + V_{r,y,p}}$,(5)	3.44572	3.640762	3.743265	3.851889	3.921612	3.983689	4.040544	4.110039
Equation (5)	QP(g)w	is the weighted-average flood discharge estimate for the P-percent AEP at streamgage, g, (from eq. 5), in ft3/s;	2791	4373	5537	7110	8349	9631	10979	12884
		$\left(\frac{2A_g - A_u}{A_g}\right)$	0.492537	0.492537	0.492537	0.492537	0.492537	0.492537	0.492537	0.492537
		$\left(1 - \frac{2A_g - A_u}{A_g}\right)$	0.507463	0.507463	0.507463	0.507463	0.507463	0.507463	0.507463	0.507463
Equation (8) - Weighted Transfer of Gage to Mouth	QP(u)w	$Q_{u,y,p} = \left(\frac{2A_g - A_u}{A_g}\right) + \left(1 - \frac{2A_g - A_u}{A_g}\right)\left(\frac{Q_{g,y,p}}{Q_{r,y,p}}\right) \times Q_{r,y,p}$, (8)	1855	2927	3701	4769	5618	6491	7408	8697

Table B3 – White River regression & weighted Gage 04027500 at Confluence of Bad River

Combination of Bad River and White River flows at Joint Confluence at Odanah	RI	Bad River	White River	Total Flow
	2-Year	6842	1855	8697
	5-Year	10523	2927	13450
	10-Year	13509	3701	17210
	25-Year	17660	4769	22429
	50-Year	21380	5618	26997
	100-Year	25224	6491	31715
	200-Year	29585	7408	36992
	500-Year	36108	8697	44806

Table B4 – White River regression & weighted Gage 04027500 at Confluence of Bad River

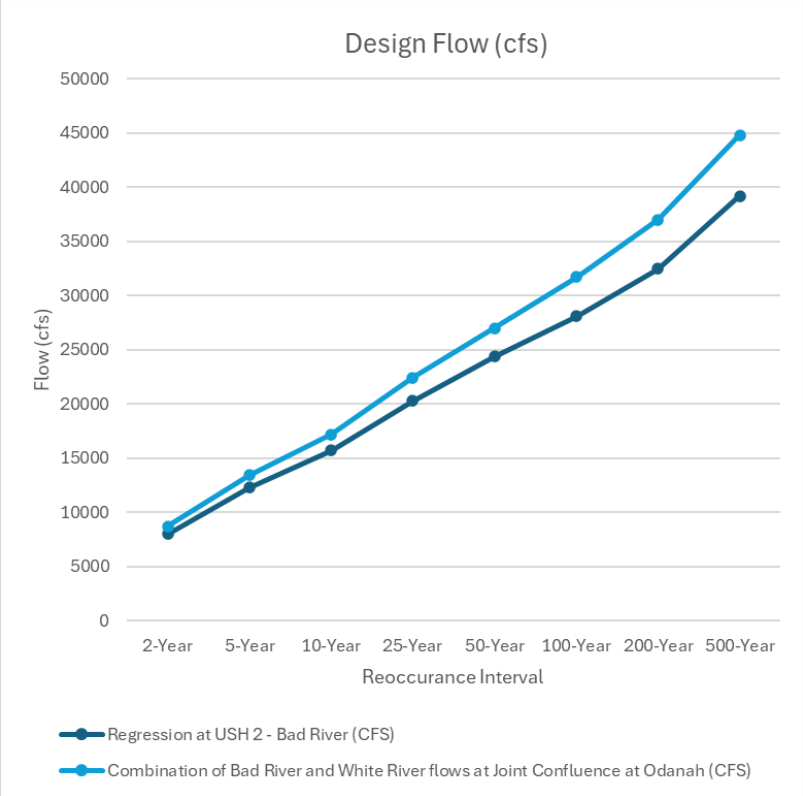


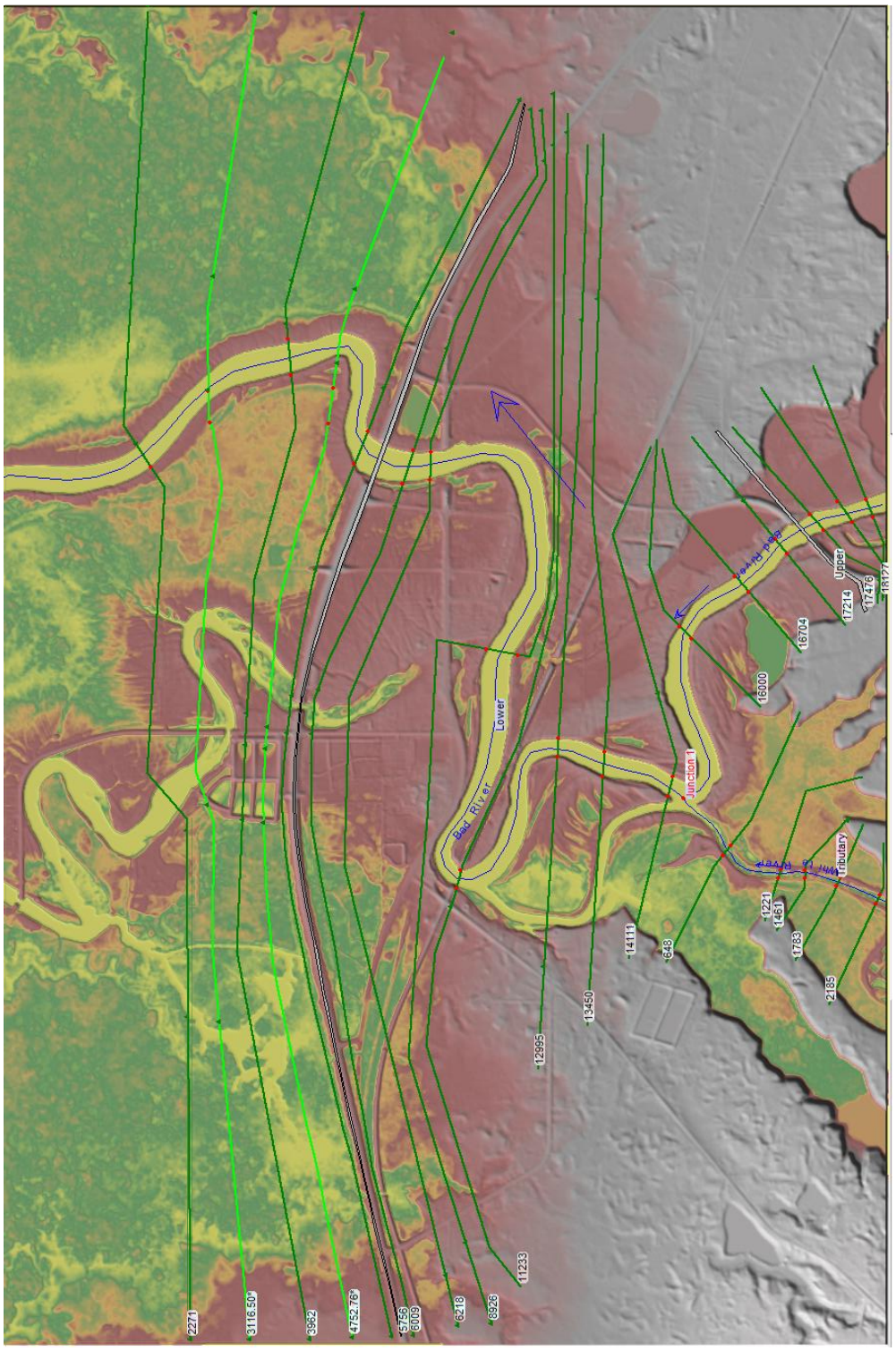
Figure 3 - Estimate of Reoccurrence Interval Flows at US 2

References:

(1) Flood of July 2016 in Northern Wisconsin and the Bad River Reservation, Scientific Investigations Report 2017–5029, U.S. Department of the Interior U.S. Geological Survey (2017).

(2) "Estimating Flood Magnitude and Frequency for Unregulated Streams in Wisconsin", USGS Scientific Investigations Report 2022–5118

Appendix C – HEC RAS Cross Section Plan



Appendix C1 – HEC RAS Table 1 Profile Results

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			Event	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bad River	Lower	2271	2-Year	8697	584.80	603.97	595.46	604.20	0.000541	3.87	2532.39	2235.95	0.22
Bad River	Lower	2271	5-Year	13450	584.80	605.93	597.22	606.17	0.000541	4.25	7897.61	11177.63	0.22
Bad River	Lower	2271	10-Year	17210	584.80	606.70	598.43	606.91	0.000541	4.34	14628.25	12230.4	0.22
Bad River	Lower	2271	25-Year	22429	584.80	607.67	599.93	607.86	0.000541	4.46	21369.67	12592.63	0.23
Bad River	Lower	2271	50-Year	26997	584.80	608.32	601.09	608.51	0.00054	4.61	26018.01	12624.26	0.23
Bad River	Lower	2271	100-Year	31715	584.80	608.93	602.16	609.11	0.00054	4.76	30343.71	12624.71	0.23
Bad River	Lower	2271	250-Year	36992	584.80	609.56	605.80	609.74	0.000541	4.91	34781.21	12625.18	0.23
Bad River	Lower	2271	500-Year	44806	584.80	610.41	606.65	610.59	0.000541	5.11	40827.3	12625.81	0.23
Bad River	Lower	3116.50*	2-Year	8697	582.60	604.37	593.17	604.47	0.000208	2.59	3857.68	4370.85	0.14
Bad River	Lower	3116.50*	5-Year	13450	582.60	606.33	595.04	606.44	0.000221	2.94	10953.13	11611.07	0.15
Bad River	Lower	3116.50*	10-Year	17210	582.60	607.08	596.14	607.20	0.000251	3.25	15286.8	12438.92	0.16
Bad River	Lower	3116.50*	25-Year	22429	582.60	608.02	597.51	608.14	0.000267	3.5	20995.88	12594.54	0.16
Bad River	Lower	3116.50*	50-Year	26997	582.60	608.67	598.55	608.79	0.000274	3.66	24964.29	12595.19	0.17
Bad River	Lower	3116.50*	100-Year	31715	582.60	609.27	599.67	609.40	0.000281	3.8	28653.23	12595.79	0.17
Bad River	Lower	3116.50*	250-Year	36992	582.60	609.89	600.97	610.02	0.000288	3.95	32445.62	12596.41	0.17
Bad River	Lower	3116.50*	500-Year	44806	582.60	610.74	602.54	610.79	0.000154	2.99	77633.53	12597.25	0.13
Bad River	Lower	3962	2-Year	8697	580.35	604.53	589.10	604.58	0.000076	1.81	5597.9	5244.59	0.09
Bad River	Lower	3962	5-Year	13450	580.35	606.49	590.97	606.56	0.000099	2.25	11852.86	11368.09	0.1
Bad River	Lower	3962	10-Year	17210	580.35	607.25	592.18	607.34	0.000126	2.61	15284.36	11755.89	0.12
Bad River	Lower	3962	25-Year	22429	580.35	608.19	593.64	608.30	0.000158	3.03	19657.59	12162.56	0.13
Bad River	Lower	3962	50-Year	26997	580.35	608.83	594.74	608.97	0.000186	3.37	22720.23	12400.73	0.14
Bad River	Lower	3962	100-Year	31715	580.35	609.44	595.79	609.59	0.000212	3.68	25601.5	12505.23	0.15
Bad River	Lower	3962	250-Year	36992	580.35	610.10	596.84	610.16	0.000122	2.86	70026.2	12526.33	0.12
Bad River	Lower	3962	500-Year	44806	580.35	610.83	598.33	610.90	0.000136	3.1	79206.98	12558.72	0.12
Bad River	Lower	4752.76*	2-Year	8697	584.23	604.59	593.59	604.67	0.000151	2.27	3957.23	4548.72	0.12
Bad River	Lower	4752.76*	5-Year	13450	584.23	606.57	595.17	606.69	0.000191	2.84	8459.48	10371.95	0.14
Bad River	Lower	4752.76*	10-Year	17210	584.23	607.35	596.20	607.50	0.000236	3.28	11778.27	11472.83	0.15
Bad River	Lower	4752.76*	25-Year	22429	584.23	608.30	597.44	608.49	0.000282	3.75	16355.53	12263.59	0.17
Bad River	Lower	4752.76*	50-Year	26997	584.23	608.96	598.48	609.18	0.000321	4.12	19589.01	12311.62	0.18
Bad River	Lower	4752.76*	100-Year	31715	584.23	609.58	599.39	609.82	0.000357	4.45	22626.67	12313.45	0.19
Bad River	Lower	4752.76*	250-Year	36992	584.23	610.18	600.26	610.26	0.000185	3.28	64401.52	12314.33	0.14
Bad River	Lower	4752.76*	500-Year	44806	584.23	610.92	601.46	611.01	0.000199	3.51	73517.42	12315.42	0.15

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			Event	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bad River	Lower	5503	2-Year	8697	590.51	604.72	596.56	604.80	0.000201	2.26	3891.96	4626.81	0.13
Bad River	Lower	5503	5-Year	13450	590.51	606.74	597.73	606.85	0.000254	2.79	5946.63	9231.81	0.15
Bad River	Lower	5503	10-Year	17210	590.51	607.55	598.48	607.69	0.000326	3.27	7098.66	10373.47	0.17
Bad River	Lower	5503	25-Year	22429	590.51	608.57	599.34	608.73	0.000426	3.61	11859.7	11479.93	0.2
Bad River	Lower	5503	50-Year	26997	590.51	609.27	600.04	609.45	0.000489	3.94	14094.74	11915.25	0.21
Bad River	Lower	5503	100-Year	31715	590.51	609.91	600.71	610.12	0.000531	4.27	16216.29	12000.9	0.22
Bad River	Lower	5503	250-Year	36992	590.51	610.34	601.44	610.40	0.000232	2.89	61133.04	12037.87	0.15
Bad River	Lower	5503	500-Year	44806	590.51	611.09	602.40	611.15	0.000242	3.08	70131.22	12043.5	0.15
Bad River	Lower	5756		Mult Open									
Bad River	Lower	6009	2-Year	8697	593.33	606.31	598.63	606.39	0.000208	2.29	4938.98	6299.82	0.14
Bad River	Lower	6009	5-Year	13450	593.33	608.29	599.72	608.38	0.000267	2.53	7866.02	10948.16	0.15
Bad River	Lower	6009	10-Year	17210	593.33	609.13	600.47	609.24	0.000301	2.84	9399.46	11476.66	0.16
Bad River	Lower	6009	25-Year	22429	593.33	610.25	601.42	610.28	0.000136	2.06	45504.44	11896.52	0.11
Bad River	Lower	6009	50-Year	26997	593.33	610.98	602.23	611.01	0.000138	2.17	52862.14	11965.49	0.11
Bad River	Lower	6009	100-Year	31715	593.33	611.52	603.14	611.55	0.000149	2.33	58311.59	11965.63	0.12
Bad River	Lower	6009	250-Year	36992	593.33	611.82	604.35	611.86	0.000178	2.58	61343.48	11965.7	0.13
Bad River	Lower	6009	500-Year	44806	593.33	612.48	605.43	612.53	0.000198	2.83	68082.07	11965.87	0.14
Bad River	Lower	6218	2-Year	8697	593.30	606.34	598.99	606.46	0.000301	3	7413.94	4903.17	0.16
Bad River	Lower	6218	5-Year	13450	593.30	608.37	600.26	608.45	0.000222	2.87	22029.5	9839.42	0.15
Bad River	Lower	6218	10-Year	17210	593.30	609.24	601.16	609.32	0.000221	3	30666.85	11008	0.15
Bad River	Lower	6218	25-Year	22429	593.30	610.28	602.21	610.35	0.00021	3.08	41701.88	11460.18	0.14
Bad River	Lower	6218	50-Year	26997	593.30	611.02	603.07	611.09	0.000209	3.17	49593.94	11595.09	0.15
Bad River	Lower	6218	100-Year	31715	593.30	611.56	604.09	611.63	0.000221	3.35	55481.53	11724.97	0.15
Bad River	Lower	6218	250-Year	36992	593.30	611.87	606.88	611.96	0.000262	3.69	58845.5	11755.09	0.16
Bad River	Lower	6218	500-Year	44806	593.30	612.55	607.62	612.64	0.000286	3.97	66198.88	11816.32	0.17
Bad River	Lower	8926	2-Year	8697	591.28	606.96	598.17	607.04	0.000184	2.45	10106.76	5372.49	0.13
Bad River	Lower	8926	5-Year	13450	591.28	608.77	599.48	608.85	0.000179	2.67	22661.37	9648	0.13
Bad River	Lower	8926	10-Year	17210	591.28	609.61	600.39	609.70	0.00019	2.87	30773.68	10804.92	0.14
Bad River	Lower	8926	25-Year	22429	591.28	610.61	601.40	610.70	0.000202	3.1	41459.22	11981.75	0.14
Bad River	Lower	8926	50-Year	26997	591.28	611.33	602.25	611.41	0.000208	3.25	49412.32	12434.6	0.15
Bad River	Lower	8926	100-Year	31715	591.28	611.87	603.04	611.97	0.000222	3.44	55581.93	12543.34	0.15
Bad River	Lower	8926	250-Year	36992	591.28	612.23	603.90	612.33	0.000258	3.76	59590.85	12589.16	0.17
Bad River	Lower	8926	500-Year	44806	591.28	612.92	606.93	613.03	0.000282	4.05	67413.48	12615.93	0.17

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			Event	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bad River	Lower	11233	2-Year	8697	591.28	607.43	599.09	607.62	0.000445	3.85	7244.56	4570.11	0.2
Bad River	Lower	11233	5-Year	13450	591.28	609.16	601.05	609.36	0.000473	4.3	14319.55	8043.42	0.21
Bad River	Lower	11233	10-Year	17210	591.28	609.98	602.37	610.20	0.000531	4.73	18682.84	8671.13	0.23
Bad River	Lower	11233	25-Year	22429	591.28	610.96	605.82	611.20	0.000569	5.13	24409.83	9449.72	0.24
Bad River	Lower	11233	50-Year	26997	591.28	611.65	607.03	611.90	0.000605	5.46	28662.13	9677.76	0.25
Bad River	Lower	11233	100-Year	31715	591.28	612.20	607.70	612.46	0.00065	5.79	32046.73	9784.94	0.26
Bad River	Lower	11233	250-Year	36992	591.28	612.59	608.71	612.88	0.000746	6.31	34466.41	9890.15	0.28
Bad River	Lower	11233	500-Year	44806	591.28	613.28	609.33	613.60	0.000823	6.82	38796.26	10211.05	0.29
Bad River	Lower	12995	2-Year	8697	591.30	608.00	597.84	608.11	0.000212	2.99	8853.53	4134.89	0.14
Bad River	Lower	12995	5-Year	13450	591.30	609.73	599.47	609.84	0.000234	3.36	16670.59	5423.34	0.15
Bad River	Lower	12995	10-Year	17210	591.30	610.59	600.63	610.72	0.000263	3.69	21083.56	6185.51	0.16
Bad River	Lower	12995	25-Year	22429	591.30	611.60	602.09	611.74	0.000298	4.09	26723.93	7100.67	0.17
Bad River	Lower	12995	50-Year	26997	591.30	612.31	603.80	612.46	0.000323	4.38	30898.17	7489.11	0.18
Bad River	Lower	12995	100-Year	31715	591.30	612.88	605.90	613.05	0.000357	4.7	34316	7903.47	0.19
Bad River	Lower	12995	250-Year	36992	591.30	613.36	607.38	613.54	0.000409	5.11	37136	8009.11	0.21
Bad River	Lower	12995	500-Year	44806	591.30	614.09	608.74	614.27	0.000424	5.34	48353.7	8205.17	0.21
Bad River	Lower	13450	2-Year	8697	590.10	608.12	598.28	608.21	0.000201	2.69	9634.03	3498.02	0.14
Bad River	Lower	13450	5-Year	13450	590.10	609.84	600.28	609.95	0.000236	3.19	16522.85	5026.79	0.15
Bad River	Lower	13450	10-Year	17210	590.10	610.71	601.49	610.85	0.000271	3.57	20691.13	5664.3	0.17
Bad River	Lower	13450	25-Year	22429	590.10	611.73	602.88	611.88	0.000312	4.01	26195.81	6574.42	0.18
Bad River	Lower	13450	50-Year	26997	590.10	612.44	604.59	612.62	0.000348	4.37	30389.54	6912.74	0.19
Bad River	Lower	13450	100-Year	31715	590.10	613.04	605.41	613.23	0.000383	4.7	33939.95	7397.8	0.2
Bad River	Lower	13450	250-Year	36992	590.10	613.53	606.54	613.75	0.000435	5.1	37067.93	7904.58	0.22
Bad River	Lower	13450	500-Year	44806	590.10	614.26	608.03	614.50	0.000476	5.49	46692.43	8172.28	0.23
Bad River	Lower	14111	2-Year	8697	590.10	608.24	598.24	608.37	0.000242	3.08	7133.82	2013.66	0.15
Bad River	Lower	14111	5-Year	13450	590.10	609.98	600.65	610.16	0.000325	3.89	9913.35	2730.42	0.18
Bad River	Lower	14111	10-Year	17210	590.10	610.87	601.65	611.12	0.000408	4.53	11543.49	3128.58	0.2
Bad River	Lower	14111	25-Year	22429	590.10	611.90	602.95	612.22	0.000513	5.3	13663.79	3635.92	0.23
Bad River	Lower	14111	50-Year	26997	590.10	612.64	604.96	613.03	0.000614	5.97	15300.95	3824.81	0.25
Bad River	Lower	14111	100-Year	31715	590.10	613.24	606.16	613.71	0.000719	6.61	16710.29	3885.86	0.28
Bad River	Lower	14111	250-Year	36992	590.10	613.85	607.01	614.27	0.000676	6.56	25174.22	4054.61	0.27
Bad River	Lower	14111	500-Year	44806	590.10	614.63	608.23	615.12	0.000792	7.3	28613.82	4747.83	0.29
Bad River	Upper	16000	2-Year	6842	594.30	608.71		608.88	0.000301	3.37	3311.64	908.98	0.17
Bad River	Upper	16000	5-Year	10523	594.30	610.60		610.86	0.0004	4.27	5619.45	1721.89	0.2
Bad River	Upper	16000	10-Year	13509	594.30	611.64		611.96	0.00047	4.85	7726.42	2192.48	0.22

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			Event	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bad River	Upper	16000	25-Year	17660	594.30	612.86		613.23	0.000542	5.48	10543.12	2364.99	0.24
Bad River	Upper	16000	50-Year	21380	594.30	613.76		614.18	0.000599	5.96	12741.85	2502.76	0.25
Bad River	Upper	16000	100-Year	25224	594.30	614.55		615.02	0.00066	6.44	14773.1	2676.69	0.27
Bad River	Upper	16000	250-Year	29585	594.30	615.11		615.66	0.00077	7.1	16283.49	2726.07	0.29
Bad River	Upper	16000	500-Year	36108	594.30	616.08		616.72	0.000873	7.82	18997.99	2839.63	0.31
Bad River	Upper	16704	2-Year	6842	594.30	608.95		609.06	0.000203	2.74	4987.42	1174.1	0.14
Bad River	Upper	16704	5-Year	10523	594.30	610.93		611.08	0.000258	3.39	7626.77	1663.39	0.16
Bad River	Upper	16704	10-Year	13509	594.30	612.02		612.21	0.000301	3.86	9749.57	2055.32	0.17
Bad River	Upper	16704	25-Year	17660	594.30	613.29		613.52	0.000355	4.41	12426.73	2168.09	0.19
Bad River	Upper	16704	50-Year	21380	594.30	614.23		614.50	0.000403	4.88	14486.84	2208.5	0.21
Bad River	Upper	16704	100-Year	25224	594.30	615.05		615.36	0.000445	5.29	16307.96	2210.2	0.22
Bad River	Upper	16704	250-Year	29585	594.30	615.68		616.06	0.000516	5.83	17709.57	2211.5	0.24
Bad River	Upper	16704	500-Year	36108	594.30	616.72		617.16	0.00059	6.46	20011.04	2213.87	0.26
Bad River	Upper	17214	2-Year	6842	593.90	609.04	599.51	609.19	0.000278	3.13	2953.08	1042.18	0.16
Bad River	Upper	17214	5-Year	10523	593.90	611.03	600.93	611.25	0.000354	3.92	5252.12	1385.84	0.18
Bad River	Upper	17214	10-Year	13509	593.90	612.14	601.93	612.42	0.000422	4.5	6741.42	1455.76	0.2
Bad River	Upper	17214	25-Year	17660	593.90	613.41	603.20	613.77	0.0005	5.17	8521.98	1482.9	0.23
Bad River	Upper	17214	50-Year	21380	593.90	614.36	604.31	614.78	0.000567	5.72	9851.36	1499.5	0.24
Bad River	Upper	17214	100-Year	25224	593.90	615.19	605.40	615.68	0.000639	6.26	11015.75	1532.27	0.26
Bad River	Upper	17214	250-Year	29585	593.90	615.83	606.49	616.42	0.00075	6.95	11929.03	1556.67	0.28
Bad River	Upper	17214	500-Year	36108	593.90	616.88	608.36	617.59	0.000862	7.72	14200.67	1684.57	0.31
Bad River	Upper	17476		Bridge									
Bad River	Upper	17623	2-Year	6842	593.30	609.24	600.22	609.35	0.00023	2.84	4541.4	1413.76	0.15
Bad River	Upper	17623	5-Year	10523	593.30	611.32	601.63	611.47	0.000263	3.39	7672.74	1588	0.16
Bad River	Upper	17623	10-Year	13509	593.30	612.55	602.62	612.74	0.000293	3.78	9597.76	1601.55	0.17
Bad River	Upper	17623	25-Year	17660	593.30	614.23	603.80	614.45	0.000308	4.17	12226.53	1622.12	0.18
Bad River	Upper	17623	50-Year	21380	593.30	615.64	604.71	615.87	0.000314	4.44	14449.96	1641.89	0.18
Bad River	Upper	17623	100-Year	25224	593.30	616.92	605.58	617.17	0.000324	4.73	16797.32	1688.73	0.19
Bad River	Upper	17623	250-Year	29585	593.30	617.61	606.50	617.92	0.000381	5.25	17967.3	1695.94	0.21
Bad River	Upper	17623	500-Year	36108	593.30	618.46	609.14	618.85	0.000472	6.01	19410.51	1704.82	0.23
Bad River	Upper	17911	2-Year	6842	594.60	609.30	601.21	609.45	0.000383	3.23	4756.3	1578.4	0.18
Bad River	Upper	17911	5-Year	10523	594.60	611.42	602.70	611.56	0.000408	3.47	8491.67	1857.45	0.19
Bad River	Upper	17911	10-Year	13509	594.60	612.67	603.76	612.83	0.000401	3.71	10803.98	1876.13	0.19
Bad River	Upper	17911	25-Year	17660	594.60	614.37	605.05	614.54	0.000375	3.94	13934.12	1896	0.19

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			Event	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bad River	Upper	17911	50-Year	21380	594.60	615.79	606.11	615.96	0.000355	4.1	16566.43	1917.4	0.19
Bad River	Upper	17911	100-Year	25224	594.60	617.08	608.56	617.27	0.000348	4.3	19261.5	1971.53	0.19
Bad River	Upper	17911	250-Year	29585	594.60	617.81	609.51	618.03	0.000396	4.73	20693.96	1977.89	0.2
Bad River	Upper	17911	500-Year	36108	594.60	618.71	610.49	618.99	0.000473	5.35	22485.74	1985.06	0.23
Bad River	Upper	18127	2-Year	6842	594.60	609.37	600.74	609.52	0.000306	3.28	3965.88	1393.25	0.17
Bad River	Upper	18127	5-Year	10523	594.60	611.47	602.13	611.67	0.000363	3.84	7277.57	1677.67	0.19
Bad River	Upper	18127	10-Year	13509	594.60	612.73	603.09	612.95	0.000388	4.22	9375.65	1713.25	0.2
Bad River	Upper	18127	25-Year	17660	594.60	614.41	604.35	614.65	0.000392	4.57	12221.68	1734.41	0.2
Bad River	Upper	18127	50-Year	21380	594.60	615.83	605.39	616.08	0.000388	4.8	14618.91	1753.63	0.2
Bad River	Upper	18127	100-Year	25224	594.60	617.12	606.47	617.39	0.00039	5.06	17086.38	1798.78	0.21
Bad River	Upper	18127	250-Year	29585	594.60	617.85	608.37	618.16	0.00045	5.57	18398.52	1803.17	0.22
Bad River	Upper	18127	500-Year	36108	594.60	618.76	610.55	619.15	0.000545	6.31	20040.3	1808.64	0.25
White River	Tributary	648	2-Year	1855	590.41	608.49		608.49	0.000063	0.92	9295.76	2407.99	0.06
White River	Tributary	648	5-Year	2927	590.41	610.31		610.31	0.000049	0.96	13701.23	2428.83	0.06
White River	Tributary	648	10-Year	3701	590.41	611.28		611.29	0.000048	1.02	16074.18	2434.31	0.06
White River	Tributary	648	25-Year	4769	590.41	612.42		612.43	0.000048	1.11	18850.44	2440.74	0.06
White River	Tributary	648	50-Year	5618	590.41	613.26		613.26	0.000049	1.17	20890.98	2446.67	0.06
White River	Tributary	648	100-Year	6491	590.41	613.97		613.97	0.00005	1.24	22634.46	2452.38	0.06
White River	Tributary	648	250-Year	7408	590.41	614.52		614.52	0.000055	1.34	23981.65	2462.08	0.07
White River	Tributary	648	500-Year	8697	590.41	615.40		615.41	0.000058	1.44	26173.67	2496.49	0.07
White River	Tributary	1221	2-Year	1855	590.72	608.54		608.55	0.000217	1.42	5423.92	1592.3	0.11
White River	Tributary	1221	5-Year	2927	590.72	610.34		610.35	0.000147	1.43	8312.25	1610.08	0.1
White River	Tributary	1221	10-Year	3701	590.72	611.31		611.33	0.000136	1.51	9884.14	1617.51	0.1
White River	Tributary	1221	25-Year	4769	590.72	612.45		612.47	0.000132	1.63	11729.14	1625.03	0.1
White River	Tributary	1221	50-Year	5618	590.72	613.29		613.30	0.00013	1.71	13088.22	1633.76	0.1
White River	Tributary	1221	100-Year	6491	590.72	614.00		614.01	0.000133	1.81	14255.17	1642.88	0.1
White River	Tributary	1221	250-Year	7408	590.72	614.55		614.57	0.000142	1.94	15161.47	1649.92	0.1
White River	Tributary	1221	500-Year	8697	590.72	615.44		615.46	0.000147	2.08	16632.07	1665.16	0.11
White River	Tributary	1461	2-Year	1855	590.85	608.57	596.96	608.59	0.000088	1.57	4182.11	1088.6	0.08
White River	Tributary	1461	5-Year	2927	590.85	610.36	598.54	610.40	0.000099	1.83	6169.75	1127.4	0.09
White River	Tributary	1461	10-Year	3701	590.85	611.34	599.50	611.37	0.000108	2.02	7265.38	1146.94	0.09
White River	Tributary	1461	25-Year	4769	590.85	612.47	600.67	612.52	0.000121	2.24	8562.33	1163.24	0.1
White River	Tributary	1461	50-Year	5618	590.85	613.31	601.52	613.35	0.000128	2.39	9523.13	1177.2	0.11
White River	Tributary	1461	100-Year	6491	590.85	614.02	602.30	614.07	0.000138	2.56	10350.96	1191	0.11

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			Event	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
White River	Tributary	1461	250-Year	7408	590.85	614.57	603.09	614.63	0.000154	2.76	10997.49	1206.93	0.12
White River	Tributary	1461	500-Year	8697	590.85	615.46	604.11	615.52	0.000167	2.97	12047.95	1223.8	0.12
White River	Tributary	1783	2-Year	1855	591.02	608.61		608.63	0.000134	1.51	4445.95	1141.29	0.09
White River	Tributary	1783	5-Year	2927	591.02	610.41		610.43	0.000125	1.68	6511.94	1152.09	0.09
White River	Tributary	1783	10-Year	3701	591.02	611.38		611.41	0.00013	1.82	7640.26	1162.21	0.1
White River	Tributary	1783	25-Year	4769	591.02	612.53		612.56	0.000138	2	8980.62	1179.51	0.1
White River	Tributary	1783	50-Year	5618	591.02	613.36		613.39	0.000143	2.13	9970.32	1186.9	0.1
White River	Tributary	1783	100-Year	6491	591.02	614.08		614.11	0.000151	2.27	10823.08	1195.28	0.11
White River	Tributary	1783	250-Year	7408	591.02	614.64		614.68	0.000166	2.44	11493.03	1206.03	0.11
White River	Tributary	1783	500-Year	8697	591.02	615.53		615.58	0.000177	2.63	12576.9	1226.27	0.12
White River	Tributary	2185	2-Year	1855	591.24	608.65		608.67	0.000077	1.43	4809.19	1222.97	0.08
White River	Tributary	2185	5-Year	2927	591.24	610.45		610.47	0.000081	1.65	7034.66	1245.22	0.09
White River	Tributary	2185	10-Year	3701	591.24	611.43		611.46	0.000087	1.8	8262.5	1266.87	0.09
White River	Tributary	2185	25-Year	4769	591.24	612.57		612.61	0.000095	2	9717.44	1273.79	0.1
White River	Tributary	2185	50-Year	5618	591.24	613.41		613.45	0.0001	2.13	10787.7	1279.76	0.1
White River	Tributary	2185	100-Year	6491	591.24	614.13		614.17	0.000107	2.27	11710.26	1285.38	0.1
White River	Tributary	2185	250-Year	7408	591.24	614.69		614.74	0.000118	2.45	12435.78	1290.32	0.11
White River	Tributary	2185	500-Year	8697	591.24	615.59		615.64	0.000127	2.63	13597.04	1298.95	0.11

Appendix D – US 2 Plan and Profile Sheets

PROJECT ID: 1180-00-04
WITH:
COUNTY: ASHLAND

ORDER OF SHEETS

Section No.	1	Title
Section No.	2	Typical Sections and Details
Section No.	3	Estimate of Quantities
Section No.	3	Miscellaneous Quantities
Section No.	4	Right of Way Plat
Section No.	5	Plan and Profile
Section No.	6	Standard Detail Drawings
Section No.	7	Sign Plates
Section No.	8	Structure Plans
Section No.	9	Computer Earthwork Data
Section No.	9	Cross Sections

TOTAL SHEETS =

STATE PROJECT	FEDERAL PROJECT	
	PROJECT	CONTRACT
1180-00-04		

STATE OF WISCONSIN

DEPARTMENT OF TRANSPORTATION

PLAN OF PROPOSED IMPROVEMENT

BAD RIVER STUDY

ASHLAND– SAXON, 38TH AVE TO IRON COUNTY LINE

USH 2

ASHLAND

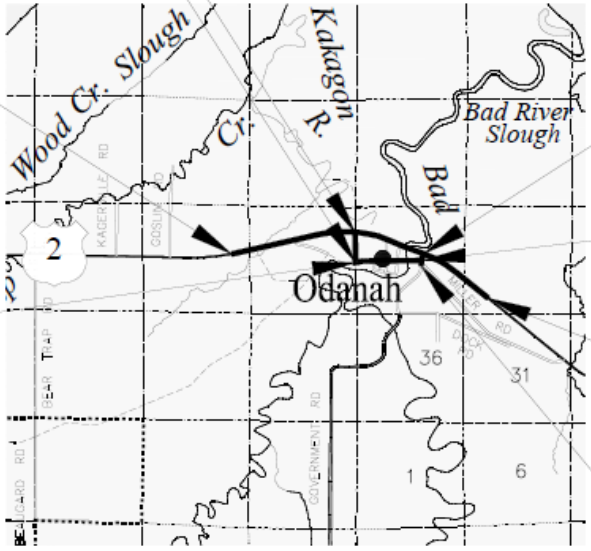
STATE PROJECT NUMBER
1180-00-04

BEGIN PROJECT
STA 10+00'O'

END PROJECT
STA 24+99'O'

BEGIN PROJECT
STA 352+50'T'

END PROJECT
STA 42+72'ST'



BEGIN PROJECT
STA 10+00'G'

END PROJECT
STA 75+34'ST'

END PROJECT
STA 486+04'T'

END PROJECT
STA 16+18'G'

DESIGN DESIGNATION

A.A.D.T.	2025	=	4600-4800
A.A.D.T.		=	
D.H.V.		=	
D.D.		=	
T.		=	
DESIGN SPEED		=	35 MPH/60 MPH
ESALS		=	

CONVENTIONAL SYMBOLS

PLAN
- CORPORATE LIMITS
- PROPERTY LINE
- LOT LINE
- LIMITED HIGHWAY EASEMENT
- EXISTING RIGHT OF WAY
- PROPOSED OR NEW R/W LINE
- SLOPE INTERCEPT
- REFERENCE LINE
- EXISTING CULVERT
- PROPOSED CULVERT (Box or Pipe)
- COMBUSTIBLE FLUIDS
- MARSH AREA
- WOODED OR SHRUB AREA

PROFILE
- GRADE LINE
- ORIGINAL GROUND
- MARSH OR ROCK PROFILE (To be noted as such)
- SPECIAL DITCH
- GRADE ELEVATION
- CULVERT (Profile View)

UTILITIES
- ELECTRIC
- FIBER OPTIC
- GAS
- SANITARY SEWER
- STORM SEWER
- TELEPHONE
- WATER
- UTILITY PEDESTAL
- POWER POLE
- TELEPHONE POLE

LAYOUT

SCALE 0 1 MI

TOTAL NET LENGTH OF CENTERLINE = 0.67

HORIZONTAL POSITIONS SHOWN ON THIS PLAN ARE WISCONSIN COORDINATE REFERENCE SYSTEM (WISCRS), ASHLAND NAD83 (2011), IN U.S. SURVEY FEET. POSITIONS SHOWN ARE GRID COORDINATES, GRID BEARINGS, AND GRID DISTANCES. GRID DISTANCES ARE THE SAME AS GROUND DISTANCES.

ELEVATIONS ARE REFERENCED TO NAVD 88 (XX). GPS DERIVED ELEVATIONS ARE BASED ON GEOID XX.

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

PREPARED BY

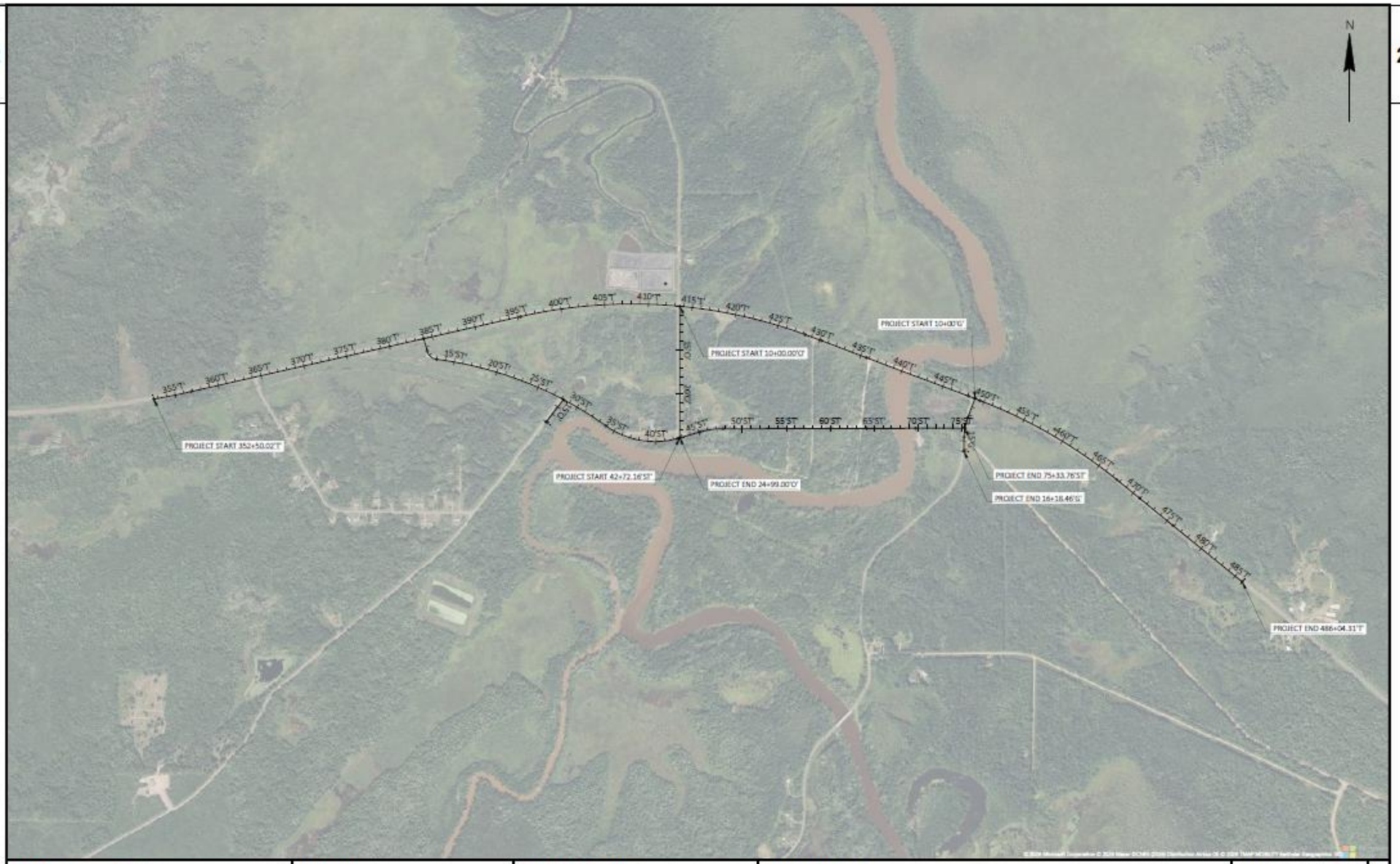
Surveyor	SURVEYOR
Designer	DESIGNER
Project Manager	PROJECT MANAGER
Regional Examiner	REGIONAL EXAMINER
Regional Supervisor	REGIONAL SUPERVISOR

APPROVED FOR THE DEPARTMENT

DATE: _____ _____
[Signature]

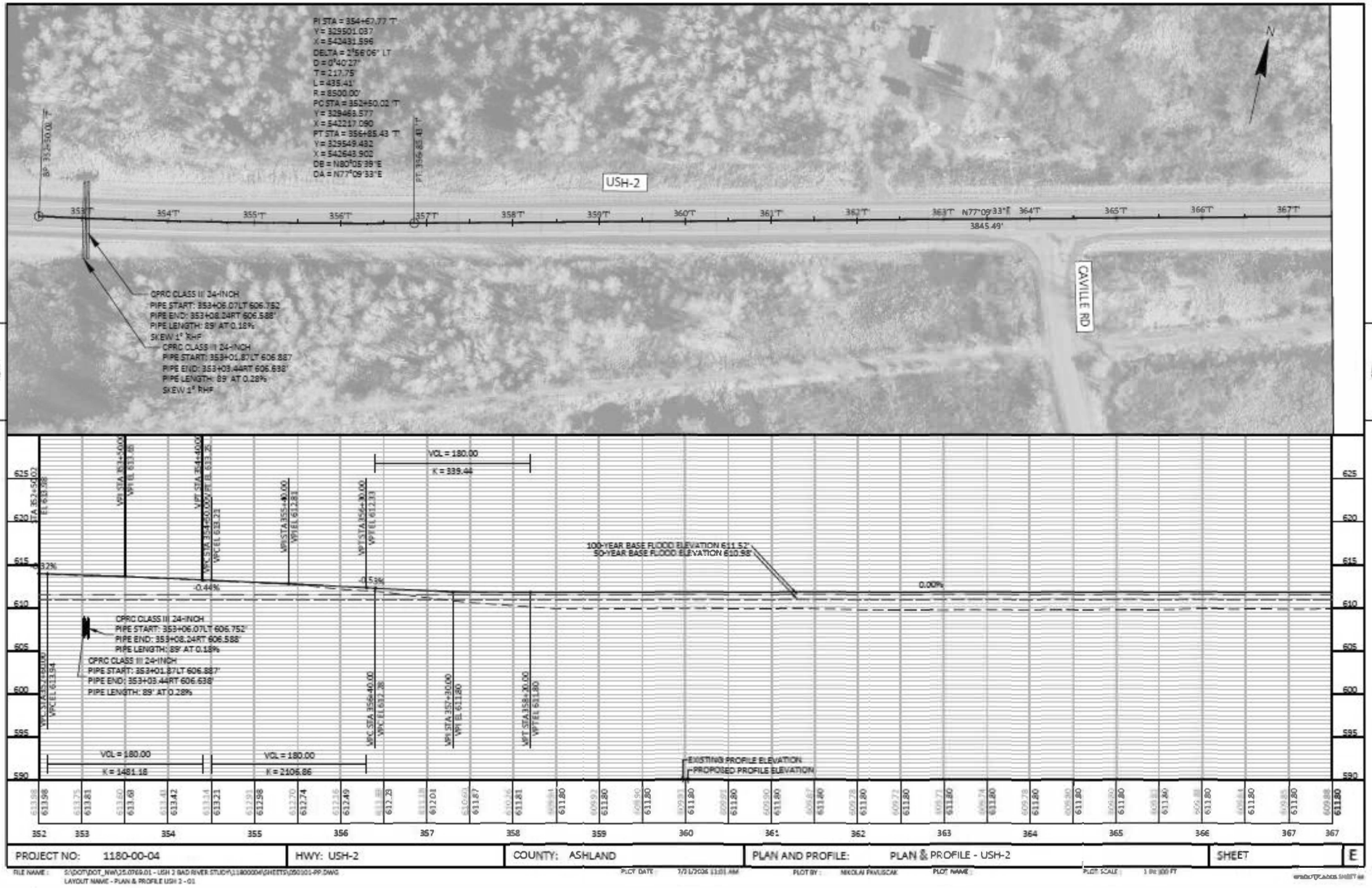
E

FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180000(4)\SHEETS\010101-TI.DWG
PLOT DATE : 7/21/2026 11:00 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :



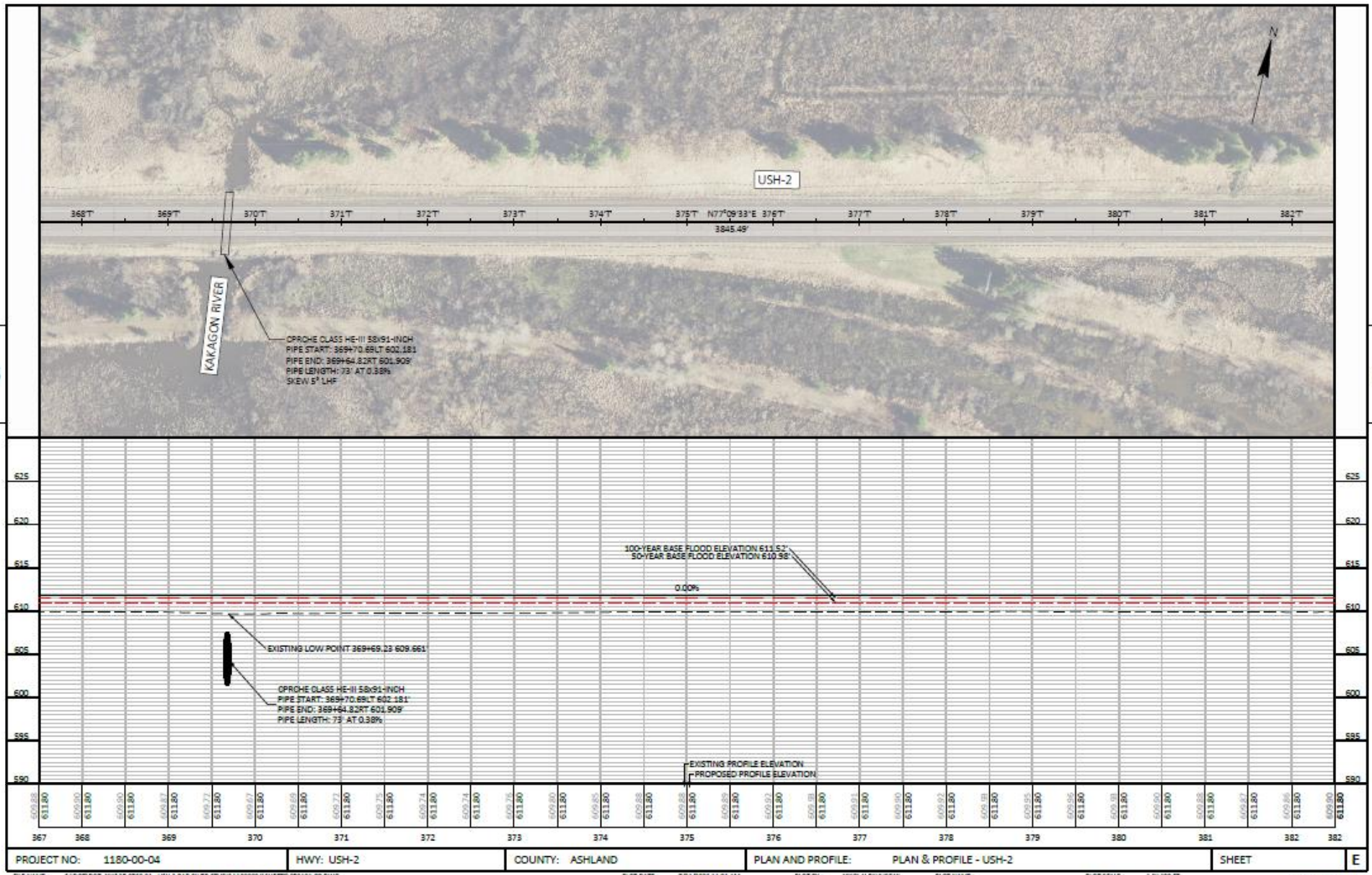
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PROJECT OVERVIEW	SHEET	E

FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180000\SHEETS\000001-PO.DWG
LAYOUT NAME : G1
PLOT DATE : 7/21/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN: 1000 FT
WISDOT/CADDS SHEET 41



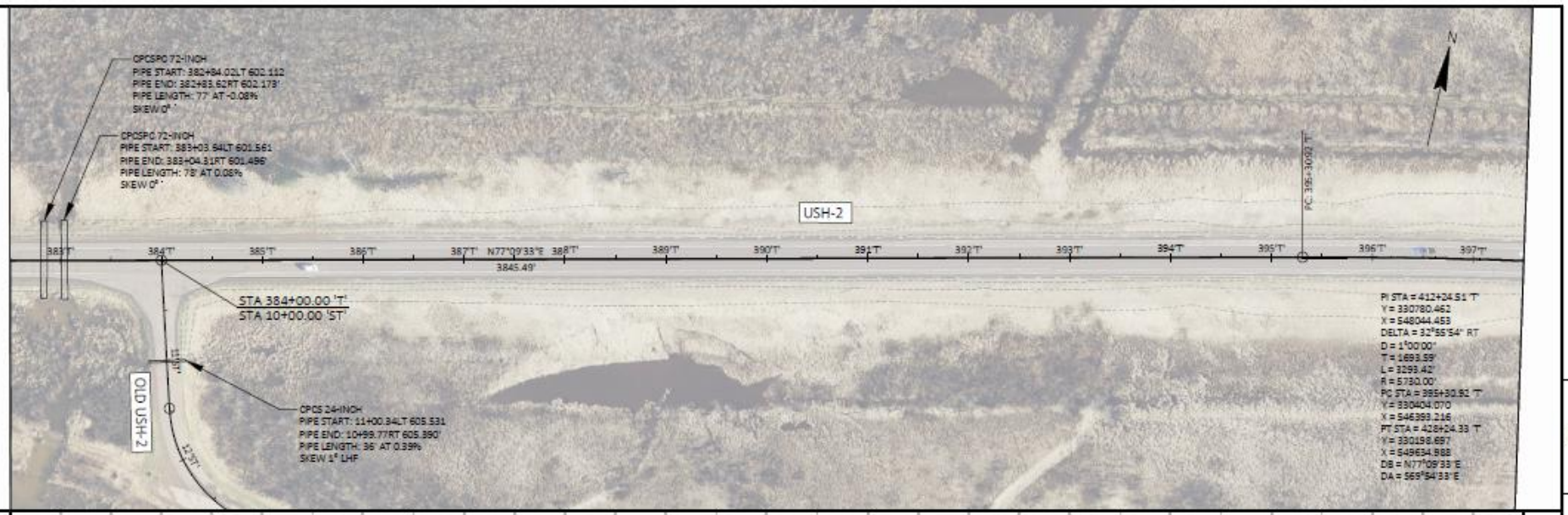
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET E

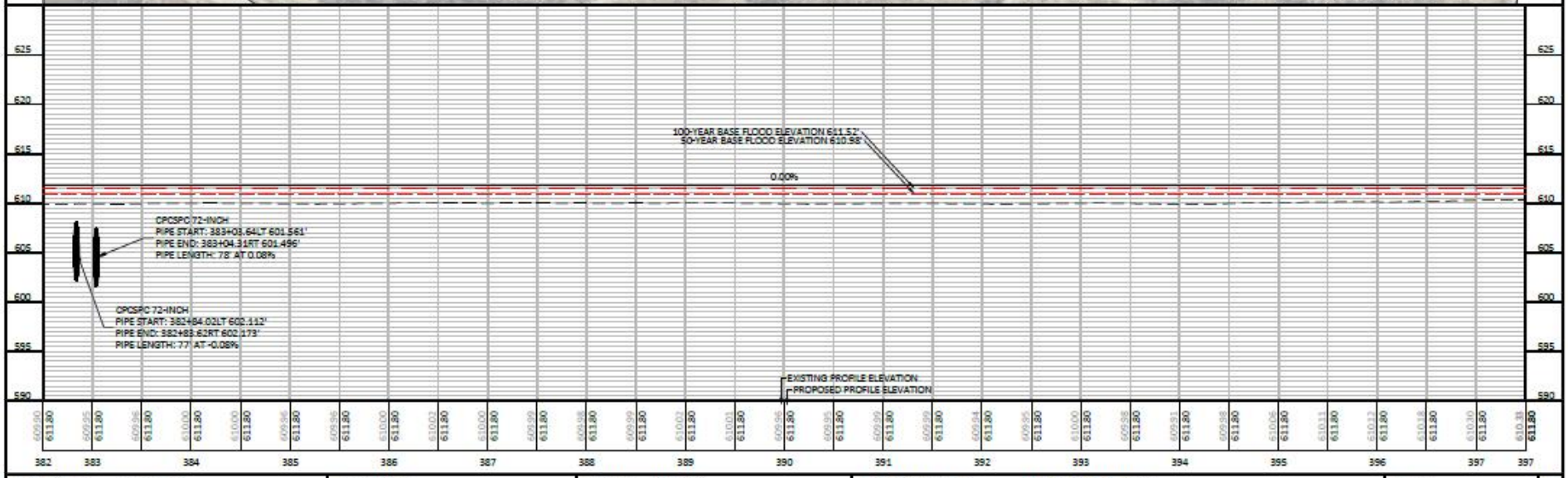
FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180000\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 01
PLOT DATE : 7/31/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT



PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

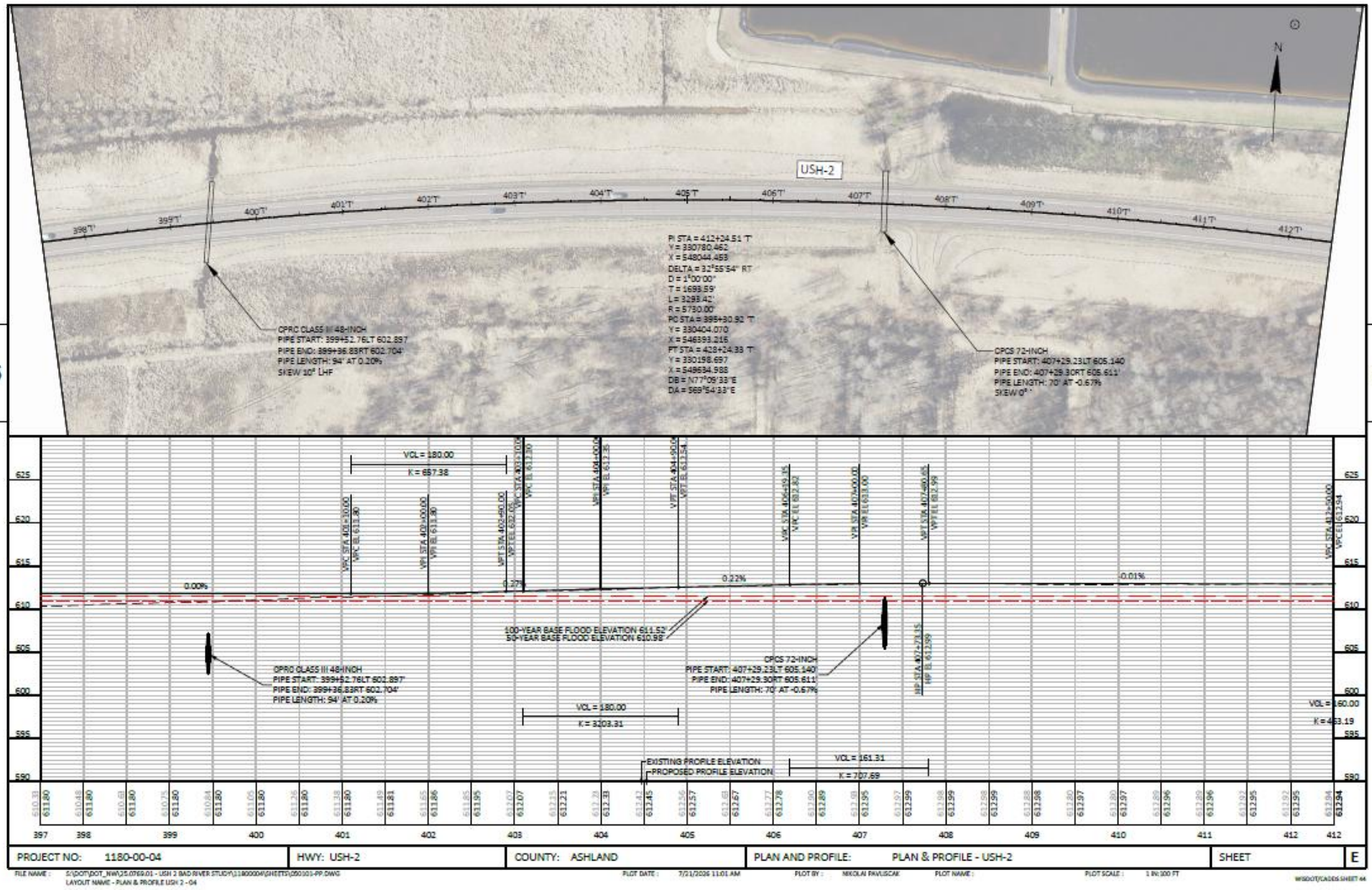
FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180000M\SHEETS\050103-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 02
PLOT DATE : 7/21/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44





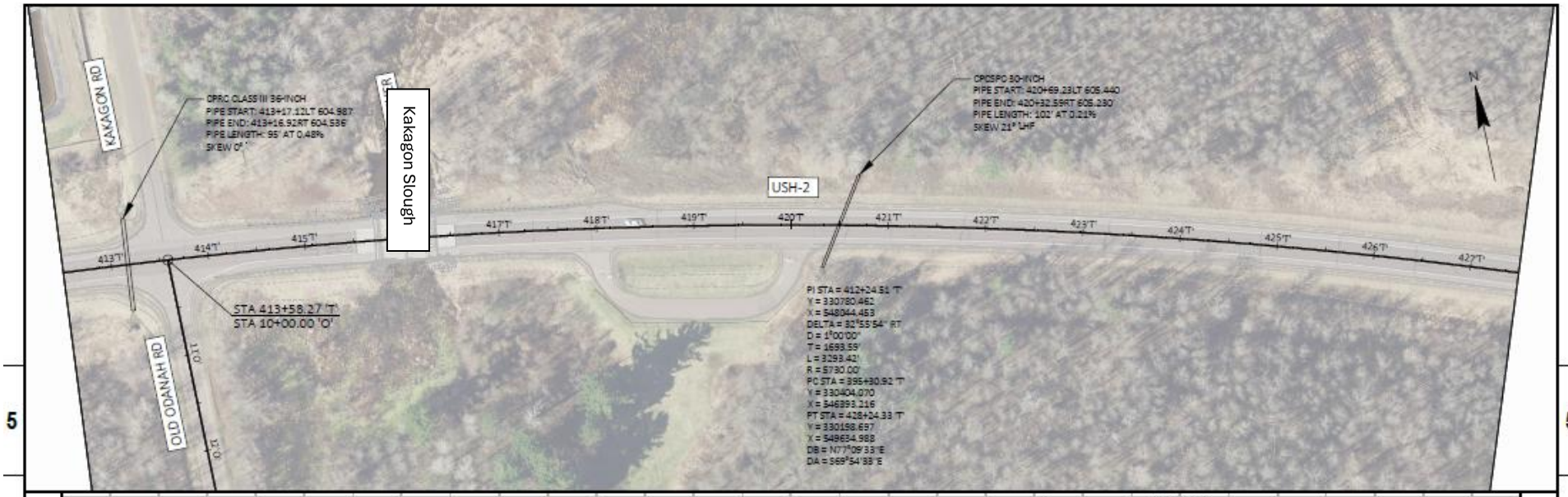
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

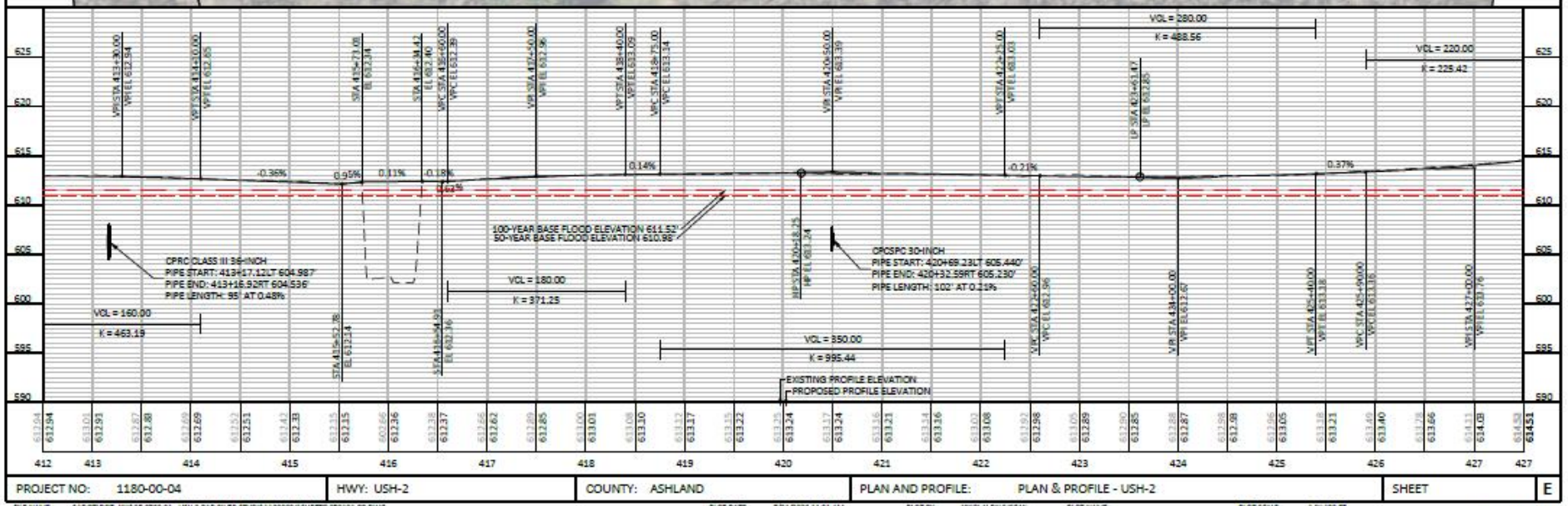
FILE NAME : C:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180004\SHEETS\050103-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 03
PLOT DATE : 7/21/2016 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44



PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

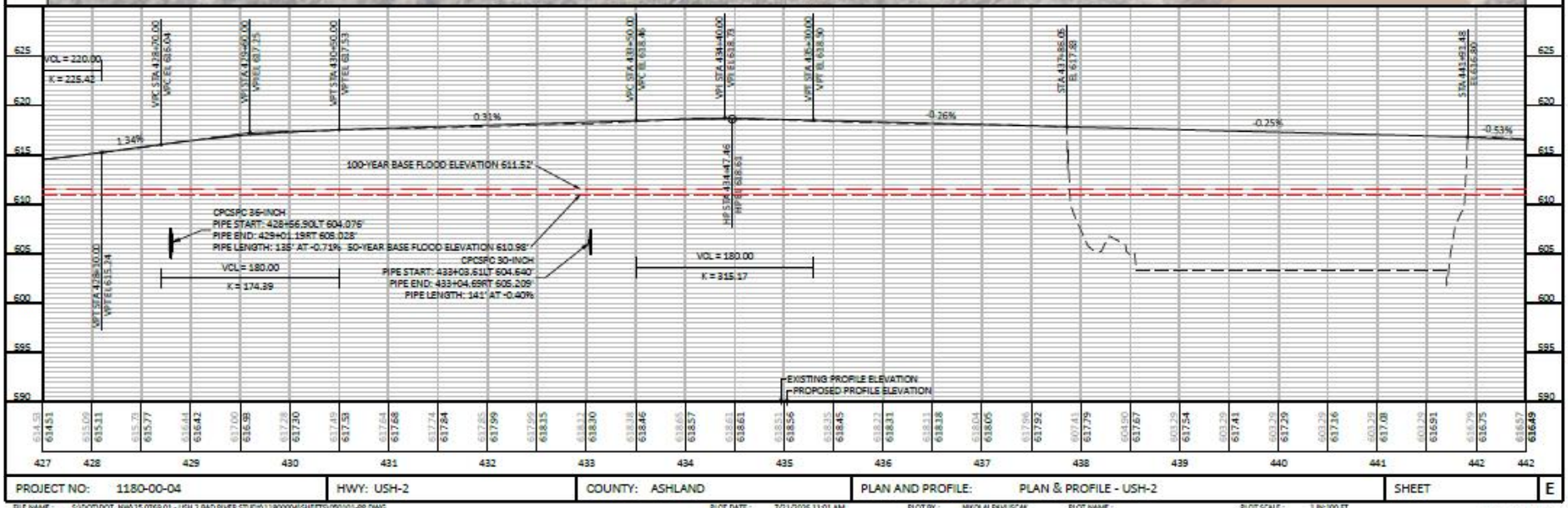
FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180004\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 04
PLOT DATE : 7/21/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44





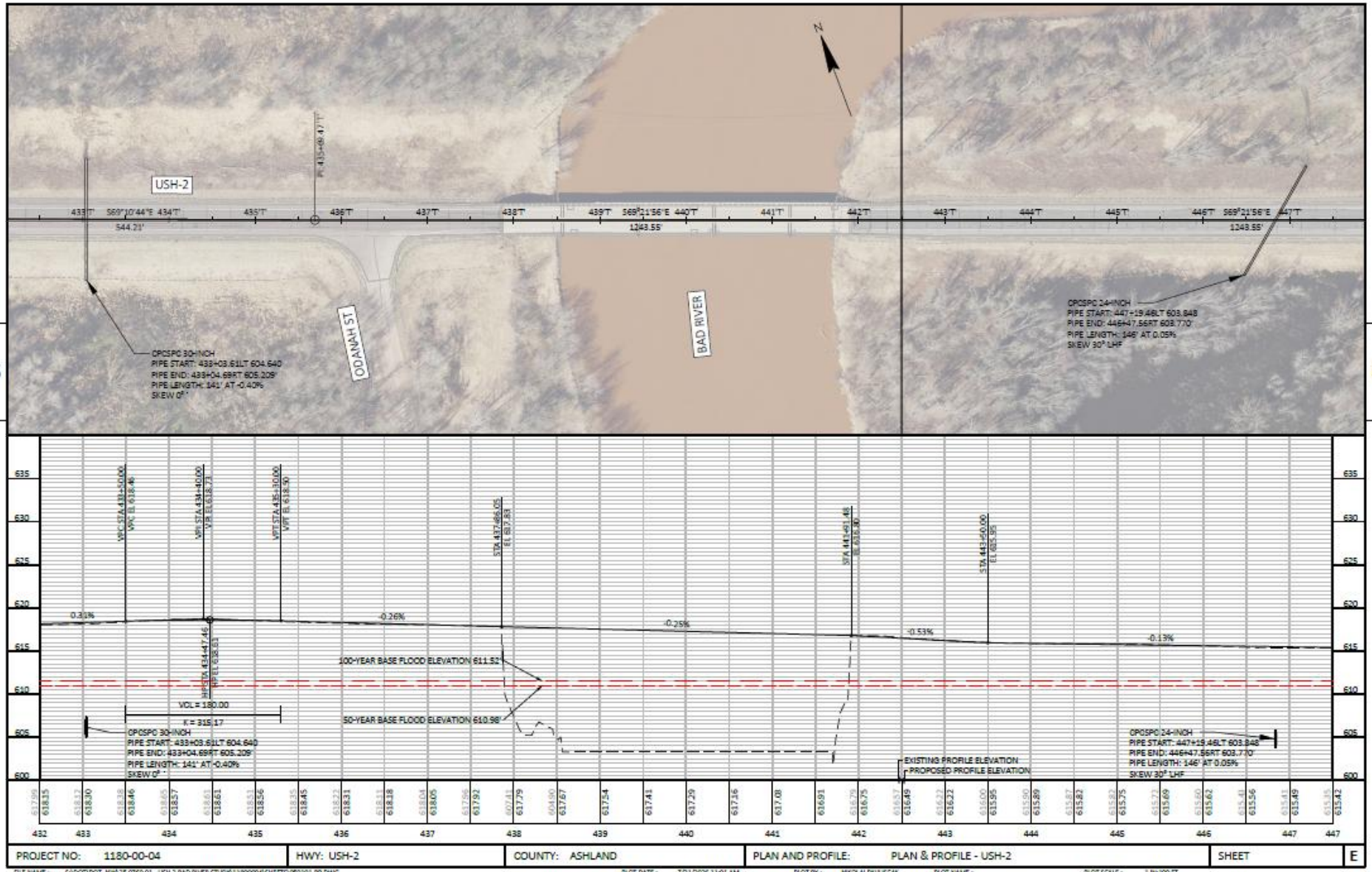
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET E

FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180004\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 05
PLOT DATE : 7/21/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44



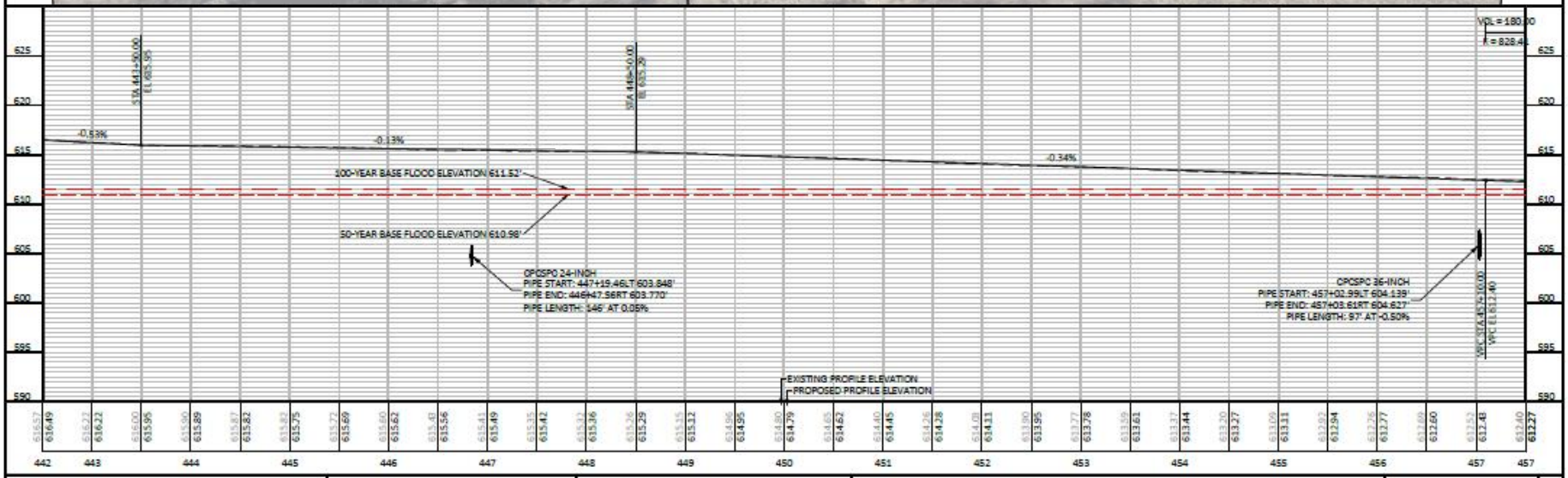
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

FILE NAME : S:\DOT\DOT_NW\15.0769.01 - USH 2 BAD RIVER STUDY\1180004\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 06
PLOT DATE : 7/21/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44



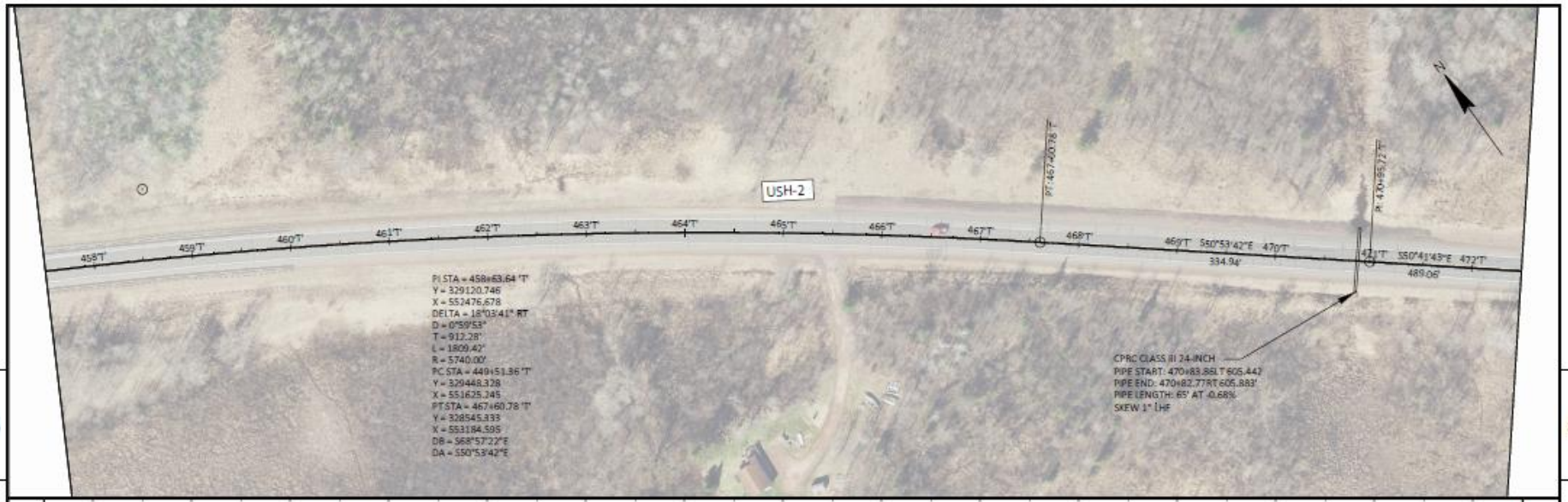
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET E

FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180004\SHEETS\050101-PP.DWG
LAYOUT NAME - 1 PLAN & PROFILE USH 2 - 6a
PLOT DATE : 7/21/2026 11:01 AM PLOT BY : NIKOLAI PAVLISCAK PLOT NAME : PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 66



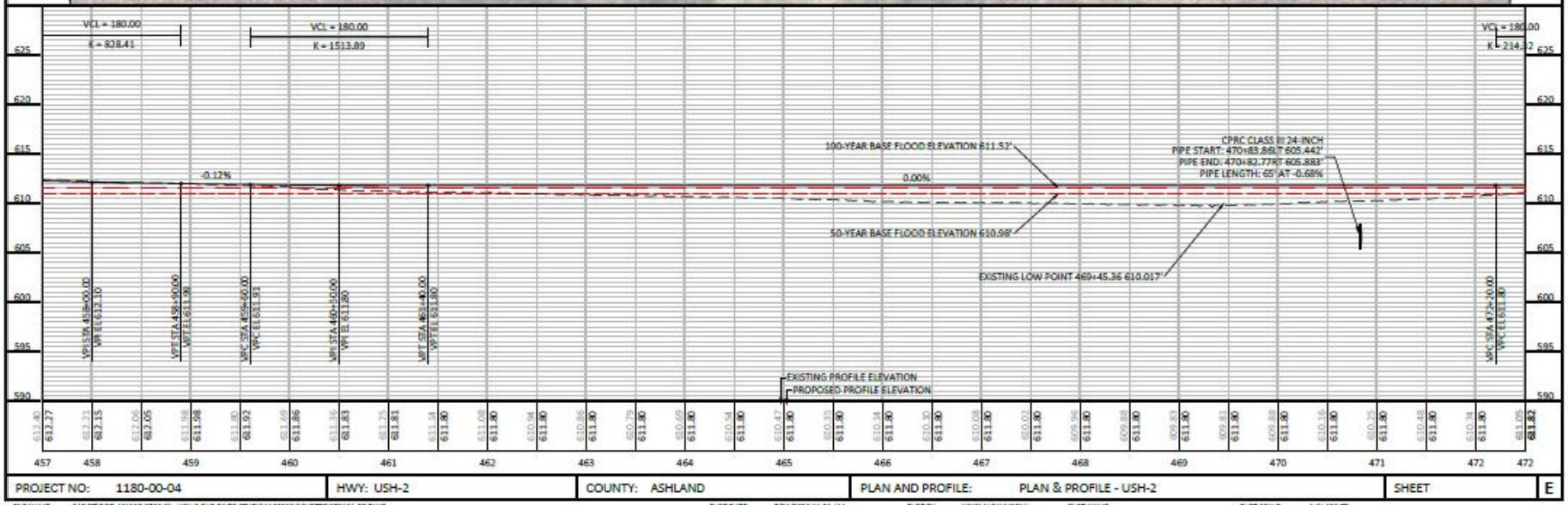
PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180000#\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 -07
PLOT DATE : 7/21/2026 11:01 AM
PLOT BY : NIKOLAI PAVLISCAK
PLOT NAME :
PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44



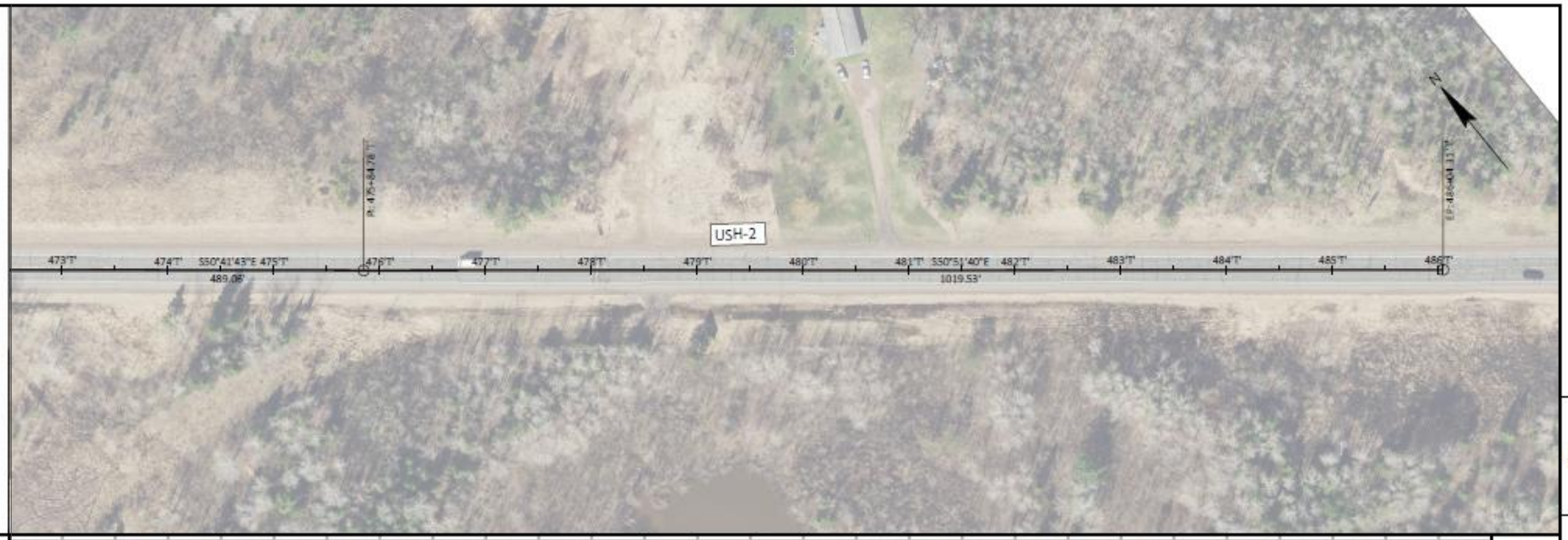
5

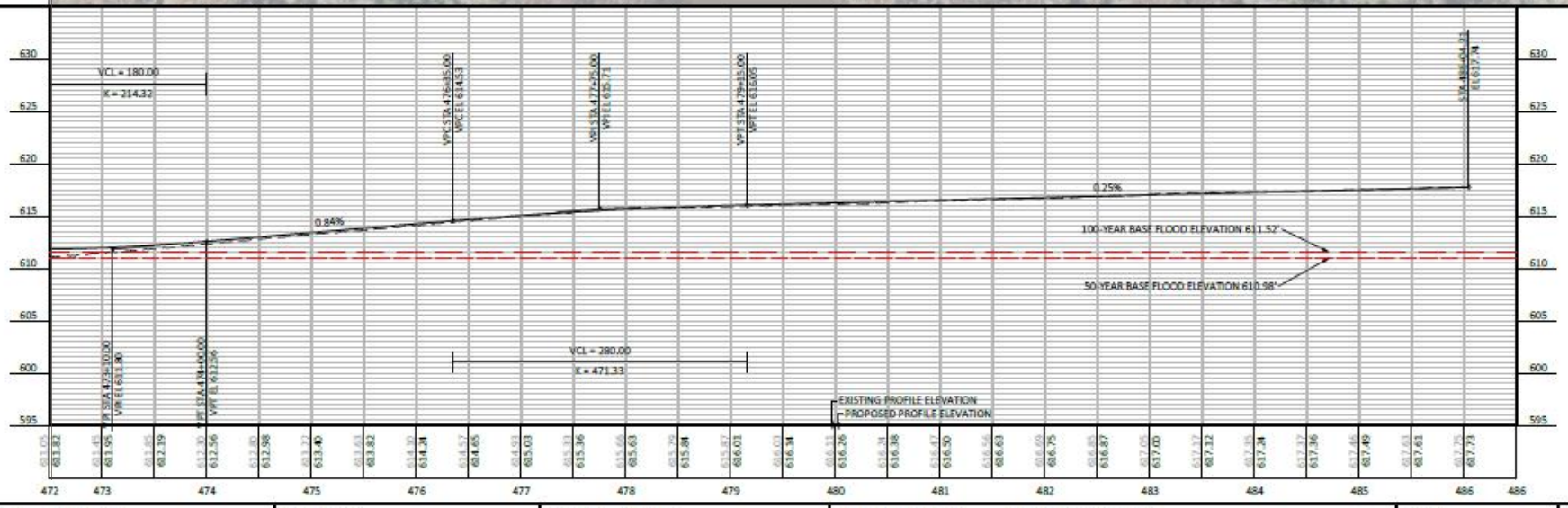
5



PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

FILE NAME: S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\1180004\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 08
PLOT DATE: 7/21/2026 11:01 AM
PLOT BY: NIKOLAI PAVLISCAK
PLOT NAME:
PLOT SCALE: 1 IN:100 FT
WSDOT/CADDS SHEET 44





PROJECT NO: 1180-00-04	HWY: USH-2	COUNTY: ASHLAND	PLAN AND PROFILE: PLAN & PROFILE - USH-2	SHEET	E

FILE NAME : S:\DOT\DOT_NW\25.0769.01 - USH 2 BAD RIVER STUDY\11800004\SHEETS\050101-PP.DWG
LAYOUT NAME - PLAN & PROFILE USH 2 - 09
PLOT DATE : 7/21/2026 11:01 AM PLOT BY : NIKOLAI PAVLISCAK PLOT NAME : PLOT SCALE : 1 IN:100 FT
WISDOT/CADDS SHEET 44