

**STANDING INSTRUCTIONS TO THE PROJECT MANAGER
FOR WATER CONTROL**

**TOLNA COULEE CONTROL STRUCTURE
TOLNA COULEE
RED RIVER OF THE NORTH DRAINAGE BASIN**



**U.S. ARMY CORPS OF
ENGINEERS
ST. PAUL DISTRICT
ST. PAUL, MINNESOTA**



**NORTH DAKOTA
STATE WATER COMMISSION
BISMARCK, NORTH DAKOTA**

MARCH 2012

Tolna Coulee Control Structure
U.S. Army Corps of Engineers
St. Paul District

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PERTINENT DATA

Location: The Tolna Coulee Control Structure is located at the outflow of Stump Lake on Tolna Coulee in Nelson County, North Dakota. The control structure is located on the lake upstream of the natural high point of Tolna Coulee. It is located about 25 miles SE of Devils Lake, North Dakota and 100 miles NW of Fargo, North Dakota.

Datum: To convert stage to elevation in 1929 NGVD add 1,400.00 feet.
To convert stage to elevation in 1988 NAVD add 1,401.20 feet.

Drainage Area: 3,810 sq miles. It is the Devils Lake Basin, which is a closed sub-basin of the Red River of the North basin.

Embankment:

Type	Earth Fill with Sheet pile core
Total Length	842 feet
Crest	Stage of 66 feet

Control Structure:

Spillway	
Type	Concrete
Length	142 feet total with eleven 2-foot piers.
Bays	12 stop log bays, each 10 feet wide. Bays are numbered 1-12 from north to south. Max stage of 58 feet. Min stage of 46 feet. Each stop log is one foot high.
Crest	Stage of 46 feet

Natural High Point between Stump Lake and Tolna Coulee: Stage of 58 feet.

Elevation of Stump Lake: USGS Gage 05056665 Eastern Stump Lake nr Lakota, ND

Definition of Overflow: Overflow occurs once water starts to flow over the natural high point between Stump Lake and Tolna Coulee.

1) Background and Responsibilities

a. General Information

i. Authorization for Preparation of this Manual: The first “Standing Instructions to the Project Manager for Water Control” for the Tolna Coulee Control Structure was prepared in 2011-2012 in compliance with instructions contained within DIVR 1110-2-240, specifically paragraph 5 and page A-9-12. Since there is not a project office, a copy of these instructions must be kept at the North Dakota State Water Commission. Any deviation from the instructions will require the advance approval of the US Army Corps of Engineers (USACE or Corps) St. Paul District Commander. This manual was prepared in compliance with the guidelines presented in:

1. Division Regulation, DIVR 1110-2-204, *Water Control Management, Reporting Current Conditions*, 5 August 1992.
2. Engineering Regulation ER 1110-2-240, *Water Control Management*, 8 October 1982, amended 30 April 1987 and 1 March 1994.
3. Engineering Manual EM 1110-2-3600, *Management of Water Control System*, 30 November 1987.

ii. Project Location and Description: The Tolna Coulee Control Structure is located at the outflow of Stump Lake on Tolna Coulee in Nelson County, North Dakota. It is located on the lake upstream (lakeward) of the natural high point in Tolna Coulee. It is located about 25 miles SE of Devils Lake, North Dakota and 100 miles NW of Fargo, North Dakota. The project consists of a combination sheet pile, embankment, and steel stop log weir structure. The stop log structure includes twelve 10-foot wide stop log bays. **Figure 1 in Appendix A** shows a photo of the control structure. **Figures 2 and 3 in Appendix A** show the location of the control structure.

iii. Project Owner and Operating Agency: The North Dakota State Water Commission (NDSWC) is the owner and operating agency. The NDSWC is responsible for project O&M in accordance with the terms of the Project Partnership Agreement between the NDSWC and the Corps of Engineers dated 09 September, 2011. References:

1. Code of Federal Regulations (CFR Title 33, Part 208.10)
2. DIVR 1130-2-304, *Maintenance by Local Interests*

iv. Project Purpose and Rules Guiding Operation of the Control Structure: As explained in the Final Environmental Assessment (EA) and the Finding of No Significant Impact (FONSI) dated September 2, 2011, the purpose of the project is to prevent a catastrophic release of flow through the Tolna Coulee in the event of an overflow from Stump Lake while allowing Devils Lake water levels to fall to the level they would have without the project. (EA section 1.3). The EA and FONSI further indicate that the control structure will be operated in accordance with a set of rules to ensure that implementation of the project is consistent with the project purpose and analysis contained in the EA. The EA states that the rules

will be incorporated into an operating plan for the structure. This document – the Standing Instructions to the Project Manager – is the operating plan referenced in the EA.

A complete listing of the rules that will guide operation of the control structure can be found in section 2.3.2.2 of the EA, as modified by the environmental review document dated 05 January 2012. Appendix G of the EA contains comments and responses on the Draft EA. This provides additional information for interpreting the intent of the rules. These rules are briefly summarized below:

- The basic premise of these Standing Instructions is the controlled removal of stop logs after the erosion of the divide to allow the lake to lower as it would have without the project, while limiting releases to no more than 3,000 cfs.
- Active management (raising or lowering) of lake levels after levels have fallen to the elevation of the eroded divide is not allowable under these Standing Instructions. In other words, just as water currently would not be impounded in Stump Lake above the natural outlet elevation, neither will water be impounded in the future in Stump Lake if natural erosion lowers the high point of Tolna Coulee below its current stage of 58 feet.
- Because impoundment of water in Stump Lake or Devils Lake is at odds with the project purpose (which is to prevent catastrophic flow through the coulee for downstream communities while allowing Devils Lake water levels to fall to the level they would in the absence of the project), once stop logs are removed from the structure to allow discharge they will not be replaced for the purpose of holding water in Stump Lake. If for some other, presently unforeseen reason stop logs are proposed to be added to the control structure after being removed to allow discharge, it could not occur unless these Standing Instructions are modified and approved by the Corps of Engineers and any required environmental review has been completed.
- No stop logs will be placed above a stage of 58 feet, the current natural high point between Stump Lake and the Tolna Coulee.
- Initially the stop logs will be placed approximately one foot below the water surface.
- As the water level fluctuates prior to water overflowing the divide, stop logs will be added or removed to maintain the approximate one foot level below the water surface. The stop logs will be placed no higher than a stage of 56 feet.
- Once water begins to flow over the divide, the stop logs in bays one through four and bays nine through twelve will be placed at a stage of 58

feet, and stop logs in bays five through eight will be placed at a stage of 57 feet. If the water level drops below a stage of 57 feet with no erosion of the divide, the stop logs elevation will be governed by the rule above.

- Prior to erosion of the divide between Stump Lake and Tolna Coulee, the stop logs will remain in place as described above, with the intent that the existing topography, not the control structure, will control the discharge.
- If and when natural erosion occurs, stop logs will be removed to the new elevation that exists after erosion has occurred. This will be conducted in a manner not to exceed a discharge of 3,000 cfs.
- On at least a monthly basis, the site will be visited to observe actual conditions and verify that the project is being operated within the parameters of these Standing Instructions.

Neither the EA nor these Standing Instructions allow future dredging upstream of the structure in the absence of certain criteria being met. However, the EA recognizes that although the control structure is designed to allow downstream erosion of the coulee, the structure may alter or impede erosion upstream of the structure, inhibiting the flow of water to the downstream eroded elevation. (EA section 4.1.4). Therefore, an inlet channel may need to be dredged upstream from the structure into Stump Lake. Prior to proceeding with such dredging, the North Dakota State Water Commission will provide to the Corps of Engineers a report containing a) analysis and supporting data demonstrating that the structure is responsible for creating the conditions that are inhibiting flows to the eroded elevation; b) a dredging plan, including the cross-section of the channel to be dredged; and c) analysis and supporting data showing that the dredging plan is designed to remove no more material than necessary to restore flows inhibited by the structure. Dredging will not commence until the Corps of Engineers approves the report and the NDSWC performs any necessary environmental analysis.

b. Role of Project Manager

- i. Low Hydrometeorological Conditions:** Conditions are low when the water surface elevation is below the high point.

The Project Manager is responsible for water control actions during low hydrometeorological conditions without day-to-day instruction from the USACE District Office. However, the USACE District Water Management Section should be contacted any time conditions are such that the standing instructions do not adequately describe the procedures to use.

- ii. Normal Hydrometeorological Conditions:** “Normal Hydrometeorological Conditions” as for the purposes of these instructions are defined as when water is flowing through the control structure and down the Tolna Coulee while not exceeding 3,000 cfs.

The Project Manager is responsible for water control actions during normal hydrometeorological conditions without day-to-day instruction from the USACE District Office. The Project Manager will issue adequate warning to possible hazards caused by project regulation.

- iii. High Hydrometeorological Conditions:** Conditions become high if discharge exceeds 3,000 cfs.

The Project Manager is responsible for water control actions during high hydrometeorological conditions (flow down Tolna Coulee exceeds 3,000 cfs) without day-to-day instruction from the USACE District Office. The Project Manager will issue adequate warning or otherwise alert all affected interests to possible hazards caused by project regulation.

- iv. Emergency Conditions:** Conditions become emergency if there is concern about the structure failing. Conditions remain emergency until both North Dakota State Water Commission and the US Army Corps of Engineers deem it over.

The Project Manager is responsible for water control actions during emergency conditions without day-to-day instruction from the USACE District Office. The Project Manager will alert North Dakota State Radio and USACE to possible hazards caused by project regulation.

2) Hydrometeorological Data Collection and Reporting

a. Low Hydrometeorological Conditions:

- i.** A USGS gage shall be maintained on Tolna Coulee downstream of the control structure to measure hourly stage. A discharge rating shall be established and maintained at the gage location.
- ii.** A site visit by the Project Manager to include a visual inspection of the entire cross section of the natural high point shall be conducted monthly.
- iii.** At least annually prior to spring runoff, the Project Manager shall contact all agencies and departments in the Contact Directory (separate document with normal and emergency phone numbers) and verify that the contact information is still valid.

b. Normal and High Hydrometeorological Conditions:

- i.** A USGS gage shall be maintained on Tolna Coulee downstream of the control structure to measure hourly stage. A discharge rating shall be established and maintained at the gage location. Should an overflow occur, the contract with the USGS shall be updated in order to have additional measurements taken throughout the year. Recommendation is a measurement at least once a month.
- ii.** Evaluation of the natural high point by the Project Manager to determine any erosion shall be documented at least monthly and physically measured when conditions permit.

- iii. A site visit by the Project Manager to include a visual inspection of the high point shall be conducted at least monthly.
 - iv. At least annually prior to spring runoff, the Project Manager shall contact all agencies and departments in the Contact Directory and verify that the contact information is still valid.
- c. **Emergency Conditions:** Project Manager or designated representative shall visit the site as soon as possible. At that point the NDSWC and the USACE will determine a future staffing plan commensurate with the risk of structure failure.

3) Water Control Action and Reporting

This Water Control Action and Reporting section is broken into four sections depending on current hydrometeorological conditions. In order to determine the current rules for stop log placement and reporting find the section that corresponds to the current hydrometeorological conditions (low, normal, high or emergency). For the normal hydrometeorological condition there are additional sections depending on erosion. Determine the amount of erosion (none, less than three feet from current water surface or more than three feet from current water surface) that has occurred before determining which rules currently apply.

- a. **Low Hydrometeorological Conditions:** Prior to erosion, for lake stages at or below a stage of 57 feet, the stop logs in all 12 bays will be placed approximately one foot below the water surface. As the water level fluctuates stop logs will be adjusted to maintain approximately one foot of water over the stop logs. Once stop logs are at a stage of 56 feet no more stop logs are added until water starts to flow over the divide, at which point the project will be operating under the Normal Hydrometeorological Conditions scenario.

For increasing water elevations: recommend adding a row of stop logs when the water surface is two feet above the current stage of stop logs.

For decreasing water elevations: recommend removing a row of stop logs when the water surface is half a foot above the current stage of stop logs.

The USACE District Water Management Section shall be informed whenever stop logs are adjusted.

- b. **Normal Hydrometeorological Conditions:** The USACE Water Management Section and the National Weather Service (NWS) North Central River Forecast Center (NCRFC) shall be informed before (at least one business day) any stop logs are removed. Once overflow starts, USACE and NCRFC shall be kept informed of proposed stop log changes via NWSChat and/or calls. This process should be continued each time stop log configuration is changed or outflow is expected to increase by more than 500 cfs in 24 hours.

- i. **Normal Hydrometeorological Conditions - Erosion has not occurred:** When water begins to flow over the natural divide (stage of 58 feet), the stop logs in bays five through eight will be placed at a stage of 57 feet and bays one through four and nine through twelve will be placed at a stage of 58 feet. Stop logs will remain in these positions unless erosion occurs.

Note: If the structure encounters an event larger than the design event of ½ PMF (1,440,000 acre-ft) on a starting lake stage of 58, or if the ½ PMF event occurs on a starting lake elevation exceeding a stage of 58, outflow may exceed 3,000 cfs. For any given year, outflow will remain below 3,000 cfs for an inflow event of the 2009 magnitude (590,100 acre-ft) or smaller.

- ii. **Normal Hydrometeorological Conditions - Erosion has occurred:**

1. **Normal Hydrometeorological Conditions - Erosion has occurred - While High Point is controlling factor:** The high point is the controlling factor when the pool elevation is less than three feet above the high point.

If erosion of the high point occurs, stop logs will be scheduled to be removed down to the elevation of the eroded high point subject to the restriction that the discharge through the structure may be no more than 3,000 cfs. Stop logs may be removed at a maximum rate of one foot of elevation per eight hours (so every eight hours 12 stop logs may be removed uniformly across the structure).

Recommendation: Set stop logs in bays one through four and nine through twelve at or above the new high point. Set stop logs in bays five through eight one foot lower.

Example: Water surface is at a stage of 59 feet.
 New high point is at a stage of 56.7 feet.
 Stop logs in bays one through four and nine
 through twelve are set at a stage of 57 feet.
 Stop logs in bays five through eight are set at a
 stage of 56 feet.

Note: While the high point is the controlling factor, there is a chance of flows exceeding more than 3,000 cfs during any large inflow event.

2. **Normal Hydrometeorological Conditions - Erosion has occurred - While Control Structure is controlling factor:** If the pool is more than three feet above the new high point then the control structure, not the new high point, will prevent the flow from exceeding 3,000 cfs.

When natural erosion occurs, stop logs will be scheduled to be removed down to the eroded high point elevation, while preventing discharges from exceeding 3,000 cfs. Stop logs may be removed at a maximum rate of one foot of elevation per eight hours (so every eight hours 12 stop logs may be removed uniformly across the structure) The Project Manager must work with the

NWS NCRFC and USACE District Water Management Section during each winter to determine risk of discharges exceeding 3,000 cfs during the following spring and summer.

To determine an estimate of flow use the following weir equation: $Q = CLH^{1.5}$, where Q = discharge in cfs, C = 3.0, L = length of weir so 10 feet times number of bays at that elevation, H = water elevation minus elevation of stop log bay. Example: 8 bays are at a stage of 58 feet and 4 bays are at a stage of 57 feet. Water surface is at a stage of 59 feet.

$$Q = [(3.0)(80\text{ ft})(59\text{ ft} - 58\text{ ft})^{1.5}] + [(3.0)(40\text{ ft})(59\text{ ft} - 57\text{ ft})^{1.5}].$$

Use the USGS gage on Tolna Coulee (as described in section 2) for actual flows and to adjust the C in the equation as discharge measurements are made downstream of the control structure.

Recommendation: In order to determine what new elevation to set the stop logs at use the weir equation above. Suggestion for first trial of input parameters in the weir equation: eight bays at a stage between three and four feet below the pool stage and four bays at a stage between four and five feet below the pool stage. If the trial does not work, any of the stoplogs may be changed in the equation as long as there is no more than one foot difference between all stoplogs.

Example: Water surface is at a stage of 59 feet.
New natural high point is at a stage of 54.3 feet.
Try eight bays at a stage of 55 feet and four bays at a stage of 54 feet.

Note: While maximum flow of 3,000 cfs is the controlling factor, there is a chance of flows exceeding more than 3,000 cfs during any large inflow event.

- c. **High Hydrometeorological Conditions:** No stop logs will be removed while outflow exceeds 3,000 cfs. The Project Manager shall work with NCRFC and USACE District Water Management section to forecast how long flows will remain above 3,000 cfs and what the peak outflow will be.
- d. **Emergency Conditions:** In case of an emergency the following list of contacts should be called immediately:
- If flows in excess of 3,000 cfs are expected:
 - Call North Dakota State Radio which will initiate actions under the Flood Incident Annex of the State Emergency Operations Plan. North Dakota State Radio will contact NWS-WFO who will issue the warnings to the public.
 - Call the US Army Corps of Engineers District Office EOC.
 - If flows are expected to remain below 3,000 cfs:
 - Call the US Army Corps of Engineers District Office EOC.
 - Call NWS-WFO.

- e. **Inquiries:** All responses to substantive inquiries received by the Project Manager from citizens, constituents or interest groups regarding water control procedures or actions should be coordinated with the USACE District Water Management Section.

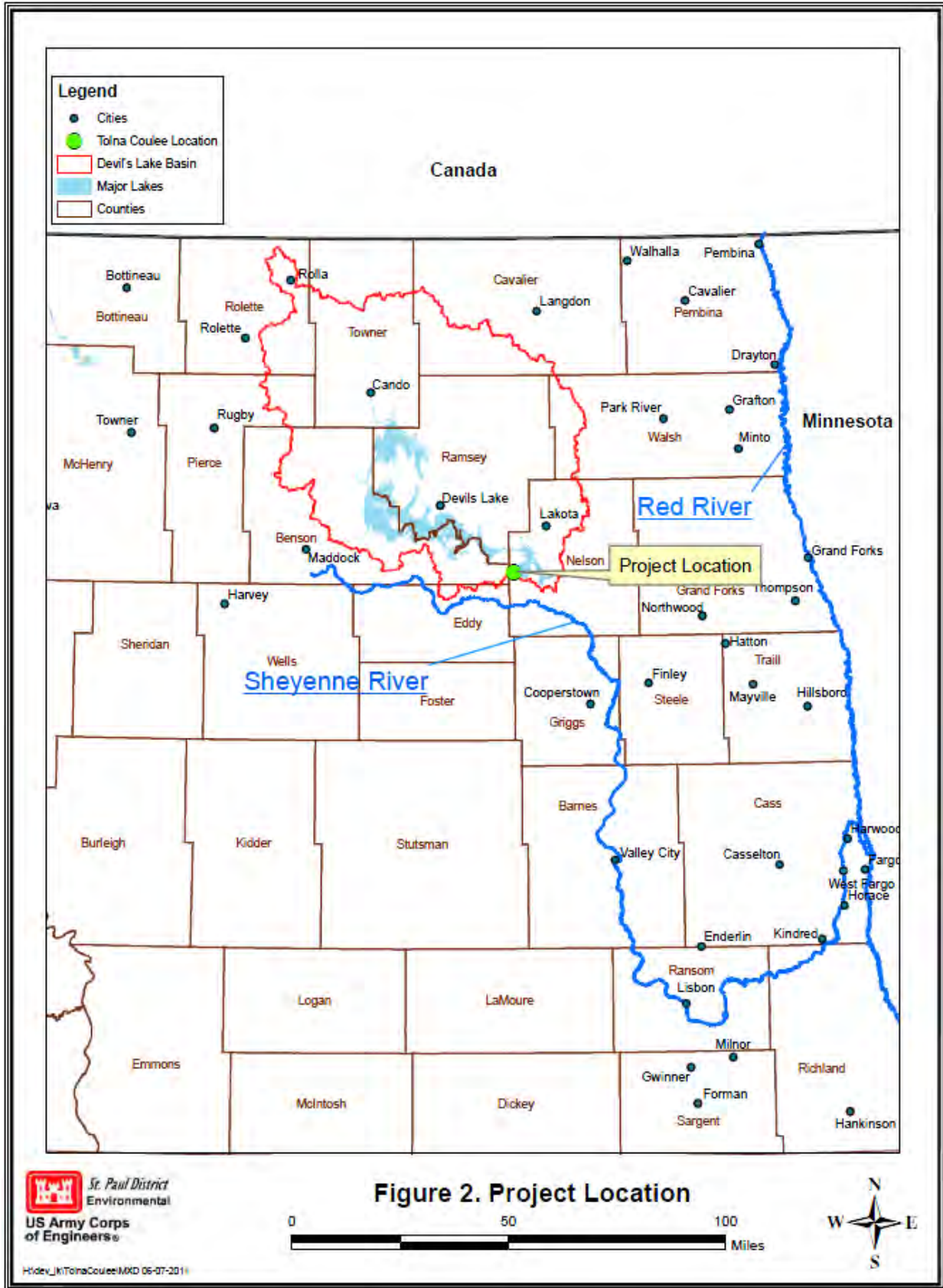
- f. **Water Control Problems:** In the case of unauthorized or unanticipated non-natural events stop logs will remain in place at the then-current elevation until an evaluation has been conducted. USACE and NDSWC will conduct the evaluation. See Comment E.1 in Appendix G of the EA for additional information and available remedies.

- g. **Communication Outage:**
 - **Low Hydrometeorological Conditions:**
 - Send any emails to the USACE District Office once the outage is over.
 - **Normal Hydrometeorological Conditions:**
 - If an outage occurs with either USACE or NCRFC but not both, have the other office pass on the information. Once the outage is over follow up with the office to confirm receipt of the information.
 - If the communication outage involves both the NCRFC and USACE District Office, no stop logs may be removed until the outage is over and contact has been made with the USACE District Office.
 - **High Hydrometeorological Conditions:**
 - Call the following people if conditions change from Normal to High during a communication outage.
 - Call North Dakota State Radio which will initiate actions under the Flood Incident Annex of the State Emergency Operations Plan. North Dakota State Radio will contact NWS-WFO who will issue the warnings to the public.
 - Call the U.S. Army Corps of Engineers District Office EOC.
 - **Emergency Conditions:**
 - If flows in excess of 3,000 cfs are expected:
 - Call North Dakota State Radio which will initiate actions under the Flood Incident Annex of the State Emergency Operations Plan. North Dakota State Radio will contact NWS-WFO who will issue the warnings to the public.
 - Call the U.S. Army Corps of Engineers District Office EOC.
 - If flows are expected to remain below 3,000 cfs:
 - Call the U.S. Army Corps of Engineers District Office EOC.
 - Call NWS-NCRFC.

Appendix A: Figures

Figure 1: Photograph of Site





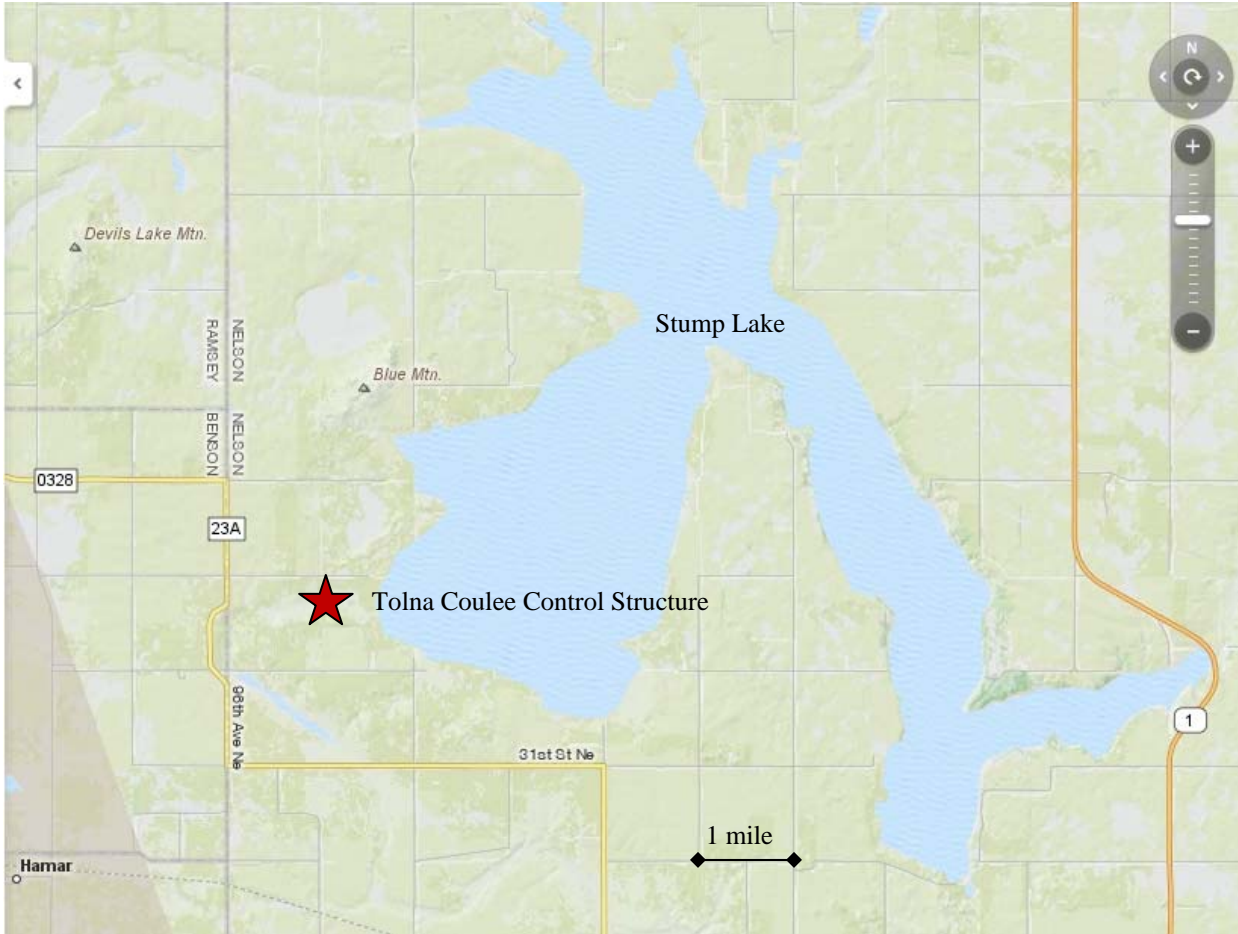


Figure 3: Location of Tolna Coulee Control Structure

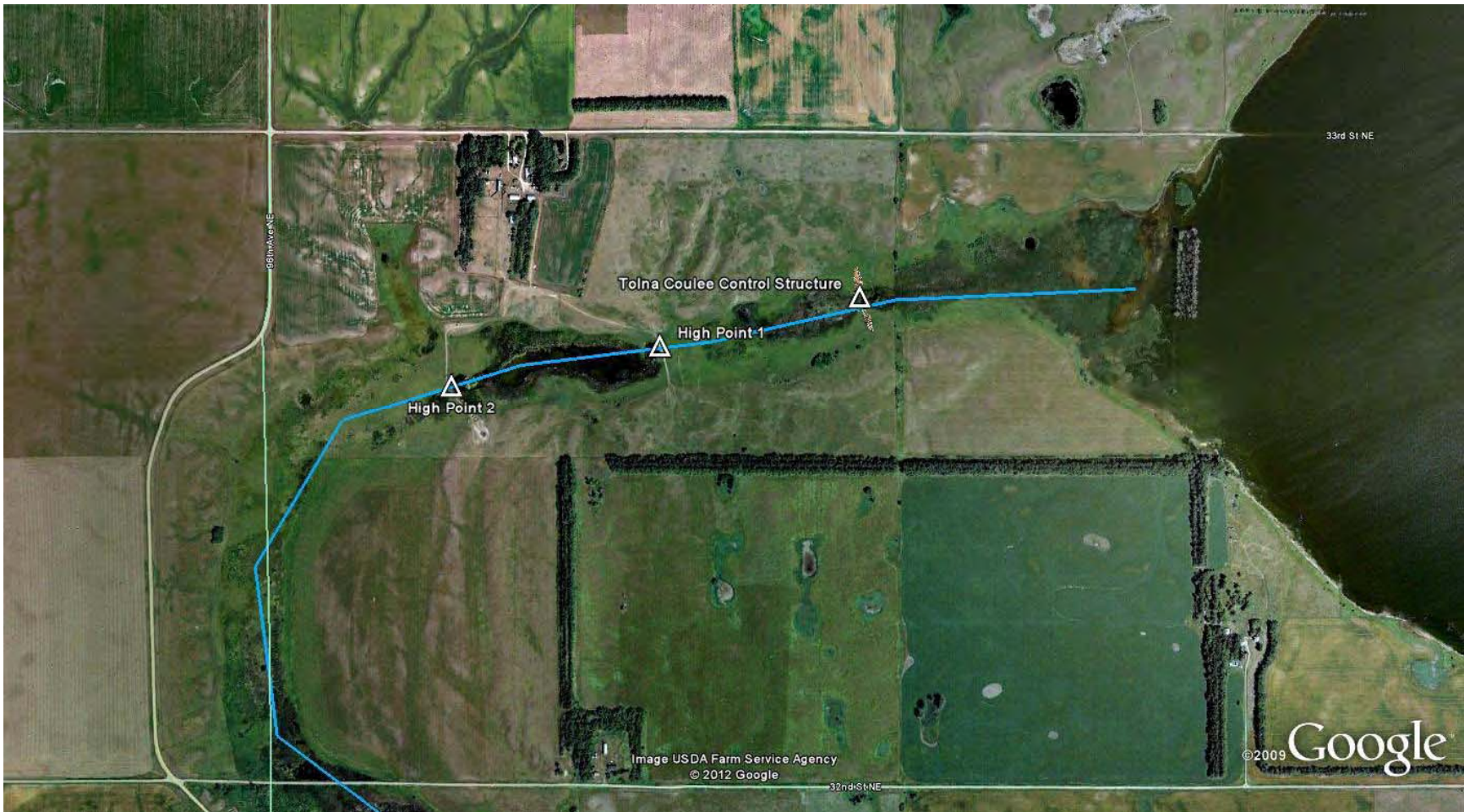
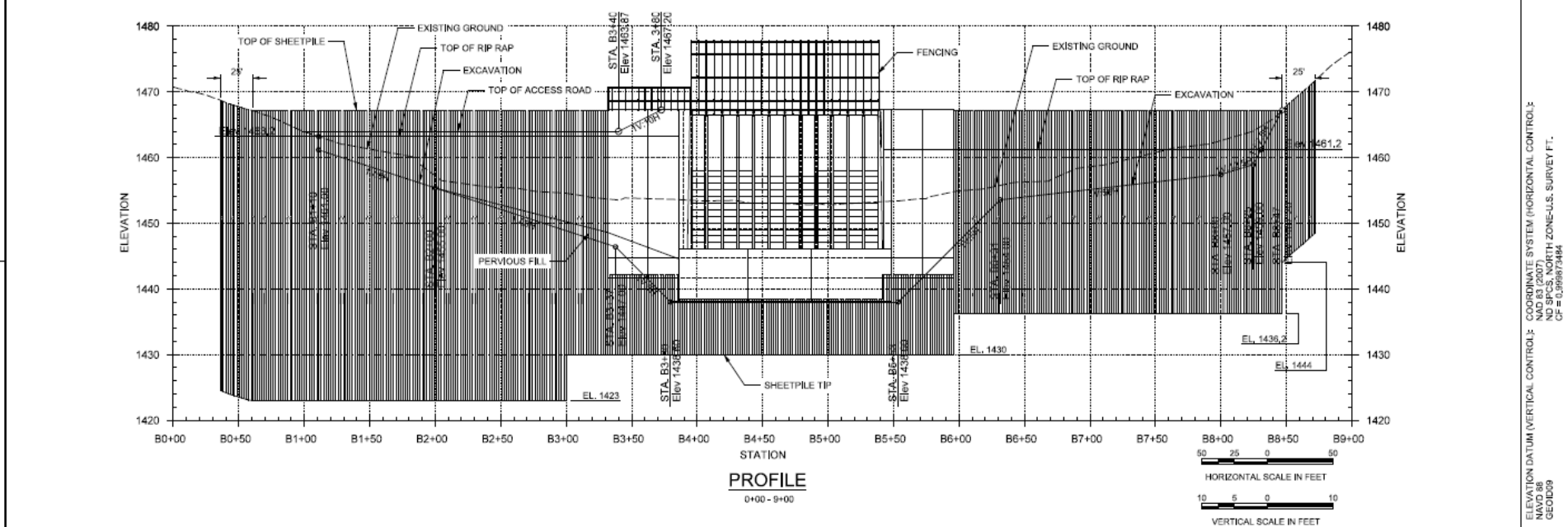
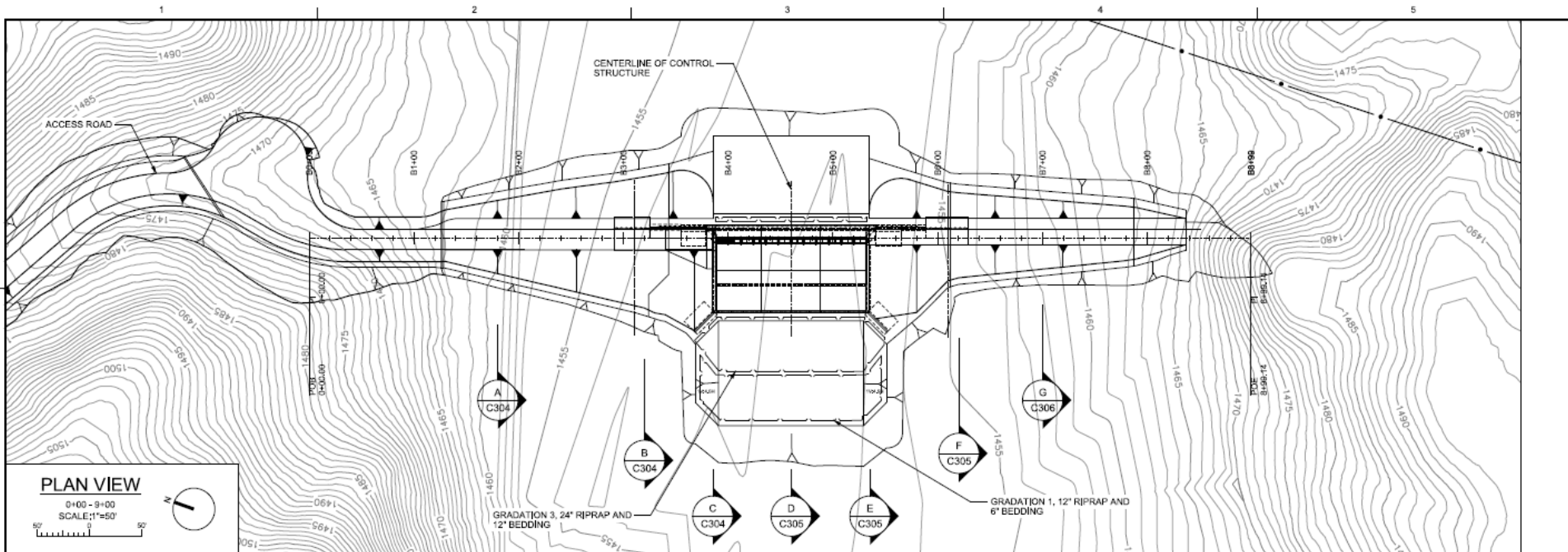


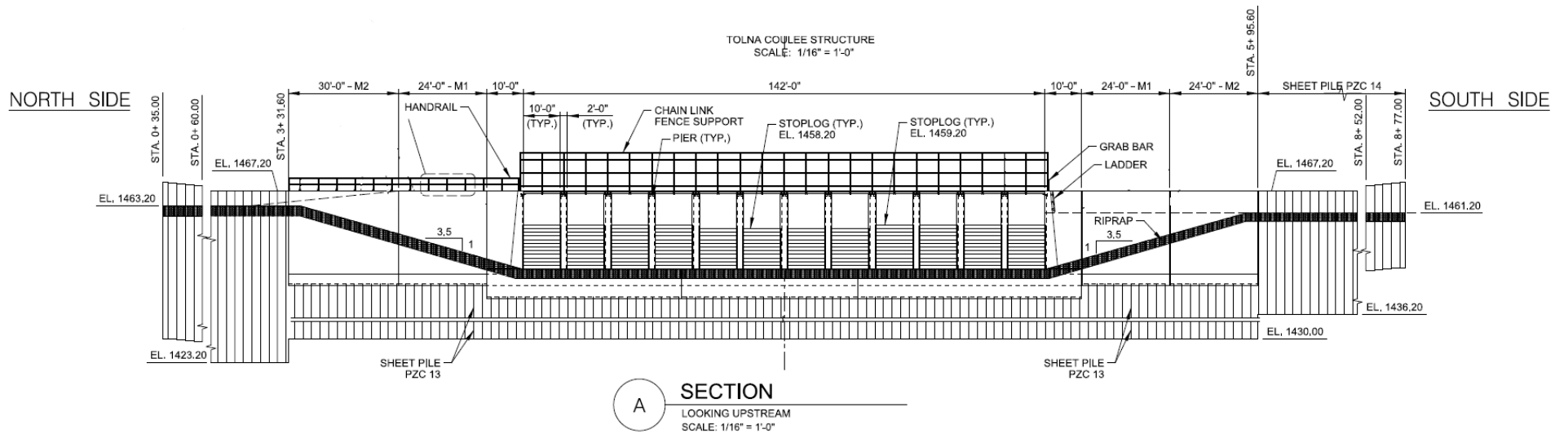
Figure 4: Location of Tolna Coulee High Points

1 mile



ELEVATION DATUM (VERTICAL CONTROL): COGNATE SYSTEM (HORIZONTAL CONTROL):
 NAVD 83 (2011)
 ND SPCS, NORTH ZONE-U.S. SURVEY FT.
 GEOID09
 CP # 0.399873484

Standing Instructions to the Project Manager, Tolna Coulee Advance Measures
 February 23, 2012



In the plan view elevations are in 1988 NAVD. (Stage=NAVD 1988 Elevation – 1401.2 ft)

Bays are numbered 1 through 12 from north to south.

Before erosion Headwater and Tailwater of Tolna Coulee Control Structure will be the same elevation as Stump Lake.