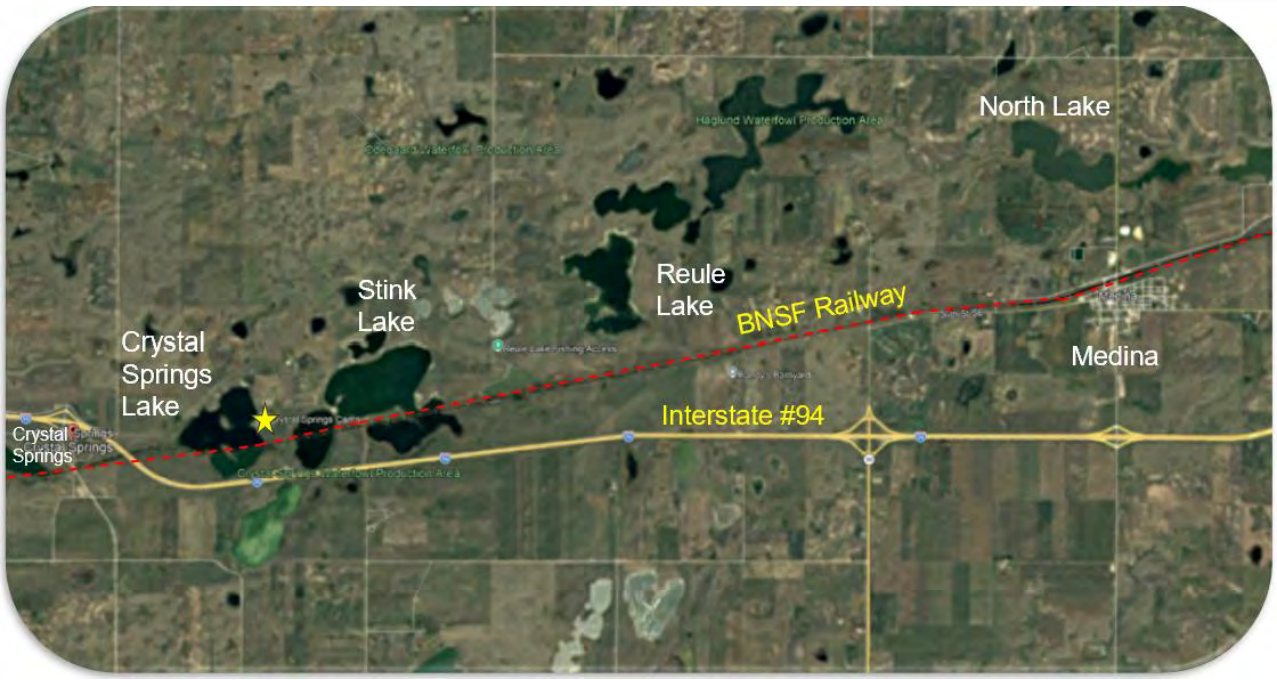
CRYSTAL SPRINGS WATERSHED INITIATIVE
FEASIBILITY STUDY – JUNE 2026



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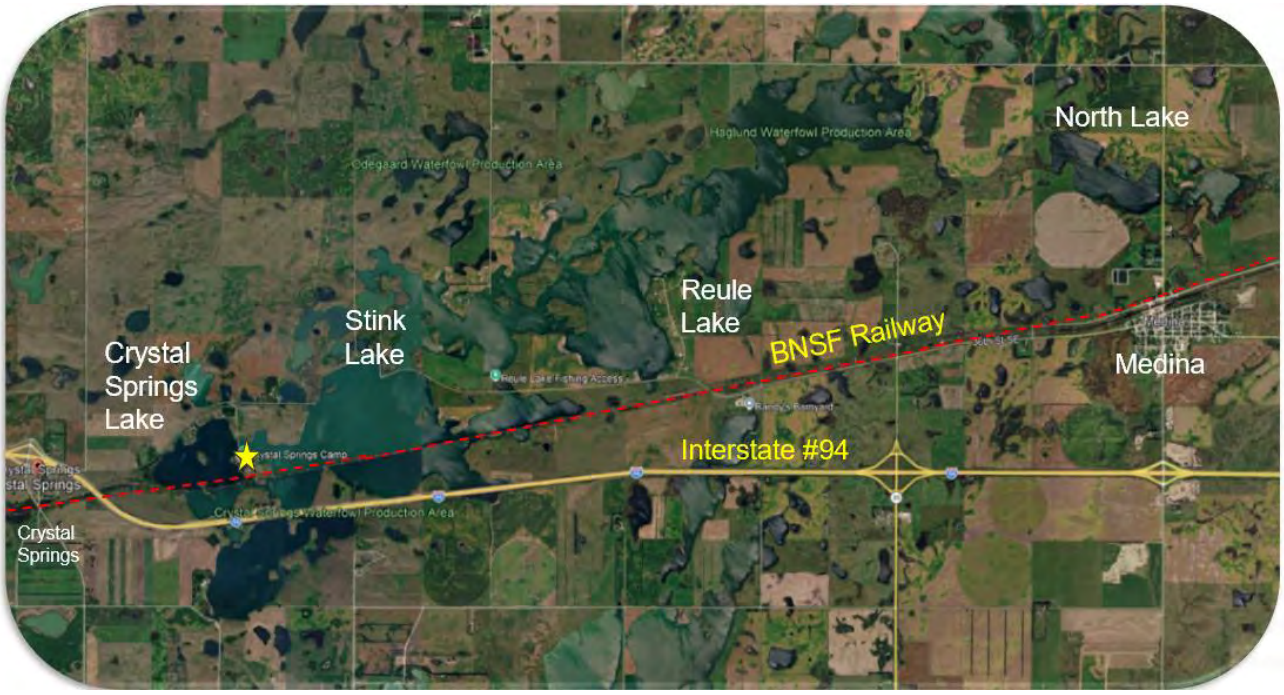

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STUTSMAN COUNTY

CERTIFICATION

I, Michael H. Gunsch, a Registered Professional Engineer under the laws of the State of North Dakota, hereby certify that this *Crystal Springs Watershed Initiative Feasibility Study, Stutsman County, North Dakota* was prepared by me or under my supervision.

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Kidder County Water Resource District
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Jamestown/Stutsman Development Corporation
National Buffalo Museum

***Dedication**: We dedicate this Feasibility Study to the memory of Jerry Bergquist, Stutsman County Commissioner, longtime Emergency Manager, and a special person who dedicated his life to public and community service. Jerry spearheaded efforts to get this study underway to benefit those in the Crystal Springs lake area who need relief from excess floodwater. Thank you, Jerry!*

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REFERENCES

1. *MEMO Crystal Springs Basin Current Hydrological Outlook (Loosmore, Knetter Circa 2002)*

2. *Grade Raise Analysis and Recommendations, NDDOT Valley City District, Pfeifer, Thompson May 19, 2011*

3. *NDDOT Study Preliminary Engineering and Hydraulics, Interstate 94 - RP 223.9 Grade Raise Analysis, Stephen Wirtz, P.E. February 4, 2021*

4. *Final Spatially Constrained Inversions Report and Data Delivery for the Airborne Electromagnetic Survey of Area 1 and Area 2, North Dakota for the North Dakota Department of Water Resources, Aqua Geo Frameworks, LLC, Abraham, Asch (February 4, 2025)*

5. *NDDOT – Runner Slough, Cleveland, ND Grade Raise, Project IM-2-094(210)237 – PCN 24461*

6. *North Dakota Statewide Irrigation Reconnaissance Study, Zhulu, Lin, Proulx, Bazrafkan, and Kim, Agricultural and Biosystems Engineering Department, North Dakota State University, Fargo, ND - February 2025*

7. *Work Area LOMO-3: North Dakota 2D Base Level Engineering Methods and Results, prepared for FEMA Region VIII, Work Area LOMO-3: North Dakota 2D Base Level Engineering, Methods and Results, December 2017*

8. *Chemical and Biotic Characteristics of Prairie Lakes and Large Wetlands in South-Central North Dakota-Effects of a Changing Climate, Scientific Investigations Report 2015–5126, U.S. Department of the Interior, U.S. Geological Survey*

9. *Normal Annual and Monthly Evaporation and Mean Annual and Monthly Precipitation from Shallow Lakes and Reservoirs, U.S. Weather Bureau Technical Paper No. 40. The evaporation information is taken from NOAA Technical Report NWS 33. NEH, Part 650, (EFH), Amend. IA50, Nov. 2007*

10. *North Dakota Century Code - CHAPTER 61-32 – DRAINAGE*

11. *USGS Stream Gage at Harvey, North Dakota (09020202)*

12. North Dakota Hydrology Manual (NDHM*)*

Executive Summary

The Crystal Springs Watershed Initiative (CSWI) Feasibility Study evaluated the technical, environmental, regulatory, and economic feasibility of mitigating ongoing and projected impacts from rising lake levels within the Crystal Springs closed-basin watershed in Stutsman and Kidder Counties, North Dakota. The watershed has experienced long-term water level increases resulting in inundation risks to Interstate 94, a Rest Area, the Burlington Northern Santa Fe (BNSF) mainline railroad, Crystal Springs Baptist Camp, county and township roadways, recreational facilities, residential properties, and agricultural lands.

This study synthesizes hydrologic modeling, hydraulic analysis, groundwater assessment, lake management planning, and stakeholder input to identify a viable excess floodwater management strategy. A central finding is that the system is volume-driven rather than peak-flow driven, with snowmelt and groundwater accounting for a substantial portion of annual inflows. As a result, structural improvements (grade raises, levees, etc.) alone are insufficient; therefore, an active water removal is necessary to achieve a long-term flood mitigation strategy.

Based on available documentation and study findings, a pumped floodwater removal system with a projected capacity of approximately 20 cubic feet per second (cfs), coupled with pipeline conveyance and downstream discharge controls, was identified as the preferred alternative for further engineering and regulatory permitting. The next step is further evaluation through a Preliminary Engineering Report , see **Section 13.0**, process to support project development, design, and implementation.

1.0 Development of Scope and Budget

1.1 Introduction - Project Description

Crystal Springs Lake, Stink Lake, and Reule Lake have experienced a rapid increase in water levels of more than nine feet since 2010, and even greater increases historically. This has resulted in the need for multiple roadway grade raises on Interstate 94 and the BNSF main line at significant public and private expense. Other adverse flood impacts include county and township roadway grade raises due to inundation and overtopping; the Crystal Springs Baptist Camp has raised its entrance roadway, constructed a levee, elevated a portion of the site, and installed other protective measures for buildings at risk of flooding. The recreational lake cabins around Crystal Springs Lake are also at risk. Recently developed recreational and residential lots on Reule Lake are at risk of future flooding. While most of these structures on Reule Lake are not at immediate risk, they will be in the foreseeable future. There continues to be a significant risk of new inundation and expanding flooding on agricultural lands around the lake system. Upstream, the City of Medina and the area known as North Lake have experienced localized residential groundwater impacts. While this area will not be directly lowered by pumped removal, the opportunity to remove excess water from this area will be enhanced by the project.

There remains a high risk of significant economic losses and damage to two major interstate transportation corridors and other facilities as water levels continue to rise. Subsequently, the Stutsman County Commission initiated the *Crystal Springs Watershed Initiative* (CSWI) to evaluate flood risks along with potential prevention, mitigation, and protection measures.

According to 2011 and 2021 NDDOT Studies[2,3], and confirmed during this study, the surface water overflow elevation from this lake complex system is into an adjacent watershed basin at 1793. This combined lake system would then overflow into the Long Lake Creek Watershed, i.e., Missouri River Basin, at around elevation 1801. This overflow elevation is ~47 feet above existing water levels, which are around 1755+, (circa May 2026) and rising. Subsequently, without removing excess flood waters the noted facilities will be flooded or inundated in the foreseeable future, as described later.

1.2 Feasibility Study

The purpose of this *Feasibility Study* is to define the contributing watershed, project future water levels, evaluate alternative floodwater removal systems, review groundwater conditions to determine their contribution to the system, identify regulatory issues associated with a pump, pipeline, and discharge into a receiving watercourse, and provide a preliminary economic analysis of benefits and damages based on an opinion of probable cost. While alternative routes were considered, as noted later, the topographic data indicated that the Long Lake Refuge (LLR) area in Kidder and Burleigh Counties is the natural overflow and receiving stream for this noncontributing watershed. The LLR is a shallow lake system located on Long Lake Creek and extends north into Kidder County through Lake Etta and Alkaline Lake. Overflows through the refuge discharge north and west into McKenzie Slough, then northwest into Random Creek, and then west into Apple Creek, which drains south and west to its confluence with the Missouri River. As discussed later, groundwater's influence on the Crystal Lake system was much greater than originally anticipated, which required a supplemental review.

1.3 Study Development

Houston Engineering prepared a *Scope and Budget* for the Crystal Springs Watershed Initiative (*CSWI*) that was subsequently incorporated into an EJCDC Engineering Services Agreement, with *Peritiacon Consulting and Contracting* utilized as a subconsultant. The first element included submitting a project summary to include the project in the North Dakota State Water Plan (circa 2024). Following that was completing a *Web Grants Application* to the North Dakota Department of Water Resources (*DWR*) and the North Dakota State Water Commission (SWC) to secure feasibility study grant funding. The approved grant was 45% based on the project being designated via cost share policy as "*rural flood control*". The requested amount was below the limit, which allowed approval by the DWR Director.

While initially funded under the NDDWR director's limit, preliminary findings indicated the need for additional funding to evaluate substantial groundwater influences on the lake system. Subsequently, a second cost share request (**Addendum #1**) was submitted to the DWR and approved by the State Water Commission. The expanded hydrogeologic evaluation was completed by *Adaptive Resources Inc. and* is contained in ***Appendix GW***. The appendix documents the potential groundwater influences on lake elevations, which were determined to represent nearly 34% of the total lake inflow volumes.

During the Steering Committee meeting process, Kidder County landowners expressed concerns regarding the proposed discharges through their properties. This was followed by a letter from the Kidder County Commission stating their opposition to the project. The Stutsman County Commission responded and then held a public informational meeting to listen to the county and local landowner concerns, (see ***Appendix L*** and ***Appendix SC***). This resulted in contract ***Addendum #2*** for out-of-scope services related to further evaluating the discharge tributary, and requesting information related to the design, conditions and water management practices within the LLR. This expanded scope of work is outlined in ***Section 11.0*** and ***Section 12.0*** and supplemented in the appendices.

2.0 Hydrologic Watershed Evaluation (Appendix HA)

2.1 Hydrologic Watershed Evaluation

The Crystal Springs Lake complex is a closed basin that has experienced historically increasing water levels, resulting in surface-water interconnection with adjoining lakes and wetlands. These waters have adversely affected Interstate 94, the Rest Area, BNSF railroad tracks, Crystal Springs Baptist Camp, local county and township roadways, and adjacent agricultural properties. While many of the agricultural properties were pasture rather than cropland, nearby properties have also been affected by higher water levels and associated groundwater influences.

Interstate 94 was raised several times by NDDOT at considerable federal and state expense to stay above rising water levels. The 2011 grade-raise was 7.5 feet, while the second, completed in 2021, was approximately 10 feet.[2,3] BNSF has also raised its track numerous times to remain above rising waters and continues to do so as needed, which currently is every two to three years, if not every year. This occurs at considerable expense, and if this main line were to become non-operational, the losses to interstate commerce and BNSF Railway would be significantly greater than the mitigation expense. These interstate commerce losses should be evaluated further as part of the Preliminary Engineering Report. Additional grade raises for both Interstate 94 and the BNSF rail line are anticipated soon, as documented later in this report, as water levels continue to rise.

The NDDOT engineering reports[2,3] stated the watershed for the primary basin before the first overflow was approximately 214 square miles and when combined with the second the total watershed prior to overflow into the Missouri River Watershed was 250 square miles. The current edge of pavement on Interstate #94 is elevation 1764.2 with the top of subgrade elevation at 1761.9.[2,3] The top of subgrade will need to be above the waterline during construction to avoid soft base materials. The top of subgrade will need to be above the waterline to allow construction to occur. The Feasibility Study looked closely at the watershed as well as the system hydrology and hydraulics. The details of this evaluation are documented in ***Appendix HA - Hydraulic Analysis Technical Memorandum***.

Using currently available LiDAR data the primary lake watershed system was determined to be around 101.3 square miles. However, after conducting a GIS LiDAR spill analysis based on inter-basin storage (i.e., prairie pothole region) the effective contributing drainage area is only *25.8 square miles*. The spill analysis was stressed based on an 11" rainfall (nearly double a 100-year event) and the resulting contributing watershed area increased to nearly *50 square miles*, see ***Figure 1***. It is important to recognize that as the upper wetland/lake basins continue to fill, based on the current wet cycle, the contributing area will increase along with the potential rate of rise in water levels.

Appendix HA documents the influence and impact of various frequency rainfall and snowmelt events. Each precipitation event influences both the short-term and long-term water levels within the lake system. That along with groundwater inflows sets the stage for complex elevation changes within the lake system. The combination of these indicates an ever-increasing water elevations and flood risks into the foreseeable future. **As such, without a project to mitigate increased water levels, significant adverse impacts and resulting economic damages will occur.** One question raised by a member of the Steering Committee, was *"When do we stop moving dirt and start moving water?"*

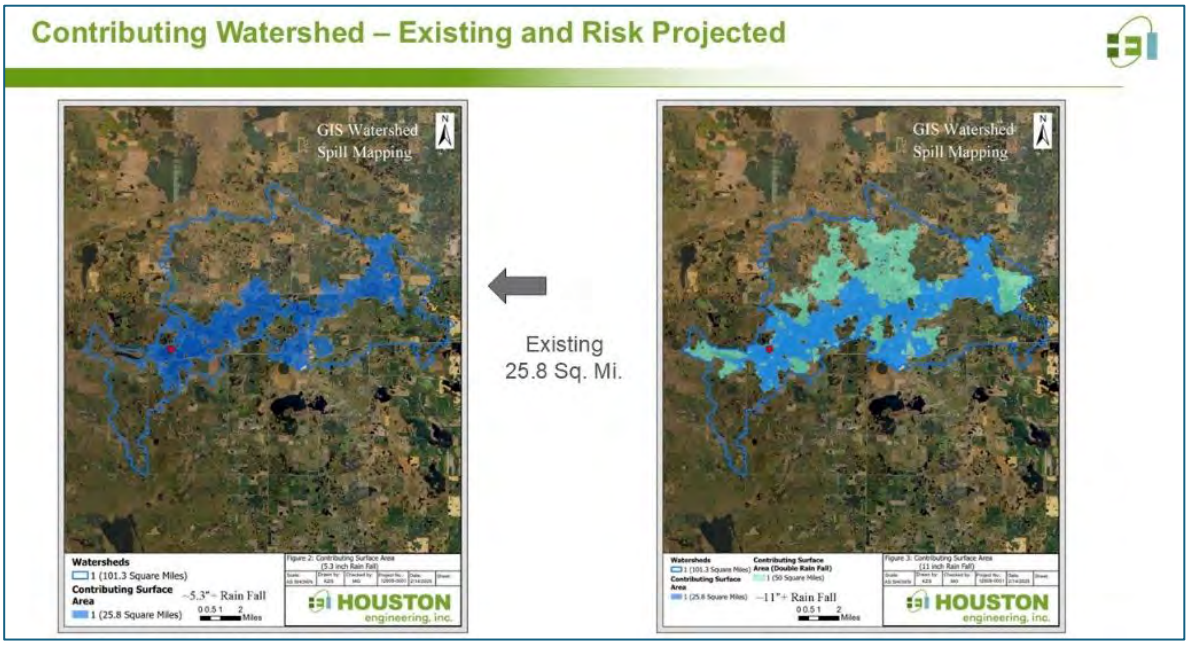
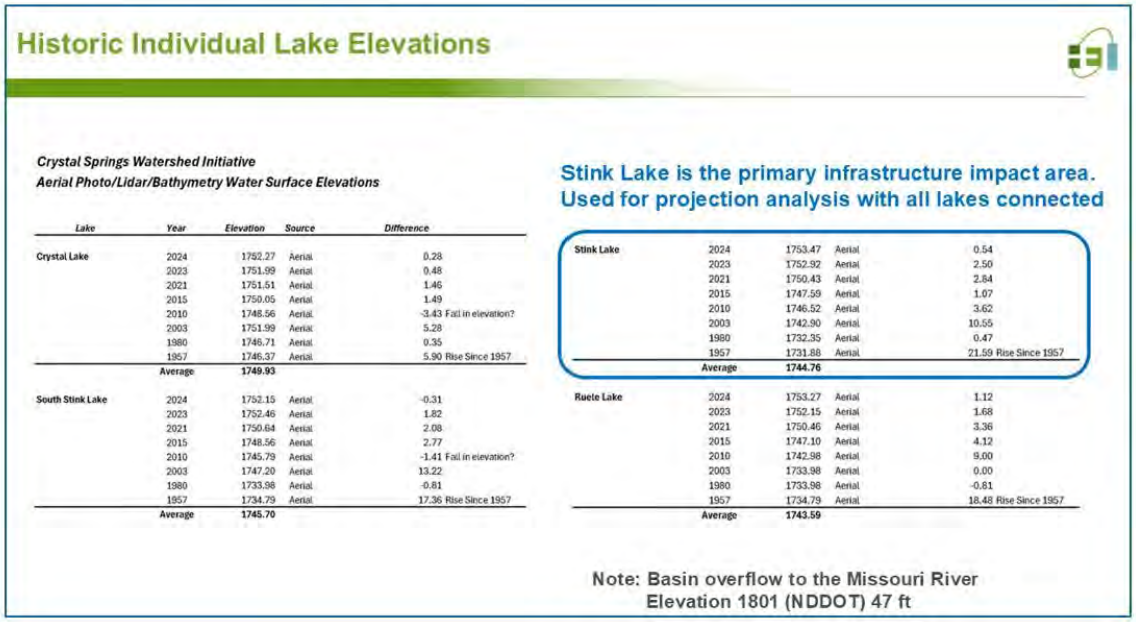


Figure 1 - GIS LiDAR Watershed Spill Mapping, Contributing Area Determination

2.2 Historic Lake Elevations

After evaluating available historical water-surface-elevation information it became increasingly clear that water levels in this now interconnected lake system have continued to rise and are projected to keep rising. ***Figure 2*** shows the historical trends occurring in the four quadrants of this system based on an aerial-photography review using LiDAR and recorded water-surface elevations dating from 1957 through 2024. Crystal Springs has shown the least overall increase at 5.9 feet, while Stink Lake experienced the largest overall increase at 21.59 feet. Based on anecdotal evidence, Crystal Springs appears to be a more stable lake influenced by local groundwater inflows from the west. This is likely why it was given its name, reflecting these clear-water inflows.



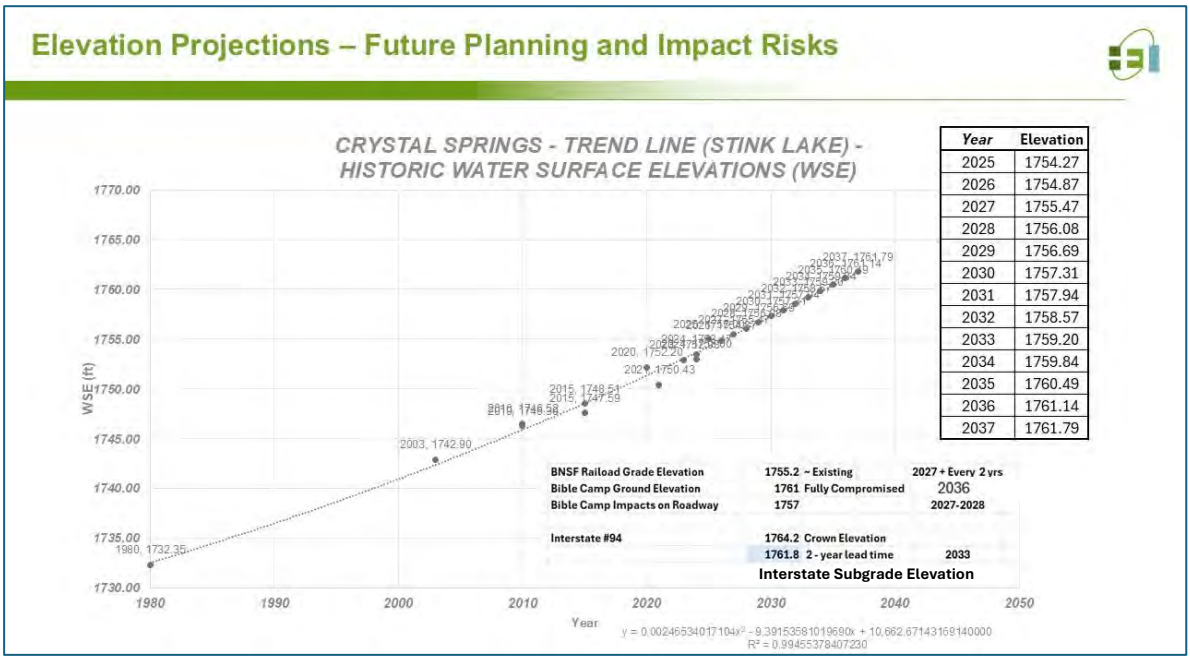
Lake	Year	Elevation	Source	Difference
Crystal Lake	2024	1752.27	Aerial	0.28
	2023	1751.99	Aerial	0.48
	2021	1751.51	Aerial	1.46
	2015	1750.05	Aerial	1.49
	2010	1748.56	Aerial	-3.43 Fall in elevation?
	2003	1751.99	Aerial	5.28
	1980	1746.71	Aerial	0.35
	1957	1746.37	Aerial	5.90 Rise Since 1957
	Average	1749.93		
South Stink Lake	2024	1752.15	Aerial	-0.31
	2023	1752.46	Aerial	1.82
	2021	1750.64	Aerial	2.08
	2015	1748.56	Aerial	2.77
	2010	1745.79	Aerial	-1.41 Fall in elevation?
	2003	1747.20	Aerial	13.22
	1980	1733.98	Aerial	-0.81
	1957	1734.79	Aerial	17.36 Rise Since 1957
	Average	1745.70		
Stink Lake	2024	1753.47	Aerial	0.54
	2023	1752.92	Aerial	2.50
	2021	1750.43	Aerial	2.84
	2015	1747.59	Aerial	1.07
	2010	1746.52	Aerial	3.62
	2003	1742.90	Aerial	10.55
	1980	1732.35	Aerial	0.47
	1957	1731.88	Aerial	21.59 Rise Since 1957
	Average	1744.76		
Ruete Lake	2024	1753.27	Aerial	1.12
	2023	1752.15	Aerial	1.68
	2021	1750.46	Aerial	3.36
	2015	1747.10	Aerial	4.12
	2010	1742.98	Aerial	9.00
	2003	1733.98	Aerial	0.00
	1980	1733.98	Aerial	-0.81
	1957	1734.79	Aerial	18.48 Rise Since 1957
	Average	1743.59		

Figure 2 - Historic Individual Lake Elevations

The rapid rise in Stink Lake (circa 2003) appears related to a lag in elevation data and inter-lake transfers occurring from Reule Lake to the east and the upstream watershed. During 2025, there was no notable rise, see ***Figure 2***. While the overflow elevation between these systems is estimated at 1744. The plotted aerial and measured elevation data are not calibrated to a specific time of year.

It is important to understand the nature of the historical trend in rising water levels. Therefore, the trend in water-level changes on Stink Lake is graphed in ***Figure 3***. This year-to-year illustration is not a month-and-day elevation graphic, so slight variations could occur if a more in-depth graphical assessment were completed based on the time of year for each recorded elevation. Validation and correlation of this trend and projected future lake elevations are supported by the similarity of data provided in the *NDDOT's Runner's Slough Evaluation*[6], illustrated in ***Figure 4***. Runner's Slough is located near Cleveland, approximately 13.5 miles east of Stink Lake.

It is clear the mathematical trend of increasing water elevations indicates adverse impacts will occur soon for the noted facilities based on the year projected. The graph is a best fit formula to project future elevations based on the historic trends. Note for illustrative reasons, the graph starts in 1980 and covers the last 46 years of record. The data from 1957 could have been plotted, however the recent trends since 2003 are more important in the future projection, given the now combined lake system.



Year	Elevation
2025	1754.27
2026	1754.87
2027	1755.47
2028	1756.08
2029	1756.69
2030	1757.31
2031	1757.94
2032	1758.57
2033	1759.20
2034	1759.84
2035	1760.49
2036	1761.14
2037	1761.79

Figure 3 - Stink Lake Historic Lake Level Projection

The critical data in ***Figure 3*** is a projection of the next significant impact (i.e., damage) that will occur associated with rising waters. While this graph is based on Stink Lake all the lakes are currently interconnected. Using the low edge of pavement on Interstate 94 is 1764.2, and a 2-year lead time the next grade raise will occur in 2033 (~6 years). The finished subgrade is 1761.8, which sets the timeline for work above water. The BNSF rail line is impacted more frequently and will need to be raised in 2026 and likely every other year to stay above rising waters. The impacts to the Crystal Springs Baptist Camp roadway will occur in 2026 or 2027 and will again need to be raised along with raising their levee system, to avoid related impacts to onsite structures.

The Baptist Camp will be compromised by 2036, see ***Figure 5***. Another facility that will be impacted is the Interstate 94 Rest Area, which will be affected on the same timeline as the interstate. This facility cannot be raised and is being considered for removal and replacement at another location by the NDDOT due to it being an aged structure.

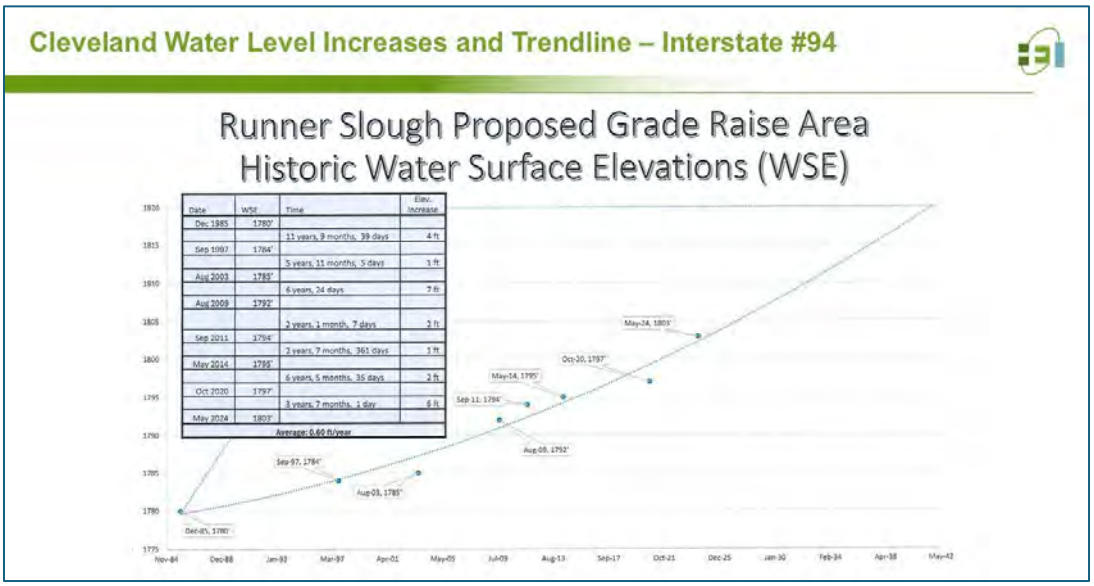


Figure 4 - Runner's Slough NDDOT Historic Water Elevation Projection [6]

Figure 5 - Crystal Springs Baptist Camp Full Impacted Elevation

2.3 Lake Level Control Elevations

Each lake, now all interconnected, at one point had what could be considered an overflow elevation. ***Figure 6*** illustrates the location of various existing control culverts within the system and elevation data for 2024-2025. The study reviewed and evaluated these elevations based on available topography and consideration of previous and current uses. Using the lake bathymetry provided by the North Dakota Game and Fish, each lake was considered for control depth and value as a fishery. Further review of this D\

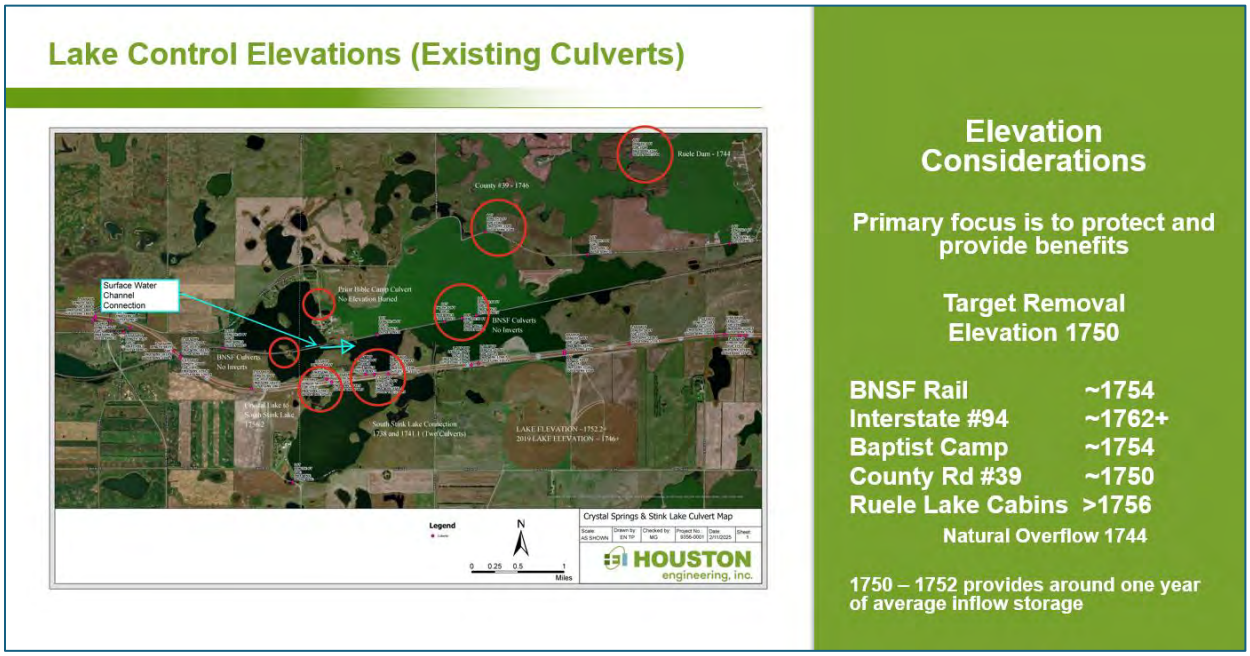


Figure 6 - Lake Control Elevations (Existing Culverts)

After considering the various lake elevations and associated factors, it was decided to select a single elevation by which to manage the lake complex. This sets the stage for a pump removal system and a designated elevation, which then reflects the time necessary to remove excess waters for flood damage projection and mitigation purposes.

The following elements were used to evaluate the feasibility of a removal system.

- Utilized available LiDAR topography along with aerial photography where quality allows
- Utilized available culvert inventory data to identify flow direction, capacity, overflow elevations and connections between the various closed, now interconnected, basins
- Reviewed existing drainage patterns within the contributing watersheds
- Water surface elevation chronology and forecasting, utilizing available historic water surface elevations to determine annual inflow volumes
- Hydrologic runoff and rainfall volumes were segregated to approximate groundwater influence
- Flood projections based on runoff frequency, including the 25-, 50- and 100-year Atlas #14 rainfall, and a GIS LiDAR based watershed spill evaluation to determine contributing watershed
- Snowmelt runoff based on ND Hydrology Manual or recorded stream flows [12]
- Annual evaporative losses projected based on the surface area of the lake system, which is influenced by the changing lake elevations

The Feasibility Study included determining the area-capacity curves for the individual lakes and the now interconnected lake system. These were then utilized based on projected inflow volumes to estimate future water surface elevation increases. A review of the trends based on available historic data or projected future runoff events was considered and graphed. Changes in available lake storage associated with fill related to transportation facility grade raises and related factors were not considered in the system evaluation or removal capacity requirements. A BNSF grade raise will need to occur more frequently, with additional rock ballast to be installed, however this represents a lost benefit each time it occurs, as with a pump removal system these expenses could be avoided. At some point further BNSF grade raises will become impacted and potentially restricted due to both height, stability and ROW considerations.

2.4 NDDOT – Crystal Springs Investigations [2][3]

Interstate #94 was raised twice by the NDDOT after their analyses in 2011 and 2021, at a substantial expense, which will need to occur again. These projects resulted in materials being placed within the lake storage area; however, the study analysis was based on LiDAR after these projects were implemented. While the projections will be further evaluated in the *Preliminary Engineering Report* indicators are a grade raise will need to occur at a point where water levels are within two feet of the road shoulder. This places the next I-94 grade-raise starting in 2033, with planning and design occurring at least several years prior to that date, see ***Figure 3***.

The estimated cost for the next I-94 grade raise, given the widening and increased height required, is projected to be at least as great as the 2021 grade raise and assumes a lesser grade raise of undetermined elevation. While this cost is deemed conservative, it was used for planning purposes in this report to establish the feasibility-level economic benefit projection. The question to be asked is this: even with a grade raise in 2033, will water levels continue to increase, and additional grade raises be necessary? The answer is yes based on known data. Setting the design top of roadway at two feet above the natural overflow, was used in the *Cleveland Runner's Slough*[5] grade raise, is not a viable solution for the Crystal Springs area. Therefore, the CSWI pump removal system is a viable benefit-cost solution; however, implementation and financing have a critical timeline.

3.0 Groundwater Influence Review (Appendix GW)

The initial groundwater evaluation was limited to a review of regional wells and ground water levels. This included reviewing available groundwater resource data, and where practical cursory findings relating to known changes and trends that contributed to or influence lake elevations. A specific determination of groundwater inflow rates and volumes was not included in this study.

After completing the hydrological evaluation, ***Appendix HA***, it was determined the contributing watershed was inadequate to create the documented increases in lake levels; therefore, groundwater was a significant contributor to lake elevations. A review of runoff, rainfall, and evaporation data provided a generalized value that 34% of the total volume into the lake system during the evaluation period was attributable to groundwater. Subsequently, an additional cost share request was submitted to the North Dakota State Water Commission (SWC) to further evaluate the groundwater contribution. A valuable element in the additional evaluation was data provided via the North Dakota Department of Water Resources aerial AEM data collection[4] in the Kidder-Stutsman County area. A detailed hydrogeologic investigation was then completed to evaluate the role of groundwater in driving observed lake level increases within the Crystal Springs watershed. *Houston Engineering* commissioned *Adaptive Resources* to conduct this analysis, with a focus on defining groundwater elevations, flow directions, and subsurface conditions influencing groundwater–surface water interaction. The investigation concluded that elevated surrounding groundwaters are a primary contributor to the sustained rise in lake levels observed since the early 2000s. Additional information regarding the groundwater evaluation is provided in ***Appendix GW*** and ***Figure 7***.

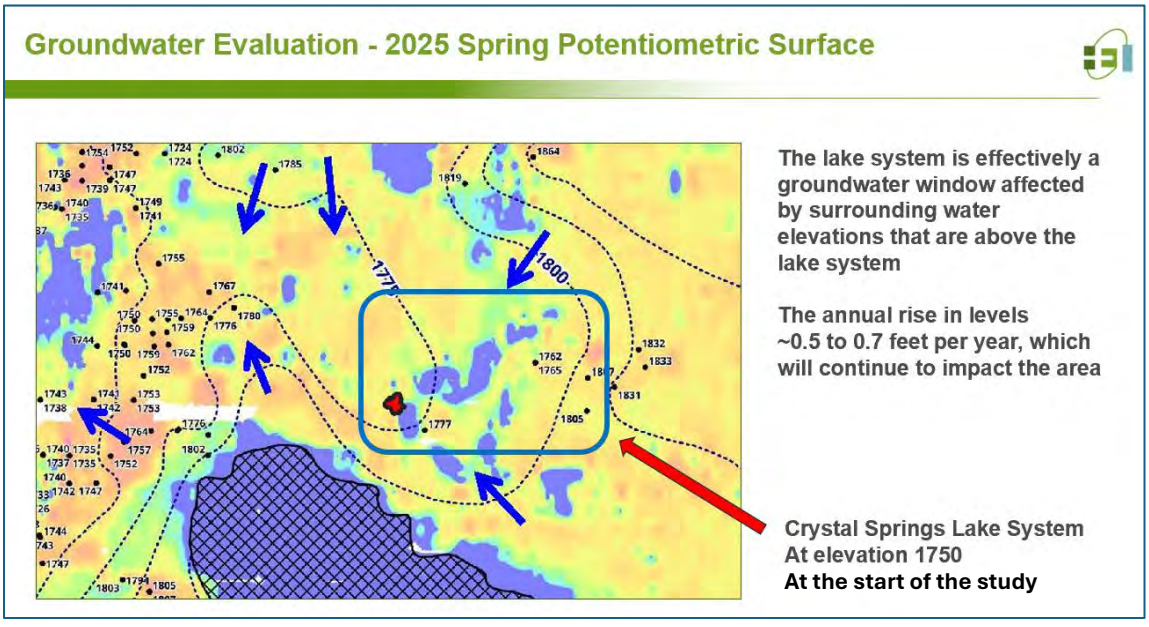


Figure 7 - Groundwater Contours in the Crystal Springs area

The groundwater influence review was conducted at a feasibility level and was intended to establish the magnitude and direction of groundwater interaction with the lake system, rather than to predict future conditions through a numerical simulation. Based on available runoff records and projections, the groundwater inflow to the lake complex was approximately a continuous 5 cfs over the 14-year period of record in this study.

3.2 System Water Balance Equation

The following provides a basis to help understand the hydrological "*water balance*" in the Crystal Springs lake complex:

Surface Water (SW) inflows generated by runoff from the watershed including combined surface flows within the tributaries and lake/slough systems. Runoff is affected by soils conditions, land use and precipitation. The total runoff value was approximated using the *USGS Stream Gage at Harvey, North Dakota (09020202)* just north of the study area. Total ac-ft runoff is projected then using a prorated or weighted function per square mile. This value was approximated for each year utilizing the gage records.

Precipitation (P) from rainfall on the open water. **Direct Rainfall (DR)** contributes to the elevation of each lake system. Simply stated a 2" rainfall generally adds 2" to the water surface elevation. The total ac-ft contribution on the lake is direct precipitation multiplied by the lake area at the time of rainfall. This value was approximated using the *Tappen, North Dakota* rainfall gage, located approximately seven (7) miles west of Stink Lake, and the available lake area-capacity information.

Evaporation (E) [9] [12] is generalized as a loss based on the open water area using *the North Dakota Hydrology Manual (NDHM), Chapter 8 Figure 8-3*. There is no available evaporation station data for this area, therefore the NDHM approximation was utilized. Subsequently, the annual losses were determined, while monthly percentage evaporation data could be applied for subsequent evaluations if necessary. Total evaporative losses in ac-ft are based on the area for a given lake elevation.

Groundwater (GW) is a significant factor and has a measurable impact on lake levels, and the inflows were evaluated. This influence is difficult to directly determine but could be estimated using the other factors, like soils and the AEM data recently acquired by the ND Department of Water Resources (*circa February 2025*).[4] The GW inflows in ac-ft were undetermined; however, they were then approximated using this water balance equation.

Annual Ac-Ft (AF) of change is determined utilizing the area-storage-capacity curves for each lake and combined lakes system and comparative values from year-to-year lake level measurements.

Annual Water Balance Equation in any given year is determined by the following equation.

$$SW + DR - E + GW = \text{Annual Acre-Feet (change in storage)}$$

The unknown in this equation is GW, which was projected over the 14+ year study period of record at an average/constant inflow rate of 5 cfs, using the other variables and total water storage volume increase. Based on this data groundwater comprised approximately 34% of the total inflows.

The feasibility study was then completed to determine the volume of water needed to be removed to stabilize water levels in the interconnected lake system.

3.3 Lake Level Management

Desired lake elevations were considered for Crystal Springs Lake, Stink Lake, and Reule Lake to balance flood protection, environmental resources, and recreational values. Selection criteria included protection of critical infrastructure, minimization of upstream and downstream impacts, preservation of natural overflow elevations, fishery sustainability, wildlife habitat considerations, and water quality.

Stink Lake was identified as the primary floodwater storage component within the system, with potentially a lower target elevation to create available storage volume to buffer future inflows. Other lakes would be managed independently to maintain recreational and ecological functions. Gradual drawdown is emphasized in all cases to reduce shoreline instability and potential groundwater response impacts.

After extensive review it was determined that using a single elevation to manage the lake complex was prudent. This reduces the volume of excess floodwater to be removed, while accomplishing objectives for flood protection. In addition, the level selected provides a buffer for future water level increases and system management, utilizing the existing protection measures previously implemented. The selected elevation was 1750, which based on current water levels of 1755+ would require the removal of over five feet of excess floodwater from the system.

Utilizing a 20 cfs removal system, the drawdown would occur over a period of around three years for the entire complex, see ***Figure 8***. It was suggested that Reule Lake could be used as interim flood storage, drawing down the other lakes first in the interest of more rapid flood risk reduction. This would reduce the initial drawdown period to around two years. An important consideration is the continuous increase in water levels at a rate of 0.6+ feet per year. If project implementation takes 2-3 years, the removal time for excess water increases by about six months for each year of delay.

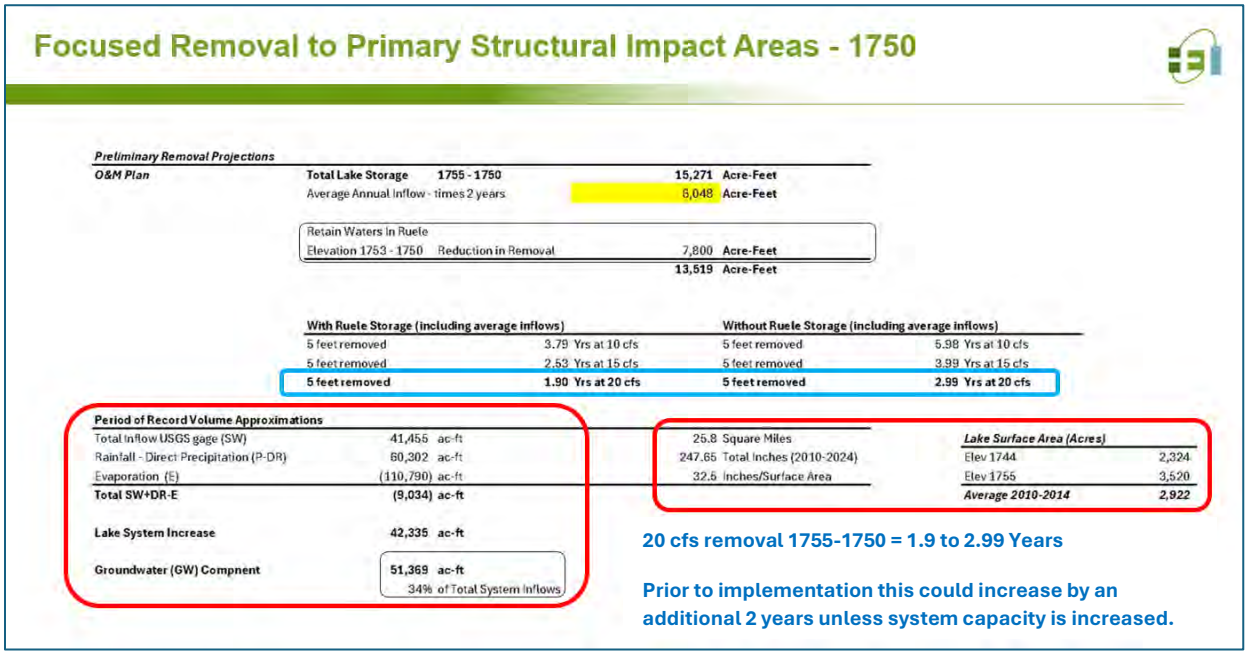


Figure 8 - Focused Water Removal to Primary Structural Impacts

4.0 Hydraulic Floodwater Removal Alternatives

4.1 Hydrologic Evaluation Parameters

The hydrologic and hydraulic analysis for the project watershed was conducted using the State of North Dakota Base Level Engineering (BLE) two-dimensional HEC-RAS models. The original BLE models, developed in 2017, were updated and converted to HEC-RAS Version 6.6 to take advantage of improved numerical stability, computational efficiency, and terrain processing tools, see further background in ***Appendix HA***.

The modeled hydrology includes a range of rainfall frequencies from a 2-year through 500-year events, as well as statistical confidence variants of the 1-percent-annual-chance event. A synthetic snowmelt event was represented as a 10-day runoff hydrograph with a depth of approximately 4.1 inches. This event was added to provide a comparative volume-based scenario, as snowmelt represents a large volume contribution to the system. This snowmelt scenario is intended for planning-level insight and has not been reviewed by regulatory agencies.

Lake bathymetry data provided by the North Dakota Game and Fish Department was georeferenced and merged with LiDAR-derived topography to develop elevation–storage relationships for each lake and the combined larger lake complex. The hydraulic models were initialized at the surveyed fall 2024 lake surface elevation of approximately 1753.22 feet (NAVD88), representing then-current conditions. They were not updated for the current lake elevation that is now nearly two feet higher and increasing.

4.2 Alternative Alignment Evaluation

The study process reviewed several potential alignments for surface water removal alternatives from the Crystal Springs lake complex to the South, East, North and West. Based on this review a preferred alternative alignment was selected, based on numerous factors. These included, but were not limited to, watershed diversion (into or out of basin); ability of the downstream system to accommodate the flows without adverse impacts; consideration of landowner/easements; USFWS easements; Waterfowl Production Areas (WPA); and water quality impacts. The preliminary alternatives were reviewed on a global economic basis considering the overall order of magnitude (e.g. pump lift, size, distance, alignment, right-of-way, etc..) for each as a guide. Then utilizing these criteria, a preferred alignment was selected and evaluated for constructability and viability. A feasibility level Opinion of Probable Cost (OPC) was prepared for the preferred alternative, as noted later. Future Operation and Maintenance costs were then projected; based on experience with other systems and assumptions, understanding that there are many unknown factors remaining to be determined during preliminary and final design.

A key element of the feasibility level design was to determine the system removal capacity and the optimization period to account for excess floodwater removal as well as storage for future runoff events. The preferred alternative established a single managed lake elevation lower than current water levels. Considering there has been nearly a nine-foot rise since 2010; a control or management elevation was based on projecting the future risk to already impacted infrastructure based on its ability to withstand waters at the selected elevation and accommodate temporary flood storage. The proposed Operation and Maintenance focused on optimizing system removal and event storage, which will impact system cost as well as operational parameters.

Figure 9 presents a tabular comparison of the five alternative alignments considered. The evaluation was based on the pump elevations, pipe length in miles, preliminary pipe size and head loss, then determining the Cost Factor comparison. The Cost Factor ranges from 1.0 under the West-North (preferred alternative) to 3.40 under the Lower Pipestem alignment. Assuming a benefit cost ratio of 2.0, any alternative with a CF > 2.0 is non-viable. There were discussions related to locating the pipeline on the West railroad alignment, as it would follow the BNSF Railroad and utilize their ROW. The Cost Factor for this alternative was 1.27, therefore more expensive, and it involved problematic construction and regulatory compliance factors.

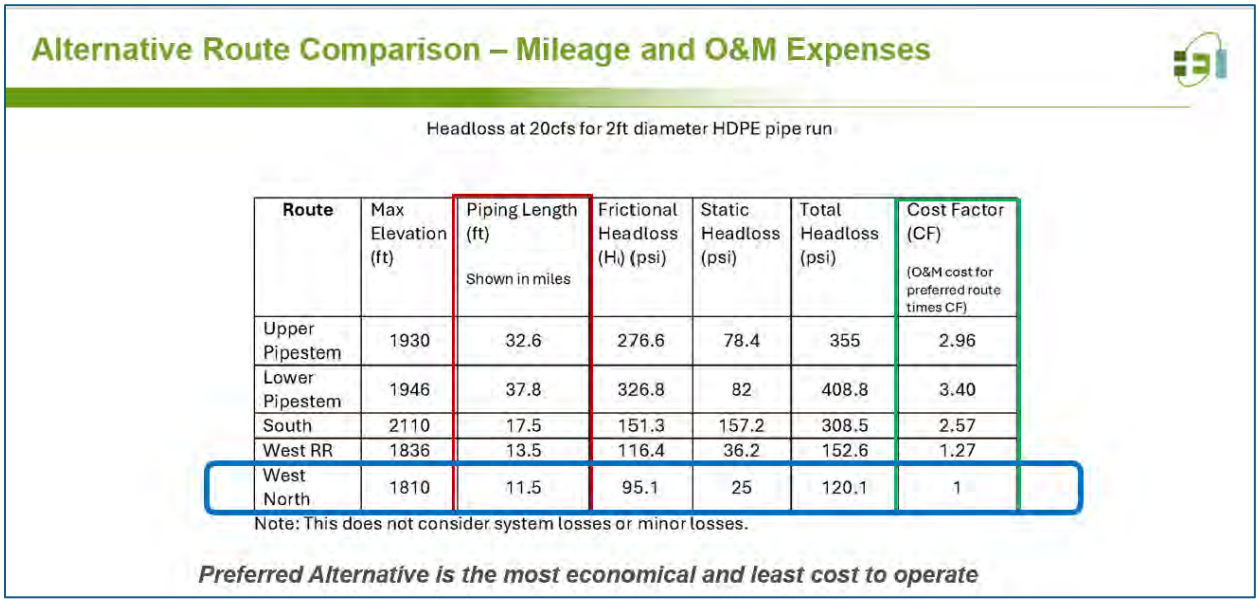


Figure 9 - Alternative Route Comparison - Mileage and O&M Expense

4.3 Preferred Alternative Preliminary System

The preferred alignment selection included many factors as noted above, see ***Figure 10***. The proposed system configuration included various considerations including, but were not limited, to the following:

- ✓ System consists of duplex pump system (20 cfs) and approximately 83,000 LF (15.7 miles) of 30" PVC pipe. This pipe size allows for lower system head loss and smaller pumping requirements, reduced internal pressures and associated operation and maintenance costs, and the ability to add pump capacity, if required. Annual Operating Costs projected at $267,000
- ✓ Roadway access to the intake and pump station located on Stink Lake
- ✓ General access to three phase electrical power
- ✓ Avoids USFWS Easements and WPA lands
- ✓ Avoids the need for crossings under the BNSF Railroad or Interstate #94
- ✓ Potential for a portion to be a gravity flow pipe to reduce pumping expense
- ✓ Navigates through or around existing irrigation systems, see ***Figure 10***
- ✓ Buried system so there are limited surface conflicts (depth = 8 feet)
- ✓ Utilizes Township ROW where practical
- ✓ No residence impacts, see ***Figure 11***
- ✓ Outfalls into a natural tributary (see **Section 11.0**)

The preferred alternative also has a positive cost/benefit ratio, see ***Section 7.0***, which justifies the project's feasibility. However, there are many issues and hurdles that remain to take this project toward design and implementation. A planning horizon greater than 10 years, would show increased benefits.

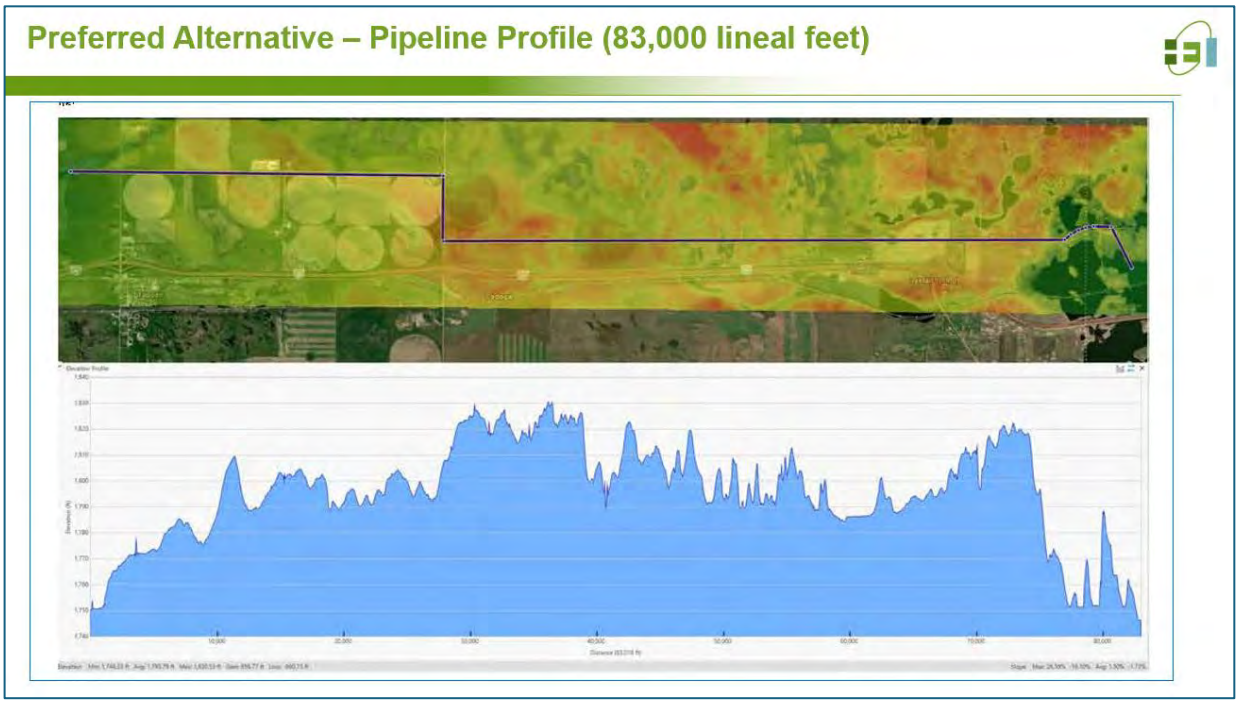


Figure 10 - Preferred Alignment and Profile

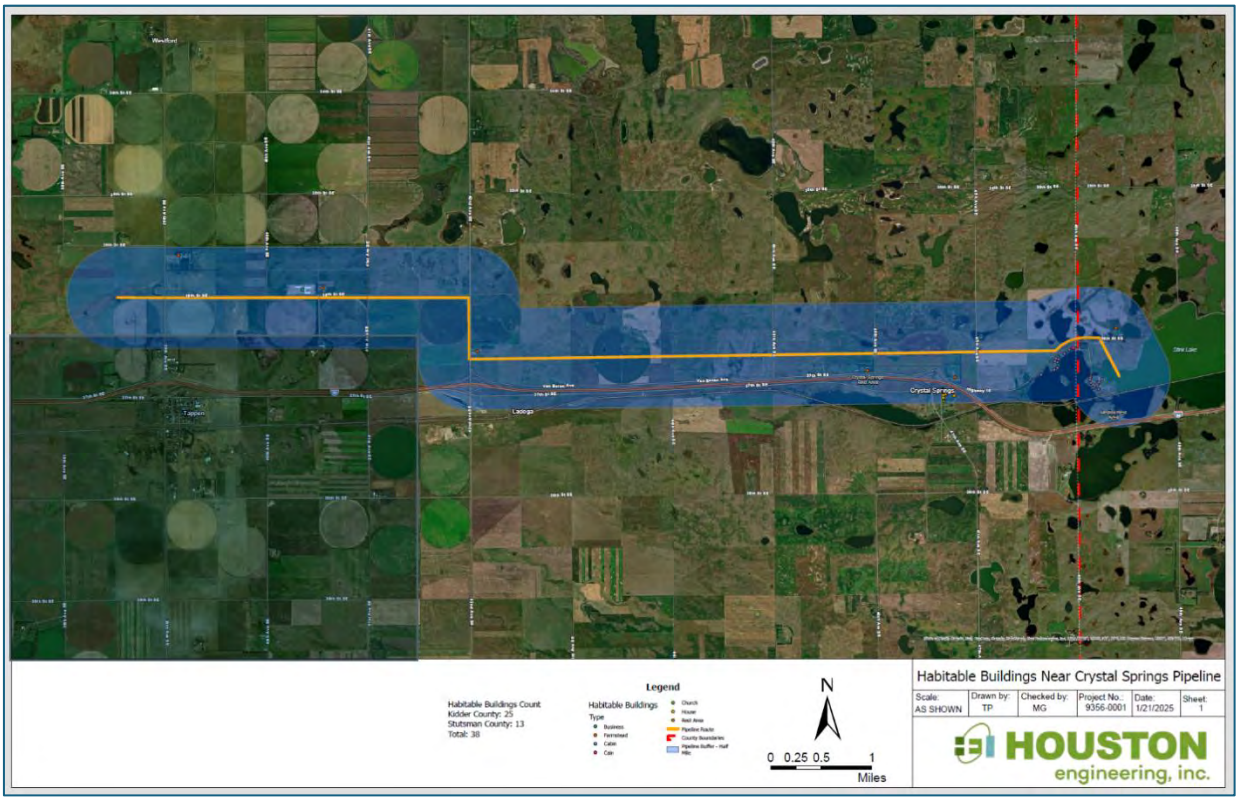


Figure 11 - Habitable Structures Near Crystal Springs Pipeline

5.0 Regulatory Considerations

Implementing the preferred alternative will require coordination with multiple regulatory agencies. Given the contributing drainage area exceeds 80 acres and spans multiple jurisdictions, a drainage and construction permit from the North Dakota Department of Water Resources is anticipated and this will be a project of interdistrict or statewide significance. As such it will require state review and approval along with assigned operational conditions.

Additional regulatory considerations include a water quality discharge permit through the North Dakota Department of Environmental Quality and U.S. Army Corps of Engineers permits for the intake pump station and potentially portions along the pipeline installation and the tributary channelization. Coordination with the U.S. Fish and Wildlife Service will also be required regarding any impacts to its easement or fee-managed lands, though most of these areas are avoided in the preferred alternative. These regulatory requirements are achievable but will influence project schedule and cost.

Subsequently the following regulatory considerations are documented, but are not considered inclusive of all permits:

- **Drainage Permits (>80 acres)** – While local permits are typically returned to the Stutsman County Water Resource District for action, that is not the case here. As the excess floodwaters are being discharged into Kidder County, the project represents a transfer from a noncontributing watershed. Though there is no out-of-basin transfer to another watershed with this project. It is anticipated a separate drainage permit may be required for the channelization and improvements along the tributary in Kidder County.
- **Easements** are required for the pump system and pipeline installation, as well as along the receiving tributary downstream. Local easements for installation within county and township roadway rights-of-way (ROW) are required. The use of surface drainage versus pipe (pump or gravity) will be evaluated further during preliminary design in select areas as it relates to regulatory and cost issues. The system will be constructed on private lands or within existing transportation ROW where practical. Initial mitigation measures for easements along the tributary related to capacity and conveyance have been considered to accommodate the discharge flow and its duration. Landowner contacts, negotiations, and securing easements or assurances were not included in the feasibility study. Some cursory contacts and discussions with landowners, however, has occurred.
- A **US Army Corps of Engineers** permit is anticipated for the lake intake and pump system, as well as construction within wetland systems along the preferred alternative alignment. The context and extent of such permit requirements will be defined during the preliminary design process and was not evaluated at the feasibility level.
- **North Dakota Department of Environmental Quality** will require a water quality permit to discharge these waters downstream. Based on the feasibility study review of water quality, see ***Section 6.0***, the discharge permit has a reasonable chance to be approved, though formal water quality testing will be required for the lakes and the receiving streams.

- The **United States Fish & Wildlife Service** easements and waterfowl property interests were mapped using GIS. ***Figure 12*** illustrates those easements and interests located along the preferred pipeline alignment. The route selection, which may vary with final design, avoids these areas, thereby reducing regulatory compliance requirements, impacts, and costs.

- The **United States Fish & Wildlife Service** also holds interests in the Long Lake National Wildlife Refuge downstream in Kidder and Burleigh County. The impacts on the refuge and background information are provided in ***Section 12.0***. While the study initially indicates the influence of waters discharged into refuge is not significant approval or acceptance from the USFWS is a consideration.

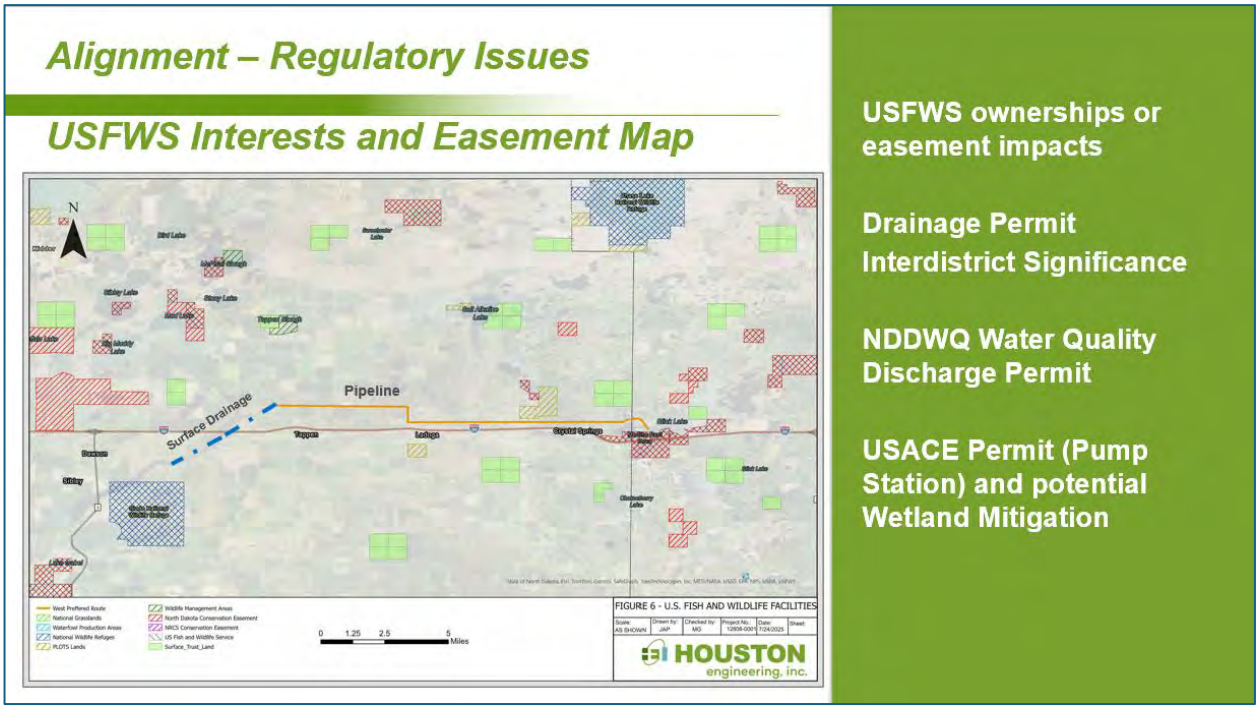


Figure 12 – USFWS Easements Along Preferred Alternative Pipeline Alignment

- The **Aquatic Nuisance Species (ANS)** issue was raised as a question during the Steering Committee meetings. Currently there is no documented infestation within this lake system though the risk exists like any other lake system in North Dakota. Additional discussion with the North Dakota Game and Fish Department to determine potential protection measures should occur during preliminary design.

6.0 Water Quality Consideration – Influence Area

Baseline water-quality conditions within the Crystal Springs watershed and the surrounding influence area were evaluated using regional data from the U.S. Geological Survey's Prairie Pothole Region water-quality monitoring program[8]. The assessment provides context for potential water-quality considerations associated with floodwater removal and discharge alternatives at a feasibility level.

USGS data indicates that prairie lakes and wetlands in south-central North Dakota have experienced substantial freshening over recent decades, driven primarily by increased precipitation and lake volumes. Median salinity and dissolved solids concentrations have decreased, and most lakes now exhibit water-quality conditions characterized by lower specific conductance and stable, well-buffered pH. These changes are hydrologically driven and reflect dilution rather than new or emerging contaminant sources.

Biological responses documented by the USGS show expanded fish presence in various lakes and shifts in macroinvertebrate communities toward species associated with fresher water conditions. These trends are consistent across the Prairie Pothole Region and are directly linked to increased water volumes and reduced salinity.

Considering a feasibility perspective, the water-quality analysis indicates that proposed floodwater management concepts are compatible with regional water-quality conditions and discharges into downstream waters. Reducing lake levels through managed excess floodwater removal may result in modest increases in constituent concentrations over time; however, such changes would represent a return toward historical conditions rather than a new impairment. Detailed discharge-specific water-quality evaluation and permitting requirements will be addressed during subsequent preliminary engineering and regulatory permitting.

As a reference the Long Lake Refuge's water permit authorization is 21,933.0 acre-feet, with an annual appropriation for use (evaporation) of 2,210 acre-feet. The discharge from the Crystal Springs Watershed Initiative during the initial years of operation is projected to be 7,128 acre-feet (20 cfs/180 days). This represents a potential 32.5% exchange of the total water stored within the refuge. This would decrease in subsequent years, after the system is operational and subject to the actual climatological conditions. As the discharged waters are of better quality than the more alkaline waters within the refuge, these inflows are deemed to be beneficial. This is a regulatory question that requires further evaluation with final design and permitting, along with further discussion with the USFWS regarding their water management practices within the refuge, see ***Section 12.0***.

Another question raised during the Steering Committee meetings was the use of excess floodwater for irrigation purposes. Such use was not part of the original scope of services; however, it is an option to further evaluate during final design, if requested by an interested stakeholder. The Central Dakota Irrigation District was requested to provide a letter of interest; however, they had not done so before the study completion. Based on the number of irrigation systems required and long-term availably of waters there are unanswered questions related to such use. The ability to utilize these waters, based on quality and quantity, for irrigation was not determined, though appears favorable. During a cursory review, irrigation was deemed not to be a viable alternative for the primary removal of excess floodwater.

7.0 Economic Analysis (Feasibility Level)

7.1 Projected Opinion of Probable Costs

A primary study focus was to evaluate the economic feasibility of the Crystal Springs Watershed Initiative by comparing the order-of-magnitude costs of the preferred floodwater removal alternative against the avoided damages and savings associated with previous, existing and continued lake level increases.

This analysis was conducted at a screening-level, appropriate for feasibility, using:

- Planning-level Opinion of Probable Costs;
- Documented historical and projected impacts to infrastructure and property;
- A 10-year planning horizon consistent with hazard-mitigation funding evaluations;
    - Selected based on avoidable impacts occurring during this period
    - This period reflects the immediate need to implement mitigation measures
    - The project design life is considerably longer at ~50 years, which if computed here would likely provide an even greater benefit cost determination.
    - These lakes have been rising since records dating back to 1957, which is nearly a 50-year period of record, and the trend for continued increasing levels is evident.

The Opinion of Probable Construction Cost (OPCC) for the preferred alternative floodwater removal system was determined to be $24.6 million; including construction, contingency, engineering, environmental, legal, and administrative costs, and reflects a feasibility-level accuracy (±20%). These costs were not indexed for inflation (time value of funds) prior to the potential implementation date. The computed positive Benefit/Cost ratio supports moving forward with the project to refine both the benefits and costs during preliminary engineering.

7.2 Federal and State Funding Sources

Potential federal and state funding scenarios evaluated include:

- FEMA Hazard Mitigation Grant Program (HMGP) – 75% federal/15% local/10% state
- FEMA Building Resilient Infrastructure and Communities (BRIC) Grant – 75% federal/25% local
- ND State Water Commission – Rural Flood Control – 45% State of ND / 55% local
- ND Department of Transportation – TBD (legislative appropriation)

All these grants need to be evaluated as the project development continues. The FEMA grants are competitive in nature, and the project should rise to the level of award, however, the nature of other projects in the submittals is unknown. Therefore, considerable effort needs to be made to clearly define project benefits and costs to secure these grants. The available HMGP funding is limited not adequate to fund project development.

An important component on the federal application is that the project is included in the County's *Flood Hazard Mitigation Plan* (FHMP). This task was completed early in the study and the CSWI is listed in both the respective Stutsman County FHMP and Kidder County FHMP's.

Figure 13 presents an illustration of potential funding opportunities under the FEMA and SWC funding scenarios for the PER. Neither is assured, though the SWC funding is most likely available. Also presented is an early projection of the cost to complete the PER ($976,000) and estimated annual O&M expenses ($267,000). Both are subject to change as project development continues.

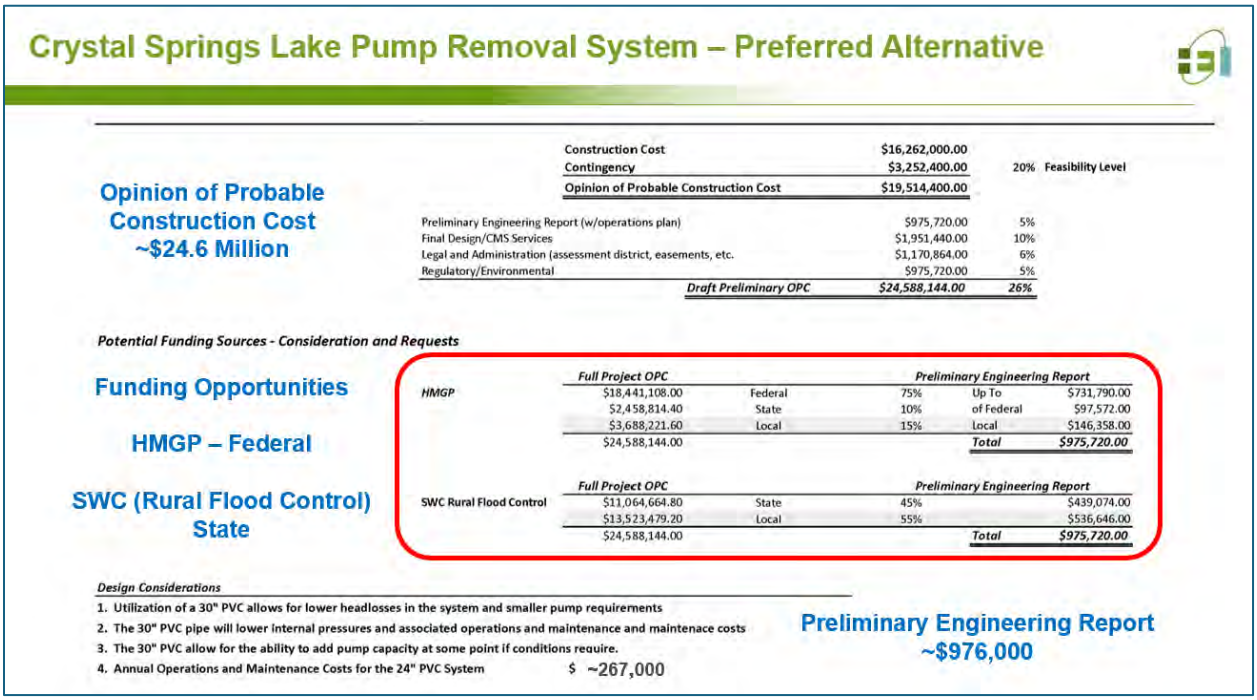


Figure 13 – Crystal Springs Lake Pump Removal System – Preferred Alternative Costs

7.3 Private and Public Funding Sources

There remain uncertainties related to private and local cost participation in project implementation. BNSF has considerable benefits to consider regarding its participation. BNSF agreed to assist in completing the *Feasibility Study* and to consider future involvement based on the study results. NDDOT will also receive significant long-term benefits; however, its participation is currently limited to future legislative funding authorization. We understand that NDDOT is not currently authorized to use federal highway funds for protection and mitigation measures outside the Interstate right-of-way. The Stutsman County Commission, through its Highway Department or Water Resource District, could fund its share through its annual mill levy. However, given recent legislation and mill-levy caps, this source may be limited for a project of this size. This makes it imperative that cost-share funding be secured for design and construction. This includes completing the next critical step, the Preliminary Engineering Report, as described in ***Section 13.0***.

The Stutsman County Water Resource District (SCWRD) could pursue a special assessment district, however the ability to assess the benefited stakeholders appears limited. There is not a large benefit assigned to removing water from agricultural lands and residential properties when compared to other beneficiaries. Therefore, landowner willingness to vote favorably will hinge on other funding sources to cover those costs. The SCWRD is also unable to special assess either BNSF or the NDDOT under their legislative authority, subsequently the funds from these beneficiaries will require a public/private partnership agreement and include an operational agreement.

On the private side the Crystal Springs Baptist Camp has limited availability to raise funds for a large contribution, however they are an impacted stakeholder. While they could be included in the special assessment district, along with residential and agricultural properties in this situation they could hold a large voting block for that process.

7.4 Economic Benefits and Damage Mitigation

Economic benefits were estimated based on avoiding future expenses and damages associated with the continued rise in lake levels and unmanaged flooding. The feasibility level benefit categories include, but are not limited to, the following:

Transportation Infrastructure

- BNSF Railway
  - Three projected grade raises in 10 years, at approximately $3.5+ million each
  - Estimated Benefit: ~$10.5 million
  - Interstate Commerce losses during construction activities not included (TBD)
  - Relocating the rail line was not evaluated for this study
- North Dakota Department of Transportation (NDDOT)
  - Interstate 94 grade raise (single raise – elevation TBD)
  - Estimated Benefit: ~$16.5 million (2011 project cost which was a 10 ft grade raise)
  - Rest Area – NDDOT is considering replacement in a new location 2029-2031
- County Roadways (those inundated would be exposed and repaired for use)
  - Two miles of roadway requiring grade raise and/or major rehabilitation.
  - Estimated Benefit: ~$8.6 million

Community and Property Impacts (Special Assessment District Option)

- Crystal Springs Baptist Camp
  - Avoid relocation or major reconstruction.
  - Estimated Benefit: ~$9–11 million
- Residential Properties around Crystal Springs (TBD)
- Residential Properties on Reule Lake (TBD – at risk)
- WAPA Electrical transmission lines (portions of this line were previously relocated)
- Underground utilities (TBD)

Agricultural Land (Special Assessment District Option)

- 500–600 acres impacted (pasture and crop land – TBD)
  - Thie number used in this study based on removal to elevation 1750
  - Based on current water levels this number exceeds 780 acres (elevation 1755)
  - Impacted property area increases by ~120 acres per foot of rise
- Estimated Benefit: ~$1.7 million (land value ~ 780 acres)
- As a reference, the Reule Lake natural overflow to Stink Lake is 1744 (6 feet lower)

Additional Considerations (TBD)

- Avoid loss of use and disruption to interstate commerce (BNSF and NDDOT)
- Avoid permanent loss of property value and tax base of the inundated properties

7.5 Benefit–Cost Determination (Feasibility Level)

Using the feasibility-level estimates created for this study:

Total Estimated Benefits:	~$46.32 million
Total Estimated Project Cost:	~$24.6 million
Benefit–Cost Ratio (BCR)	1.88:1

These values indicate a strong economic justification to advance the project to the preliminary engineering phase. The time value of money based on a potential implementation date, was not determined for this feasibility level assessment. Generally, cost changes on the benefits and damages would be generally equal percentage as they are mostly construction related. Updating and providing increased detail is necessary for the grant processes as an Economic Assessment is required for the NDSWC grant, and an in-depth Benefit/Cost analysis is necessary under federal grant programs.

7.6 Feasibility-Level Conclusions

The economic analysis demonstrates the following:

- The preferred alternative is cost-effective at a screening level.
- Benefits substantially exceed damage costs/risks.
- The project is well-positioned for hazard mitigation funding program consideration after preliminary engineering is completed.

Refinement of benefit estimates and development of a formal FEMA-compliant BCA is recommended during the Preliminary Engineering Report (PER).

Creating or projecting design and grant level damage values was outside the scope of this study. It is anticipated that further evaluations will result in a greater benefit/cost ratio. Subsequently, more detailed damage documentation will need to be provided by the following parties as part of the preliminary engineering process:

1. Stutsman County Highway Department (impacted local roadways)
2. ND Department of Transportation (impacted state roadways/rest area)
3. BNSF Railway (impacted tracks and interstate commerce losses)
4. Crystal Springs Baptist Camp (impacted facilities and flood protection)
5. Recreational Properties (lot areas and structures impacted)
6. Agricultural Impacts (acres flooded/damages on a case-by-case parcel basis, as available)
7. WAPA Transmission Line and other underground utilities

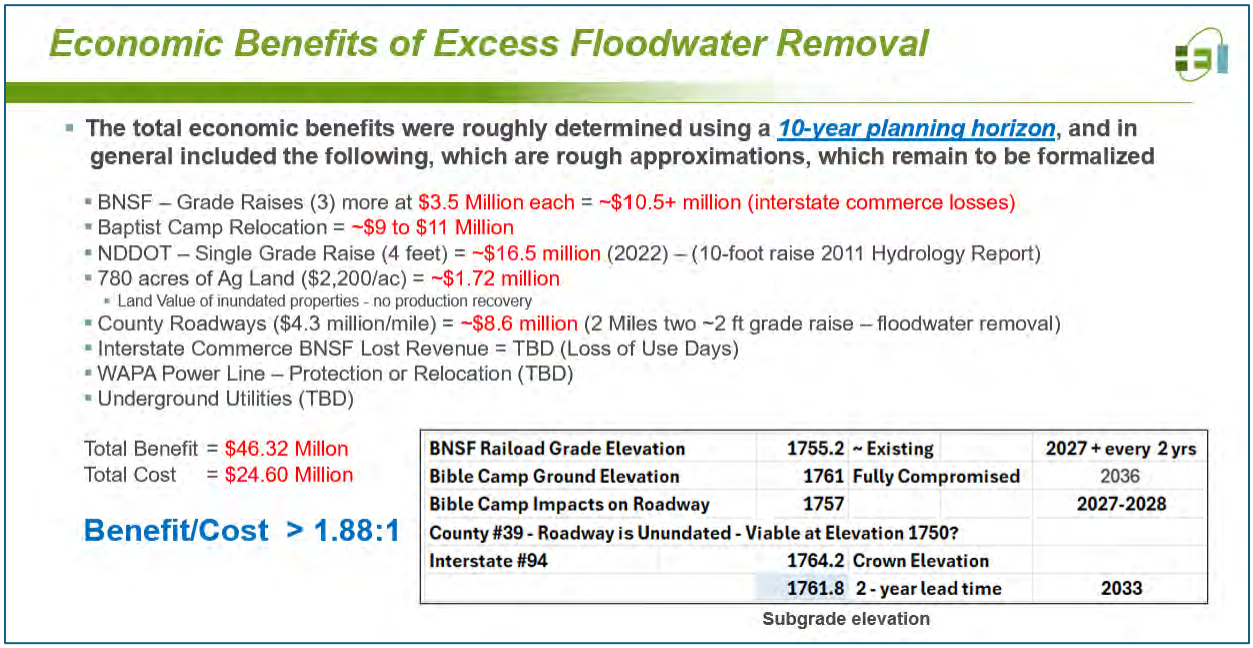


Figure 14 – Economic Benefits of Excess Floodwater Removal

7.7 Operational Costs

The principal operational costs for the project are for maintenance of the intake and pump station as well as electrical expenses. The framework for an operational authority and tributary maintenance requirements downstream remain unknown. The following is a summary of annual operation expenses:

CSWI Initial 3 phase field pull from source to site:

4-5 miles installation via boring at an estimate of $350k-$400k. The cable cost ($250k) makes up the majority due to the required footage needed. This is according to Northern Plains Electric Cooperative point of contact.

Peritiacon LLC has an estimate of $85k-$100k per mile.

These estimates agree with one another and are constructed with conservative margins.

CSWI Pump House Annual O&M:

Operational – Electric loading on pump (Major Load), auxiliary systems (Minor Loads), operational startup/shutdown/monitoring/system checks/operational control (Operator).

Maintenance – Pump and Auxiliary system maintenance and repair. Maintenance frequency depends on component and tech spec requirements. Quarterly and annual schedules are the most common for lift station systems.

Assumptions: No consideration given to pump/load curves. 600hp is being used as a conservative measure. The 480v Motor Control Center (MCC) may use older DB style breaker schemes or newer Eaton style...shall be sized accordingly for redundancy and amp rated for starting current draws (5 times running current). In the PER, individual component sectional will more closely determine system efficiencies and cost reductions/savings opportunities. Fixed rate is assumed as NPEC has a fixed rural rate.

Operational	**Rate**	**Annual Cost @ 180 days operational**	
Pump Load @ 600hp @ 90% 20hrs/day	Fixed rural rate of $0.098/khw	$142,160.00	Assuming we can secure a fixed rate.
Minor Loads-MCC, lighting, HVAC...etc	8% of total pump load	$11,372.80	
Operator/Mech	55/hr with OT built in	$65,000.00	2 part time cross disciplined operators
Maintenance			
Routine – oil, filters, ventilation, minor leak repairs, valve M&R	$3,000.00/ operational month	$18,000.00	
Non-Routine – vendor service, equipment, unplanned downtime	$30,000.00 Annual	$30,000.00	
		Total O&M	per 1000 acre-feet of water removal @ 20cfs
		$266,532.80	$44,792.32

7.8 Proposed Passenger Rail Line Restoration

The North Dakota State legislature passed $150,000 in funding to participate in a planning study related to the opportunity associated with reimplementing passenger rail through North Dakota. This system would be located on the southern BNSF tracks. This is the line through the Crystal Springs Lake Complex, see ***Appendix V***. The Federal Railroad Administration has identified restoration of the former North Coast Hiawatha as a national priority. The state's Rail Authority says North Dakota is the only state so far to allocate any money for the project's matching-fund grant program. The reason for North Dakota to participate is to have a voice in the project development. The cross-country rail project would start in Chicago and end in Seattle, allowing both passenger and freight service through eight states. The expected completion of this study is in the mid-2030's, outside the window of need for the CSWI project.

Big Sky Passenger Rail Authority has federal Corridor ID funding and is entering the next phase of planning, see link Big Sky Passenger Rail Authority. The standards for passenger rail lines would be applicable to these tracks; however current serviceability and viability of the line are questionable without significant investment. This includes upgrades as well as the excess floodwater removal system. Currently, the reality of a new passenger rail program is undetermined, however there is potential value in its implementation. Given the infancy of this pursuit there are no established values included in this study for this opportunity. *Though without the CSWI the viability of the BNSF passenger rail line is largely diminished.*

8.0 Steering Committee and Feasibility Guidance *(Appendix SC)*

The Steering Committee, see membership in ***Appendix SC***, was formed to guide the feasibility study, help coordinate stakeholder input (counties, agencies, affected landowners, and major infrastructure owners), and provide direction on priorities such as local funding, target lake levels, alternative review, regulatory considerations, and next phase planning. The Steering Committee members were encouraged to share the project updates and information with the constituents they represented. This process resulted in a secondary email listing for those interested in project updates and information. The distribution of information to these individuals should continue through project development and implementation.

The Steering Committee was provided with periodic updates including memorandums, and presentations on study progress. The committee held four meetings and attended a public informational meeting in Kidder County focused on downstream issues. The final meeting was associated with the approach to inquiring into the impacts on the receiving tributary and water management practices within the Long Lake Refuge. This water management question was referred to the Burleigh County Water Resource District as the refuge control structures are in Burleigh County, see ***Appendix LLR***. Meeting summaries are included in ***Appendix SC***. There is considerable data contained in these meeting records. The meeting summaries were also posted on the Stutsman County web site under the Water Resource District page.

The Steering Committee participated in discussions related to, and assisted in the following accomplishments:

- ✓ Pursuing and securing local funding, which was a prerequisite to the Stutsman County Commission authorizing the study to proceed. These funding sources are not available for the next steps in project development but illustrate a local commitment toward seeking a solution.
- ✓ Lake system management concepts, including lake connectivity and LiDAR integration of the area-capacity/bathymetry LiDAR to define removal volumes and target elevations.
- ✓ Recognizing groundwater influence was a key driver requiring expanded the study scope to further evaluate its contribution.
- ✓ Alternative selection and advancing the preferred alternative pumping concept located along the north side of Interstate 94 with a 20 cfs design capacity.
- ✓ The ability to utilize storage in Reule Lake to provide earlier flood mitigation on Stink Lake.
- ✓ Encouragement to preserve recreational values, where practical – goes to target elevation.
- ✓ Special attention and expansion on the migration consideration for downstream impacts
- ✓ Addressing stakeholder concerns about downstream impacts through project-funded channel/crossing mitigation and permitting-based operational controls.
- ✓ Public input reinforced the need to carry unresolved topics—such as tributary conveyance improvements, irrigation-use considerations, and Long Lake Refuge water management concerns into the Preliminary Engineering Report for further evaluation and stakeholder coordination.

It is recommended and encouraged that the Steering Committee continue through the Preliminary Engineering Report development to provide insight and consistency in the planning and development process between the participants and political jurisdictions.

9.0 Funding Opportunities

The Feasibility Study funding process was unique in that it included county funds, State Water Commission grant funding, an agreement with BNSF, funds from the Crystal Springs Baptist Camp and other private organization participation. The project has been submitted for inclusion in the 2028 State Water Plan, which sets the stage for further cost share consideration. The following is a breakdown of the total Feasibility Study costs.

Total Budget	**Initial Budget**	**$221,900**
	Addendum #1	**$ 40,000 = $261,000 (SWC Cost Share Requested)**
	Addendum #2	**$ 22,300 = $283,300 (SWC Cost Share Not Requested)**
	Stutsman County	**$ 84,400**
	Private funding	**$ 81,000**
	SWC Grant	**$117,900**
Pending	**Addendum #3**	**Preliminary Engineering – Scope and Budget Pending submittal to the Stutsman County Commission There is no cost share for these services.**
Prime:	**Houston Engineering, Inc**	
Subcontractors:	**Peritiacon LLC**	
	Adaptive Resources Inc	

While grant funding was authorized through the ND State Water Commission, under the rural flood designation, several delays occurred related to the Stutsman County Commission's desire to secure local private funding and subsequent authorization to proceed. These local funds were very helpful to illustrate community interest in seeking a solution to the excess floodwater flooding in this area. Those entities that provided funds are noted in the acknowledgements.

9.1 Future Funding – Preliminary Engineering Report

Securing future funding is critical to the preliminary design phase and project implementation. It will require full cooperation from the identified beneficiaries, as without any one of them the task will be more difficult, if not impractical. The next step is to raise adequate funding to proceed with the Preliminary Engineering Report. Based on a simplistic breakdown of project benefits the following table presents a weighted percentage per beneficiary. This breakdown requires a more in-depth review given unknowns associated with federal funding and undetermined benefits, including those associated with interstate commerce. The level of participation in the PER remains undetermined and will likely vary significantly from the percentages noted in order to carry the project to the next stage.

Beneficiary	Benefit (10 Year Planning Horizon)	Percentage of Total
Stutsman County	$ 8.6 million	18.6%
NDDOT	$16.5 Million	35.6%
BNSF	$10.5+ Million	22.7%
Crystal Springs Baptist Camp	$9-11 Million	19.4%
Agriculture	$1.7 Million	3.7%
Residential/Recreation	TBD	? %

The distribution table contains several assumptions that need to be clarified as follows:

- BNSF Railway's share is likely to be much greater when the full mitigation measures and interstate commerce values are considered. Their benefit was also not indexed over the 10-year planning horizon.
- The Camp relocation costs were computed at $9 million, reflecting their limited ability to participate at a higher level.
- The agricultural percentage and residential portion is a Stutsman County expense, as there is no current means to collect funds from these landowners for the PER.
- Any participation at the levels noted here or as part of the PER completion, based on the above distribution, does not commit any beneficiary to that level, as the project is still at the feasibility level and these numbers will change.

The currently projected OPC to complete the PER is around $976,000. This was approximated based on the total project cost and will change based on the final scope and budget process to be completed under ***Amendment #3****, see* ***Section 13.0.***

9.2 Future Funding Considerations

One study objective was to identify and position the Crystal Springs Watershed Initiative for potential future funding opportunities associated with project design and implementation. Activities completed during funding review were limited in scope and focused on coordination, eligibility, and long-range planning rather than preparing or submitting any formal grant applications. No preliminary engineering or construction funding was secured as part of the feasibility study.

Discussions were held with local, state, and federal stakeholders regarding potential funding pathways that may be available if the project advances beyond feasibility. These discussions emphasized that most large-scale flood-mitigation and watershed-improvement funding programs require a completed Feasibility Study and then a Preliminary Engineering Report prior to application for, or award of, construction funds.

A critical component of the future grant application process was to coordinate with both Stutsman County and Kidder County Emergency Management to ensure the Crystal Springs Watershed Initiative was included in the applicable County Hazard Mitigation Plans. Inclusion in these plans is a prerequisite for eligibility under federal hazard mitigation programs and establishes a foundation for pursuing future grant funding tied to flood risk reduction and infrastructure protection.

The feasibility study identified the FEMA Hazard Mitigation Grant Program (HMGP) as a potential future funding source for the PER. These programs were discussed in the context of long-term implementation funding and require a completed feasibility study, demonstrated benefit–cost justification, and a defined project sponsor. No HMGP application was prepared or submitted as part of the feasibility study, and discussions with the ND Division of Emergency Services indicated that available funding is limited.

The project's future is highly dependent on funding provided by the beneficiaries. While cost share opportunities exist with both FEMA (HMGP and BRICC) grants (75%) and the ND State Water Commission (SWC) grant program (45%) neither is assured at this point. Though state funding is the most likely to be available.

The first step to secure funding is to complete the PER scope and budget process, establish a contract to proceed, then secure the beneficiaries funding commitment (based on the anticipated cost share. Only after that should a Web Grant Application be filed with the NDSWC.

The overall project cost and benefit distribution will continue to be evaluated as the PER is completed. It is anticipated that a framework for not only how to pay for the project, but to create a functional operational authority will be required. BNSF and the NDDOT (State of North Dakota) are the primary beneficiaries and will need to play a larger role, at least financially, for the project to move forward. While BNSF will be corporate funding, the NDDOT funding will likely need legislative authority. Another option is for the NDSWC to play a larger role in cost share percentage to address the NDDOT contribution though an increase in cost share percentage. Ultimately, there will need to be a public/private partnership agreement and to create an operational authority with long range funding.

Subsequent project updates noted that the FEMA Building Resilient Infrastructure and Communities (BRIC) program may also represent a future funding opportunity if the project advances to final design and construction. At the time of the feasibility study, the availability and timing of such funding were uncertain, and no assumptions were made regarding award likelihood or schedule.

Overall, ***Section 9.0*** documents the awareness, eligibility, and planning alignment for future funding opportunities but did not include the pursuit, application, or receipt of implementation funding. Advancement to the Preliminary Engineering Report phase is anticipated to be the appropriate point at which specific funding strategies, agency participation, and grant applications would be further developed and evaluated.

10.0 Feasibility Report Conclusions

This Feasibility Study presents a summary of the various project elements and documents the evaluation and decision-making process used to identify a viable preferred alternative. Each section describes the individual parts of the study evaluation and analysis completed. *The conclusion is clear: lake water levels will continue to increase to the significant detriment of interstate transportation, public safety, county roadways, and private property.* Subsequently, based on this investigation and evaluation, it is strongly recommended that the Stutsman County Commission and the Stutsman County Water Resource District move forward with the Preliminary Engineering Report to facilitate project implementation. The construction schedule is considered critical given the projected impacts and the need for timely action.

10.1 Flood Impact Timelines

Given the forecasted water surface increases, the critical timeline for implementing a flood mitigation project is short to prevent avoidable damage, which is around a three-year window. Damages to the BNSF rail line, the Camp facilities, county roadways, agricultural lands are ongoing and future impacts to residential and recreational properties. In addition, it is important to understand that the annual water-level increase of approximately 0.6 feet will require additional pumping costs of roughly $250,000 per year. Therefore, timely action is imperative to prevent future avoidable losses, particularly in the case of the BNSF rail line.

BNSF Raiload Grade Elevation	**1755.2**	**~ Existing**	**2027 + every 2 yrs**
Bible Camp Ground Elevation	**1761**	**Fully Compromised**	2036
Bible Camp Impacts on Roadway	**1757**		**2027-2028**
County #39 - Roadway is Unundated - Viable at Elevation 1750?			
Interstate #94	**1764.2**	**Crown Elevation**	
	1761.8	**2 - year lead time**	**2033**

10.2 Additional Watershed Contribution

As the study neared completion, increasing concerns arose regarding the expanding contributing watershed. This is occurring in at least two locations, as upper shallow basins and wetlands are becoming lakes and beginning to overflow downstream into the Crystal Lake complex. Recently, another 3,200 acres associated with a 2021 drainage permit in Peterson Township were identified as directly contributing to the Crystal Lake system. Details on this remain to be investigated but should be reviewed as part of the PER. If this sub watershed is fully contributing, it adds approximately twenty percent (20%) to the currently contributing drainage area. The details on the second watershed location have not yet been reviewed.

These inflows did not influence the historical rise or the analysis completed for this feasibility study because these lands were not directly contributing during that period. Therefore, this does not change the study's determination regarding water-level increases or groundwater influence estimates, as these are newly contributing surface-water sources.

This trend in the rise in local wetlands, filling and overflow, is anticipated to continue and will be evaluated in more detail under the PER phase. These inflows will increase the risk and rate of water level increases in the Crystal Springs Lake Complex, making the timeline and need to implement a project even more critical.

10.3 Potential Irrigation Component

During the Steering Committee discussions as well as public informational meetings landowners questioned the ability to irrigate with excess floodwater. Initial reviews of this have indicated supply concerns and the issues faced by irrigators to secure permits. As part of the study process the Central Dakota Irrigation was contacted and requested, if they wish, to send a letter to express their interest in becoming a stakeholder during the Preliminary Engineering Study and design process. At the time of this report's completion, they have not yet formalized that request.

11.0 Kidder County Concerns

During the Steering Committee meetings representatives from Kidder County expressed their concerns and reservations regarding the discharge of water into their county and impacts on their landowners. Letters were exchanged, and after a meeting with Kidder County it was agreed a public informational meeting would be held for Kidder County and downstream landowners. This meeting had good attendance and the commentary, questions and responses were documented, see ***Appendix SC***. This was a valuable tool and transparent approach to collaborate and look for opportunities toward problem resolution.

During this meeting the tributary to the Long Lake Refuge was described as unable to accommodate any additional water as it had limited capacity to adequately convey either existing or additional flows. This condition was previously acknowledged, and a preliminary mitigation plan was presented to the Steering Committee. After the meeting it was modified based on the discussion, see ***Appendix SC, Meeting #4***. These modifications included channelization and new culvert installations to accommodate and mitigate for the additional flows. The channel and crossing improvements would extend from the discharge point south to Highway #3 as illustrated in ***Figure 15***. There are no improvements in the lake sections.

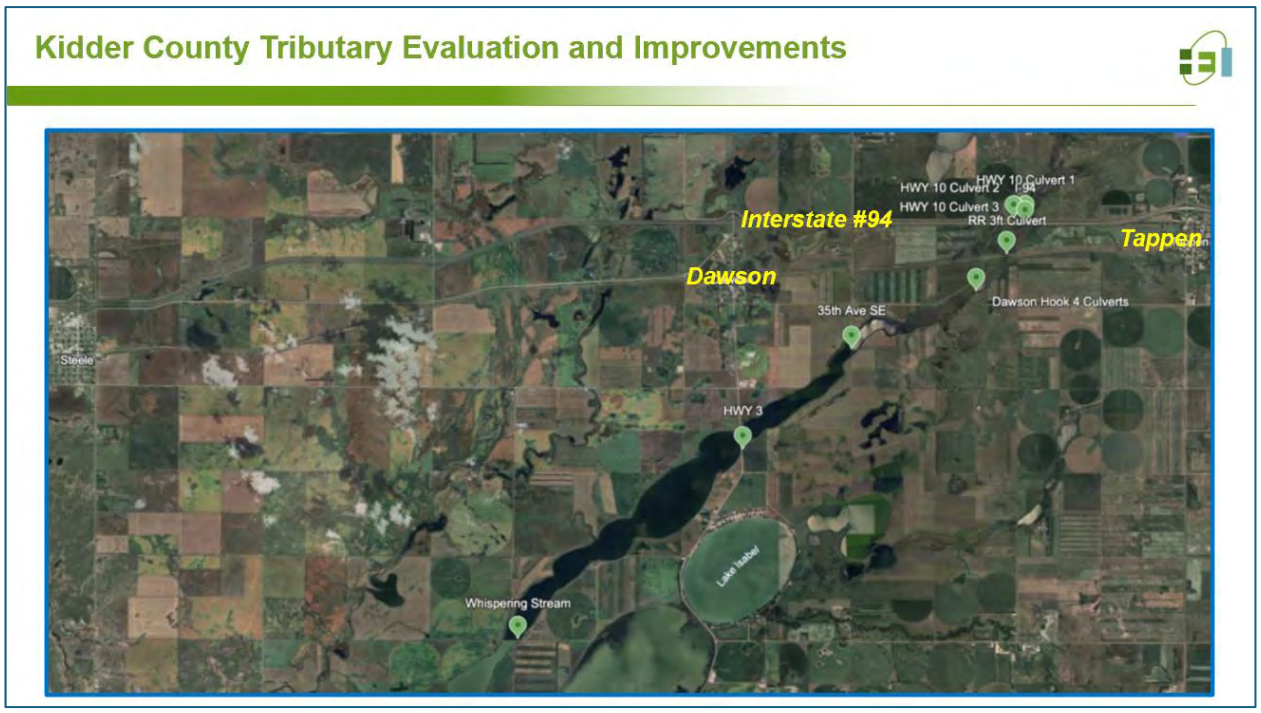


Figure 15 - Location of Kidder County Discharge Tributary Stream Crossings

In summary, the initial downstream review using existing culverts determined that all roadway crossings complied with the North Dakota Stream Crossing Standards. After project flows were added, headwater elevations increased; however, all crossings still remained in compliance (see ***Figure 16***). The only crossing out of compliance was the BNSF rail crossing, which would be upgraded if the project proceeds. One means of mitigating the identified headwater increases is to construct a drainage channel within the tributary and install a 35" x 24" arch culvert at each crossing with an invert two feet lower than the current channel bottom. The BNSF 42" culvert would also be installed with the lower invert. This is a preliminary projection and remains subject to evaluation during final design and easement negotiations.

Stream Crossing Compliance and Mitigation Evaluation

Crossing Name	Culvert Size [inch]	Culvert type	Invert of Culvert [1] [NADV88]	Design Event Return Frequency (ND Stream Crossing Standards)	Allowable Headwater Elevation [NADV88]	Water Surface Elevation for the Design Event [NADV88]		Change in Water Surface Elevation based on 15 cf added to roadway design event (inches)	Mitigation Measures [2]	Pass/Fail
						Existing Conditions	Proposed 15 cfs Pump		Added Culvert and Channel Construction to two feet to accommodate 20 cfs discchrages	
Highway 10	3-36	RCP	1737.00	25 Year	1742.00	1740.67	1740.89	2.6	35"X24" RCP	P - P - P
I-94	3-36	RCP	1737.00	50 Year	1742.00	1741.07	1741.27	2.4	35"X24" RCP	P - P - P
Railroad	36	RCP	1735.00	50 - 100 Year	1738.00 - 1739.50	1740.93 - 1741.71	1741.14 - 1741.84	1.6	42" Steel Pipe	F - F - F
Dawson Hook	2-30, 2-24	CMP	1731.50	15 Year	1736.00	1733.65	1734.02	4.4	35"X24" CMP	P - P - P
35th Ave	36	CMP	1723.23	10 Year	1728.23	1726.74	1727.86	13.4	35"X24" CMP	P - P - P
Highway 3	2-18	Box Culvert Unconfirmed	1724.5	25 Year	1728.00	1727.12	1727.43	3.7	35"X24" RCP	P - P - P
Whispering Stream	2-24	CMP	1723.60	10 Year	1727.60	1726.12	1726.12	0.0	35"X24" CMP	P - P - P

[1] Values are based on survey data, while HEC-RAS modeling of culvert inverts are based on the lowest LiDAR value near the culvert
[2] Channelization at ~ 2 feet in depth, 12 ft bottom width and 4:1 side slopes - target no water depth above existing channel bottom.

Recommendation for the Preliminary Engineering Report:

Evaluate downstream mitigation features early in the process to address concerns.
All increases in water surface elevations to be mitigated with channel and culvert improvements

Figure 16 – Kidder County Tributary and Stream Crossing Standards Compliance

12.0 Long Lake National Wildlife Refuge

Another issue raised during the Kidder County meeting was adverse impacts associated with the management of waters within the Long Lake Refuge (LLR) by the United States Fish and Wildlife Service (USFWS). This is a complex situation that has existed for many years without Kidder or Burleigh County landowners understanding what was occurring and seeking a formal resolution. The Stutsman County Commission, while not having any jurisdiction in either Kidder County or Burleigh County, directed the undertaking of an investigation to determine what might be occurring within the refuge.

The information provided by the USFWS, and the North Dakota Department of Water Resources was very informative. The result was a summary memorandum transmitted by the Stutsman County Commission to the Burleigh County Water Resource District (BCWRD), see ***Appendix LLR***. Since refuge control structures are in Burleigh County, the BCWRD is going to discuss water management issues with the USFWS. The desire is to determine what practical actions might be undertaken to resolve adverse water impacts associated with water management in the refuge.

The BCWRD efforts and discussions with the USFWS are outside the CSWI project scope and are separate issues. The resolution of concerns, however, is important to CSWI regulatory permitting and design, and that process will run concurrently with the Preliminary Engineering Report. Any system modifications by the USFWS will require federal funding, which can be problematic to secure.

Documentation related to Long Lake National Wildlife Refuge highlights the complexity of regional water management interactions. Historical and modified outlet structures, discrepancies between permitted and constructed control elevations, and easement coverage uncertainties underscore the importance of a coordinated water level management plan across jurisdictional boundaries. A recent review of information obtained from the ND Department of Water Resources indicates the known issues with water management within the refuge dates back decades.

Observed backwater conditions and prolonged property inundation durations reinforce the conclusion that unmanaged storage exacerbates upstream flooding. Lessons from the LLR establish the need for system structural improvements, clearly defined operating plans, verified control elevations, and coordination among federal, state, and local entities.

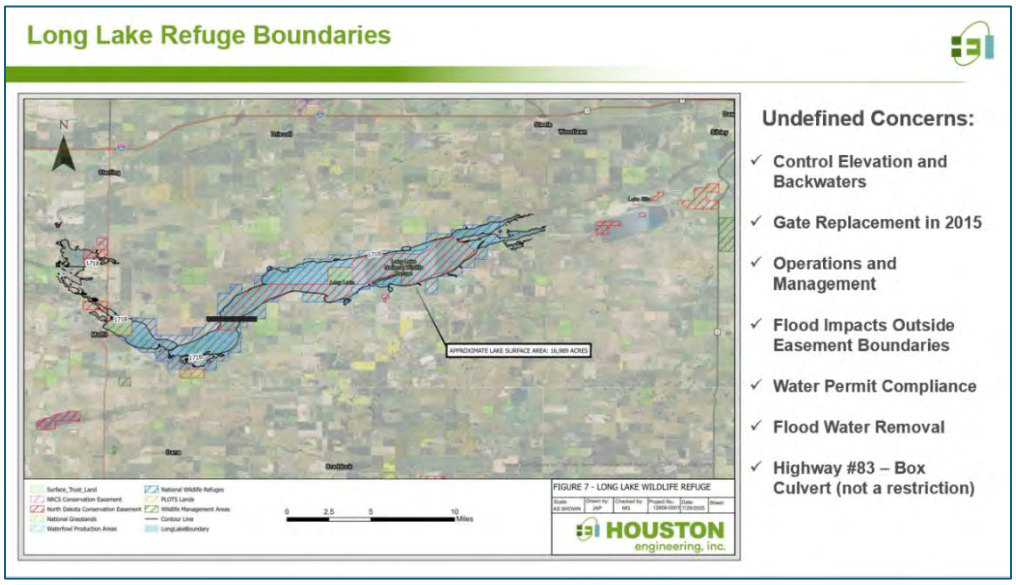


Figure 17 – Long Lake Refuge Boundaries

13.0 Preliminary Engineering Report

Completing the Feasibility Study represents a critical step and decision point for the *Crystal Springs Watershed Initiative* and the future partnership required to move forward. The next step in advancing the project toward implementation is preparing a Preliminary Engineering Report (PER). The PER bridges the gap between a feasibility level evaluation and preliminary design by refining the preferred alternative, addressing outstanding technical and regulatory questions, and establishing the level of detail required for project funding, permitting, and stakeholder commitments.

13.1 Preliminary Engineering – Next Steps

The Feasibility Study identified a "preferred alternative" which is a conceptual approach that confirmed excess floodwaters within the lake complex can be managed through an optimized pump removal and conveyance system. However, the analyses completed to date were intentionally performed at a planning level and are subject to further refinement. A PER is necessary to convert planning level concepts into a defensible, implementable project that can be evaluated by funding agencies, regulatory authorities, and participating entities.

The PER would include refining the preferred alternative alignment, system capacity, operational strategy and funding options identified during the feasibility study. This includes advancing hydrologic, hydraulic, and groundwater evaluations to a level that supports engineering decisions and addresses the expanded understanding of hydrologic, hydraulic and groundwater influence documented during the Feasibility Study. The PER would further evaluate downstream conveyance improvements, operational controls, and mitigation measures to ensure project discharges can be accommodated without adverse impacts and in compliance with applicable regulatory standards.

A key purpose for the PER is to reduce uncertainty for the beneficiaries and downstream landowners. At the feasibility stage, many assumptions are necessarily conservative and generalized. The PER provides the opportunity to confirm assumptions, evaluate design sensitivities, and quantify risks related to constructability, operations and maintenance, environmental compliance, and landowner impacts. This level of refinement is essential to support reliable opinions of probable cost, long-term operational planning, and benefit–cost evaluations required by state and federal funding programs.

The PER also serves as the primary document used to support regulatory coordination and permitting. While feasibility level coordination identified no obvious regulatory barriers, permitting agencies generally require project-specific design information, defined discharge parameters, and detailed impact assessments before authorizing construction. Advancing to a PER allows these issues to be addressed proactively, reducing the risk of delays or rework during final design or construction.

The PER establishes a more refined framework for the public and private participation in the project design, construction and operational governance. The Feasibility Study confirmed broad interest and identified affected parties, but the PER provides the level of detail needed for participating entities to evaluate commitments related to funding, easements, operations, and long-term responsibilities. This includes further coordination with the stakeholders including funding agencies, counties, transportation agencies, railroads, landowners, and resource agencies to confirm roles and expectations.

Future funding for the Preliminary Engineering Report itself is a necessary step to ensure the project continues to move forward. Unlike this Feasibility Study, which was supported by a SWC grant, a BNSF and many smaller local contributions, see acknowledgments. The next phase has a larger cost and complex partnership requirements to succeed. PER funding typically requires a combination of local, state, and federal participation, see **Section 7.0**. The project documentation notes that future funding opportunities such as the State Water Commission, hazard mitigation funding, and other federal infrastructure programs generally require a Feasibility Study prior to consideration. Advancing the project to a PER positions the project to meet eligibility requirements to compete for funding.

Securing funding for the PER is therefore both a technical and strategic step. Completing the PER demonstrates commitment, reduces funding risk, and signals to potential funding partners that the project is viable, coordinated, and ready to advance. Without a PER, the project would remain conceptual and not meet the threshold requirements for most grant funding programs.

The Preliminary Engineering Report will refine the preferred alternative, address remaining technical and regulatory uncertainties, support stakeholder decision-making, and establish the foundation required to pursue construction funding. Advancement to this phase is necessary to maintain project momentum and to ensure that the Crystal Springs Watershed Initiative can progress in a structured, defensible, and fundable manner. This project has a critical timeline to achieve the desired benefits, otherwise the damage will occur and be unrecoverable, and continuing impacts will only be greater.

13.2 Scope and Budget Services (*Addendum #3*)

The PER requires an extensive scope and budgeting process, which occurs prior to the grant application submittal and is not eligible for cost share. The ***Addendum #3*** process includes, but is not limited to, budgeted costs to complete the following:

- Presentation to the ND Legislative Water Topics Policy Committee – June 10
- Consideration of beneficiary cost sharing options for the preliminary engineering report
  - Funding commitments required before grant applications are submitted.
  - Primary Beneficiaries and a Memorandum of Understanding (MOU)
  - Public/Private Financial Plan/Operational Funding
- Preliminary design (35%) of the preferred alternative
  - Pump station design – inlet and location, and 3-phase electrical power supply
  - Pump and pipeline modeling – sizing, optimization and configuration.
  - Pipe size selection and pipe alignment (intake and pumps)
  - Survey of the pipe alignment, appurtenance location and BNSF ROW review
  - Property Appraisals for easements or acquisition (as required)
  - Pump line access and O&M considerations.
  - Evaluation of inter-lake control features for water level management (Crystal Springs)
  - Consideration of an irrigation supply system, if requested by stakeholders
- Consideration of the design and operational parameters
  - Capacity to remove excess flood waters and achieve long-term target elevation
  - Projected O&M cost and funding sources
  - Regulatory permitting requirements
  - Consider irrigation use by the Central Dakota Irrigation District (optional)

- Expanded evaluation of the watershed hydrology and system hydraulics
    - Newly contributing watershed area (volume impacts to system design)
    - Consideration of system surcharge or flood storage (removal time)
    - Projected inflows and design capacity confirmation for removal
- Develop a groundwater model to predict anticipated inflows needing to be removed
    - Verification of inflows and projected long-term rate of inflow
    - Travel time for groundwaters to reach the lake
    - Volumetric predictions of annual inflow and balance with evaporative losses
- A more detailed economic analysis of Cost/Benefit to support funding request for implementation via the SWC criteria.
- Evaluate and determine benefits, then prorating the construction and O&M costs
    - Projected distribution of costs to the beneficiaries
    - Commitment agreement for construction funding as well as operations
    - Development of a Memorandum of Agreement
- Regulatory permitting required and projected
    - Drainage Permit(s) (NDDWR) – Interdistrict Significance/Kidder County
    - Water Quality Discharge Permit (NDEQ)
    - USACE/USFWS regulations – Section 401, Section 404, Section 106 (archaeological)
- Flow mitigation measures along the discharge tributary to the Long Lake refuge
    - Landowner discussions, prioritization of this evaluation and construction
    - Survey of tributary for topography and culvert locations
    - Design channelization and stream crossing improvements
    - Property Appraisals for easements or ROW acquisition (as required)
    - Operational and Maintenance cost projection
- Long Lake Refuge – Water Management Plan revisions through the USFWS
    - Assurance or support from the USFWS related to project support
- Federal Railroad Administration (FRA) contacts and discussions
    - Ability to have federal funding for rail line upgrades
- Big Sky Passenger Rail Authority (BSPRA) contacts and discussions
- Request for cost share funding contributions and grant applications
    - FEMA BRICC Grant – if available and project qualifies
    - ND State Water Commission – Rural Flood Control or Alternative Percentage
    - Legislative Funding – NDDOT (non-federal funds)
    - Burlington Northern Santa Fe Railroad (corporate contribution)
    - BSRPA Opportunities (congressional funding)
    - Crystal Springs Baptist Camp (private funds)
    - Stutsman County (Highway Department/Water Resource District)
    - Stutsman County WRD (Special Assessment District)
    - Private

The anticipated cost to complete ***Addendum #3*** is subject to acceptance of this Feasibility Study and the PER elements outlined above. Refinements and additions to this task list will be made as the scoping process proceeds, with discussion of requirements and the approach going forward. There are unknowns that will be defined during the scoping process; therefore, the process needs to be transparent and flexible. A typical PER timeline from start to completion is 18 to 24 months. In this case, the schedule will first be affected by the ability to secure funding from the beneficiaries and, second, by the ability to secure grant funding.

Appendix HA

Hydraulic Analysis Technical Memorandum

HOUSTON engineering, inc.

Appendix (HA) - Hydraulic Analysis Technical Memorandum

From: Adam N. Nies, PE CFM Author, Michael H. Gunsch, PE CFM Reviewer
Subject: Crystal Springs Hydraulic Analysis
Date: December 14, 2025
Project #: 12808 - 0001

INTRODUCTION

The Crystal Springs is a closed basin that has experienced historically increasing water levels with the resulting surface water connection and joining of adjoining lakes. These waters have adversely impacted Interstate #94, the BNSF Railroad tracks, Crystal Springs Bible Camp local county/township roadways and adjoining agricultural properties. The Interstate has been raised by NDDOT several times, the second time in 2011 approximately 10 feet. BNSF has raised its trackage numerous times to stay ahead of rising waters and continues to need to do so every two the three years. Each time at a considerable expense.

HYDRAULIC ANALYSIS

HYDRAULICS

The Crystal Springs hydraulic analysis began with the State of North Dakota Base Level Engineering (BLE) models. These BLE models were originally developed in 2017 and are RAS5 rain-on-grid two (2) dimensional models that encompass re-delineated watershed boundaries based on up-to-date topography, similar to that of a HUC10 scale, across the entire State. Each 2-D mesh is set with breaklines defining critical control points within the drainage area, such as roadway embankments, but they have no culvert or bridge data within them. Rather, the conveyance through roadways is represented through “burned-in” conveyance channels on the landscape via LiDAR terrain modification and using strategically placed cell faces that allow water to pass through roadways at locations of hydraulic structures. The modeling was originally developed in HEC-RAS version 5.0.3, which was one of the first versions with 2-D capabilities. At the time of this study, version 6.6 is available and incorporates vast improvements to the 2-D computations and overall run times, as well as the functionality of RASmapper tools for geometry creation and terrain modification. As such, the BLE model for Crystal Springs has been converted up to HEC-RAS version 6.6 for this analysis. Hydraulic differences in results between the two versions is negligible.

HYDROLOGY

Hydrology for the model is a precipitation hyetograph that is applied over the entire mesh area. Several events are available within the BLE models including the 2-, 10-, 25-, 50-, 100-, and 500-year events. The model also includes a 1% Plus event and a 1% Minus event, which is a representation of the statistical confidence limits on the 100-year event. The hyetographs for these events are based on a 24-hour rainfall event and were generated through application of a HEC-HMS (v.3.5) model incorporating a single catchment representing the watershed utilizing the SCS curve number method. Since this Crystal Springs analysis is a volume driven issue, there was need to represent the potential of a snowmelt event for comparison in the modeling, and the HMS model did not include a snowmelt event. To represent a snowmelt event, the HMS model was retrofitted with a 10-day duration typical snowmelt distribution curve along with a snowmelt depth of 4.1 inches, both based on NRCS guidance for central North Dakota. The curve number in the model was set to 99 to account for the winter soils conditions of the landscape. Once the HMS model was complete, the excess precipitation hyetograph was placed into the HEC-RAS flow file, and the model duration was extended to account for the longer duration snowmelt event. This snowmelt hydrology has not been reviewed or approved by any state agency and is only a representation of the potential volume a large snowmelt could possibly generate. It is labeled as a 100-year, 10-day snowmelt event simply to provide a frame of reference of what is projected.

LAKE BATHYMETRY

The North Dakota Game and Fish has provided underwater bathymetric contours of the Crystal Springs lake system. This information is beneficial as LiDAR technology is not able to penetrate through water. The topographic information utilized within the model is based on LiDAR collected in November 2020 and represent the lake water surface elevation at that time. Since that time the water surface has continued to fluctuate due to inflow from rain and snowmelt events, as well as evaporation and infiltration. The lake bathymetry contours were merged into the LiDAR to generate a terrain model representing the Crystal Springs basin with no water present in the lakes. This is relevant to recognize the full potential storage volume available within the basin, however it does not aid in representing realistic conditions for the modeling. The most recent water surface elevation of the lakes was surveyed in the fall 2024 at elevation 1753.22 and was utilized as the starting water surface elevation for the model effort to represent true current conditions and expected water level rises from potential runoff events. The model terrain was modified within RASmapper (HEC-RAS v.6.6) to adhere to the surveyed water surface elevation. The 2-D mesh recognizes the terrain elevation and accounts for it through modification of the storage curve within the cells and the conveyance area within the cell faces. All events were computed with an identical terrain representing the current surveyed water surface elevation. During the time of this study water surface elevations increased significantly, however given the limited project funding and groundwater fundings, the hydraulic analysis was not revised for these increases. However, in general a rise of a foot or so would translate into a similarly change in the results presented.

TIME TO PUMP

Using the lake bathymetry from the NDGF combined with the LiDAR data, an elevation-storage curve was established for each lake within the connected Crystal Springs system. From this curve, displayed visually in **Figure HA-1**, the model resultant water surface elevations can be read to establish the applicable volume. Then subtracting the volume associated with the 1753.22 set water surface elevation, the influx of volume per event is gained. Using an assumed 10 cfs pump scenario, as an initial baseline, we computed the time to pump the volume added to the lakes per event to give a general perspective on how many days it would take to remove the volume given the frequency/size as presented in **Table HA-1**.

Table HA-1 – Hydraulic Results Summary Table

Event	Water Surface Elevation (NAVD 88)	Volume in Excess of 2024 Water Level (ac-ft)	Time to Pump** (Days)
100-Year 10-Day Snow Melt	1754.81	6,141	310
500-Year	1754.20	3,720	188
100-Year Plus	1754.35	4,299	217
100-Year	1753.63	1,522	77
50-Year	1753.49	1,002	51
25-Year	1753.42	742	37
10-Year	1753.32	371	19

*** Assumes a 10 cfs pump*

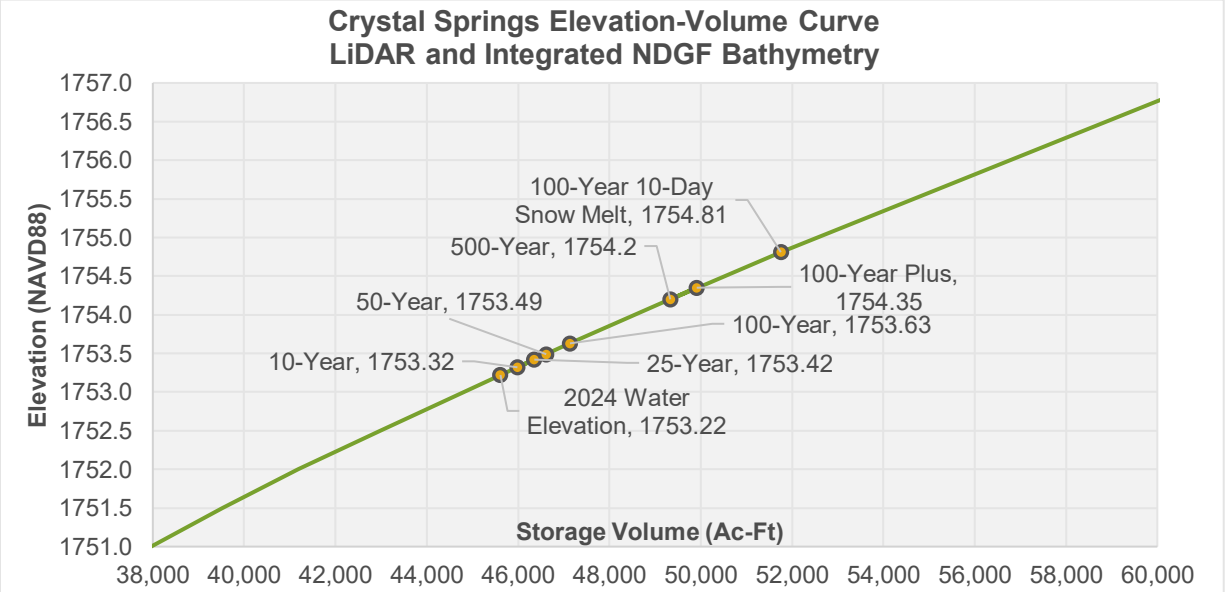


Figure HA-1 – Event Based Volume Comparison

USGS GAGE COMPARISON IN NEARBY WATERSHED

To compare the data from the Harvey USGS Gage #09020202, a non-contributing drainage area analysis was completed for the Crystal Springs Watershed. This allows the volumes to be compared in a historic perspective to aid in projecting what could be expected for flood volumes into the Crystal Springs system. The non-contributing drainage area analysis began with available 2021 LiDAR and running a "fill and spill" analysis through tools contained in GIS. This analysis utilized a 100-year 24-hour rainfall raster grid based on NOAA Atlas 14 along with a curve number grid to establish runoff volumes on the landscape. Natural depressed areas within the LiDAR retain the volume up to a crest elevation. If the volume draining to each depressed area is not sufficient to exceed the crest elevation, then the area upstream is considered non-contributing. If the volume does exceed the crest elevation, then the remaining volume continues downstream to the next depressed area and the computation repeats. The Crystal Springs drainage area contains thousands of depressed areas, which results in a large percentage of the watershed as being non-contributing. Roadway embankments crisscrossing the landscape also create obstructions to the flow accumulation grid and will incorrectly represent storage and non-contributing area if conveyance structures are not represented, where applicable. To represent the conveyance through hydraulic structures such as culverts and bridges, a partially hydro-conditioned Digital Elevation Model (DEM) was created for the watershed. Hydro-conditioning is a GIS process of modifying the LiDAR to remove, or "burn-in", a portion of the roadway embankment where a known bridge or culvert is located, down to the elevation of the natural field on either side of the embankment. This allows the flow accumulation grid to pass through a roadway, though not accounting for the storage created behind the embankment. The scope of this study did not include a complete hydro-conditioning of the LiDAR due to cost and time constraints but instead focused on those obstructions that represented the majority of the error for the non-contributing analysis. It is estimated that we have resolved approximately 90% of the error through selective partial hydro-conditioning. Therefore, of the overall 101 square miles of the Crystal Springs watershed, it is estimated that 26.8 square miles contribute to the lakes, as displayed in **Figure HA-1**. This again was based on the 100-year rainfall raster grid, with current LiDAR topography. With the current climatic trends, it is worth considering that the depressional areas within the watershed may continue to fill, and exhaust additional storage with the potential to make some areas that were non-contributing to become contributing over time. To represent this condition in a uniform manner, we have analyzed a secondary flow condition for the non-contributing analysis by doubling the rainfall raster grid projection. This accomplishes the partial filling of many of the depressional areas and allows more of them to be counted towards contributing. Under this secondary analysis, the contributing area to the lakes increases to nearly 50 square miles, from the initial representation of 26.8 square miles, as displayed in **Figure HA-1**.

PUMP OUTLET ADEQUACY ANALYSIS

The outlet hydraulic analysis started with the State of North Dakota Base Level Engineering (BLE) two (2) Dimensional HEC-RAS model. The model was modified to incorporate several relevant culvert crossings within the project area inside of the 2D gridded "mesh". The hydrology for the outlet model is a precipitation hyetograph that is applied over the entire mesh area. Several events are available within the BLE model including the 10-, 25-, 50-, 100-, and 500-year events. The model also includes a 1% Plus event and a 1% Minus event, which represents the statistical confidence limits on the 100-year event. The hyetographs for these events are based on a 24-hour rainfall event. The outlet model compares the existing conditions with two proposed flow conditions into the stream based on anticipated pumping rates. The proposed conditions have a 10 cfs or 15 cfs flow into the downstream tributary where the outlet pipe would be located, to represent the additional flow due to the proposed pump, in addition to the normal precipitation events. Elevations and flows were compared to ensure the projected pumping conditions do not cause adverse impacts to downstream roadway crossings. Note that a later review of removal requirements increased the projected removal rate to 20 cfs. A reanalysis of the increased flow was not included in this study.

To further evaluate the potential for hydraulic impacts on downstream crossings, a comparison of the allowable headwater elevations was made using the ND Administrative Code 89-14 Stream Crossing Standards. The typical stream crossing analysis use steady state modeling and peak flows generated from the USGS Regression Equations, or through the online application StreamStats (USGS). That method was investigated but was found insufficient due to overprediction of attenuation due to storage, the peak flows were unreasonably small and deemed inaccurate. Therefore, the 2D modeling was used as the best available data for most of the downstream crossings. Culvert sizes and inverts were surveyed, and a unique allowable headwater elevation determined based on roadway type, as outlined within the stream crossing standards. Several of the roadways are classified as an off system, rural system county road, and required a 15-year event to be evaluated. To generate this event, an interpolation of the 10-year and 25-year events was completed for the inflow hyetograph and the unsteady 2D model was rerun with an additional event. A summary table of the analysis is provided within **Table HA-1**. The BNSF Railroad crossing was the only location to fail the allowable headwater check, on both proposed events as well as existing conditions. This is due in part because of the LiDAR elevation adjacent to the structure. The LiDAR appears to have been flown at a time when the water was high adjacent to the railroad embankment` and is essentially at the allowable headwater elevation when comparing the surveyed inverts of the crossing. Because of this limitation in the 2D model, the road crossing was modeled in HY-8 to determine what type of culvert(s) would be needed to have an allowable headwater elevation. Peak flows from the unsteady 2D model were utilized by generating a flow hydrograph via application of a profile line that is cut across the 2D mesh area as if it were a cross section. The profile line summarizes the combined hydrograph flow across the mesh, and a peak is extracted. Locating the profile line was of particular importance due to the unsteady nature of the model for peak flow attenuation. Therefore, the profile line was drawn on the downstream side of the Interstate-94 crossing, to provide a reasonably accurate representation of the anticipated peak flow that could be expected to contribute to the railroad crossing.

The HY-8 model is then used to evaluate allowable headwater in a steady state condition, both for the existing peak flows as well as the peak flows generated by the 10- and 15-cfs proposed pumping condition. To meet the allowable headwater criteria at the railroad, an additional 42" culvert would be required to be bored through the railroad embankment, while leaving the existing 36" in place.

In the appendix, there are charts of the model results displaying the impacts that the proposed pumping would have along the outlet tributary channel. Flow and elevation hydrographs compare each relevant crossing downstream of the outlet, and impact profiles display the change in peak water surface elevation from the pump outlet to long lake.

RECOMMENDATIONS

The Crystal Springs closed basin is filling based on a regular trend over the selected review period and rising water levels will continue into the future. This significantly increase the risk for damages to the Interstate, BNSF rail line, Crystal Springs Bible Camp, County and Township Roadways and agricultural lands. A subsequent review and in-depth groundwater conditions in the region has determined that groundwater has a significant influence on the rising water levels. Therefore, based on other factors not included in **Appendix HA** it was determined that a 20 cfs system is required to adequately remove existing stored waters and the projected future inflows. This removal rate is addressed in other sections of the Feasibility Study.

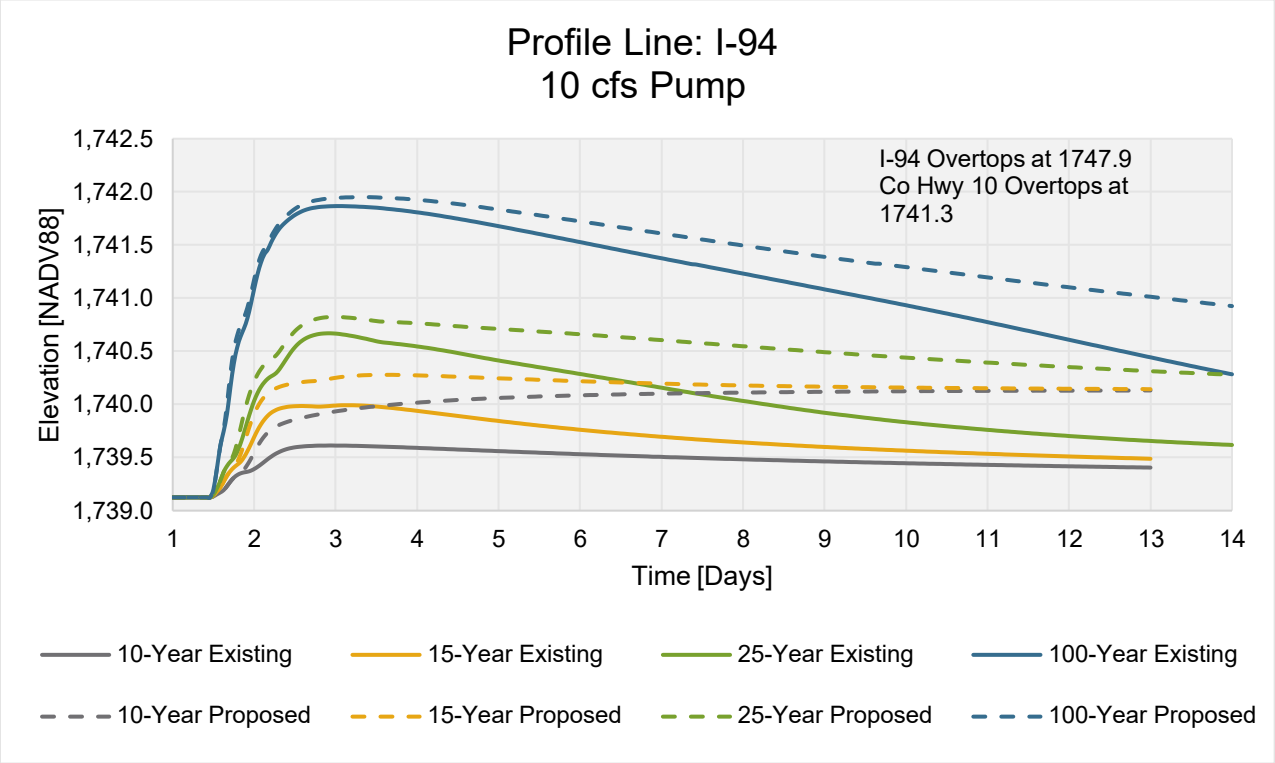
Table HA-1 – Allowable Headwater Results Summary Table

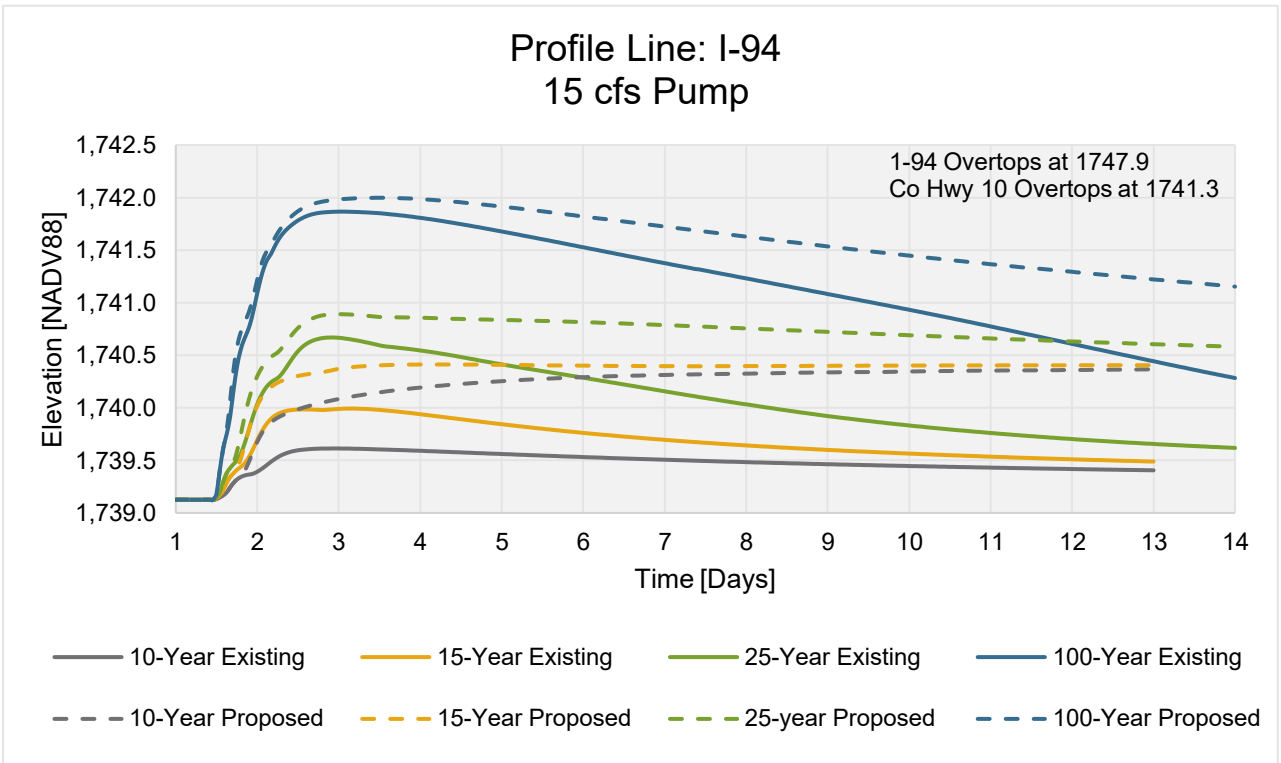
Crossing Name	Culvert Size [inch]	Culvert Type	Invert of Culvert* [NADV88]	Design Event Return Frequency	Allowable headwater Elevation [NADV88]	Existing Conditions WSE [NADV88]	Proposed 10 cfs Pump WSE [NADV88]	Proposed 15 cfs Pump WSE [NADV88]	Pass/Fail Ex/10/15
Highway 10	3-36	RCP	1737.00	25 Year	1742.00	1740.67	1740.82	1740.89	P - P - P
I-94	3-36	RCP	1737.00	50 Year	1742.00	1741.07	1741.19	1741.27	P - P - P
Railroad	36	RCP	1735.00	50 - 100 Year	1738.00 - 1739.50	1740.93 - 1741.71	1741.06 - 1741.79	1741.14 - 1741.84	**F - F - F**
Dawson Hook	2-30, 2-24	CMP	1731.50	15 Year	1736.00	1733.65	1733.86	1734.02	P - P - P
35th Ave	36	CMP	1723.23	10 Year	1728.23	1726.74	1727.50	1727.86	P - P - P
Highway 3	2-18	Box Culvert Unconfirmed	1724.50	25 Year	1728.00	1727.12	1727.35	1727.43	P - P - P
Whispering Stream	2-24	CMP	1723.60	10 Year	1727.60	1726.12	1726.12	1726.12	P - P - P

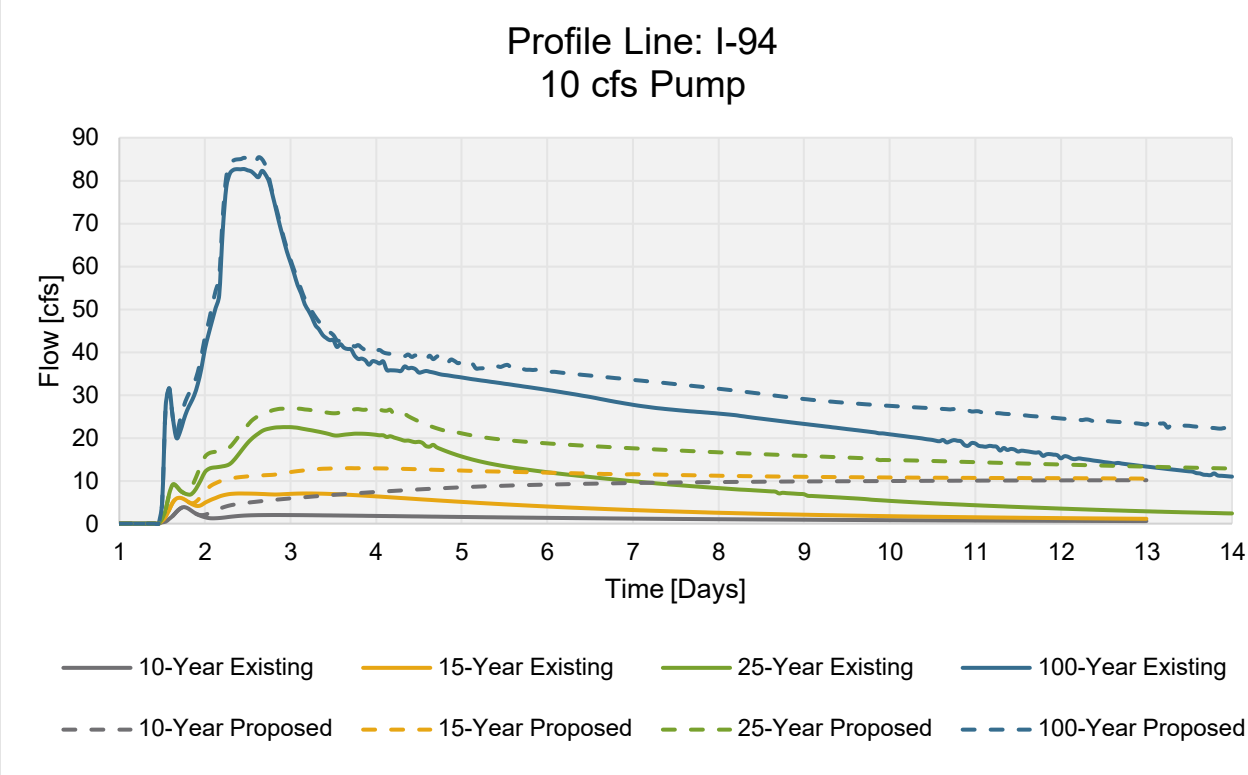
*Invert values are based on survey data, while HEC-RAS modeling of culvert inverts are based on the lowest LiDAR value near the culvert

APPENDIX HE-1

OUTLET FLOW AND ELEVATION CHARTS



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10 cfs Pump
Flow [cfs]
Time [Days]
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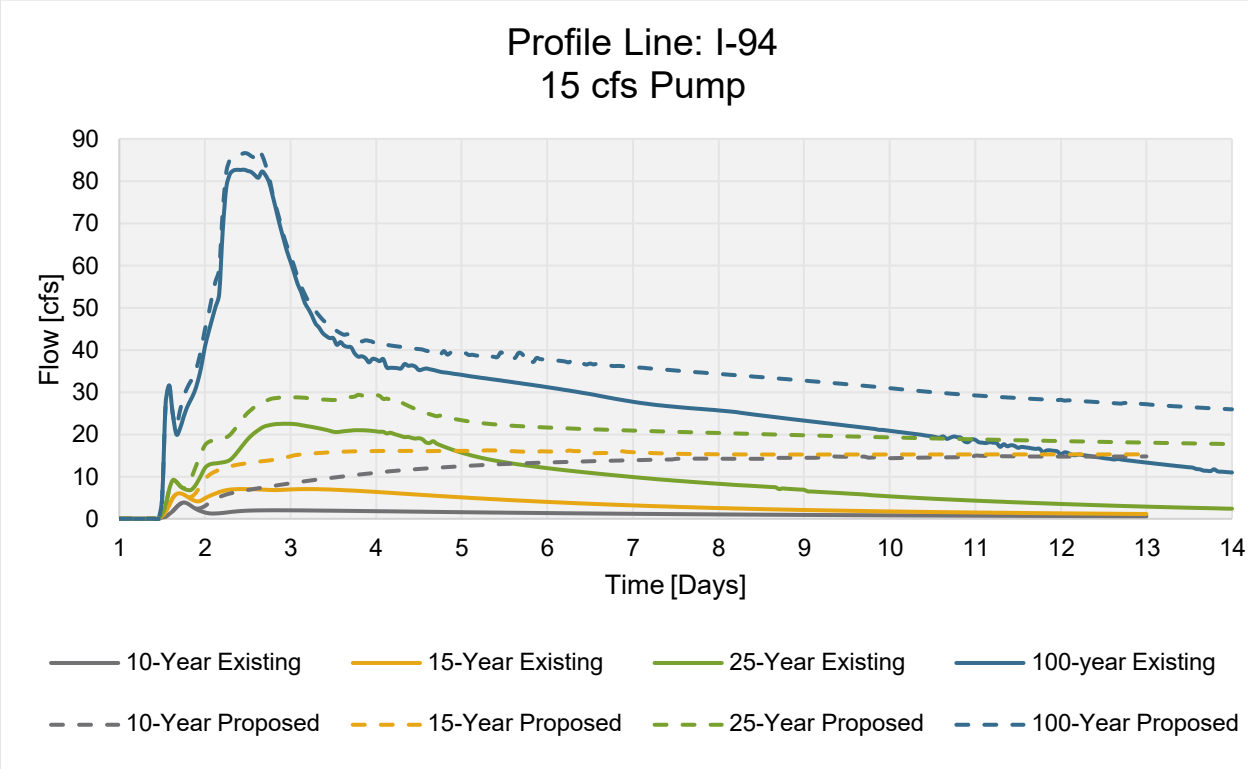
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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Flow [cfs]
Time [Days]
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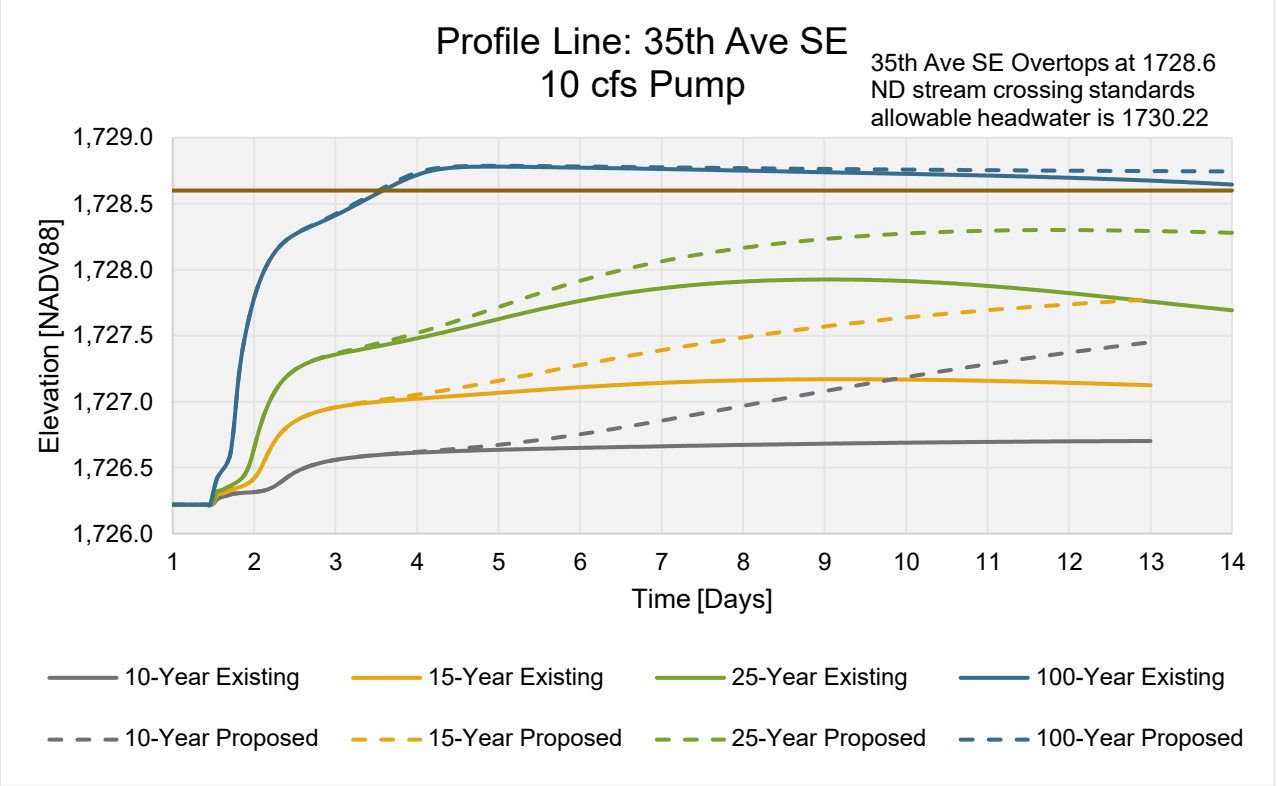
25-Year Existing
100-year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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10 cfs Pump
35th Ave SE Overtops at 1728.6
ND stream crossing standards
allowable headwater is 1730.22
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1,728.0
1,727.5
1,727.0
1,726.5
1,726.0
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Time [Days]
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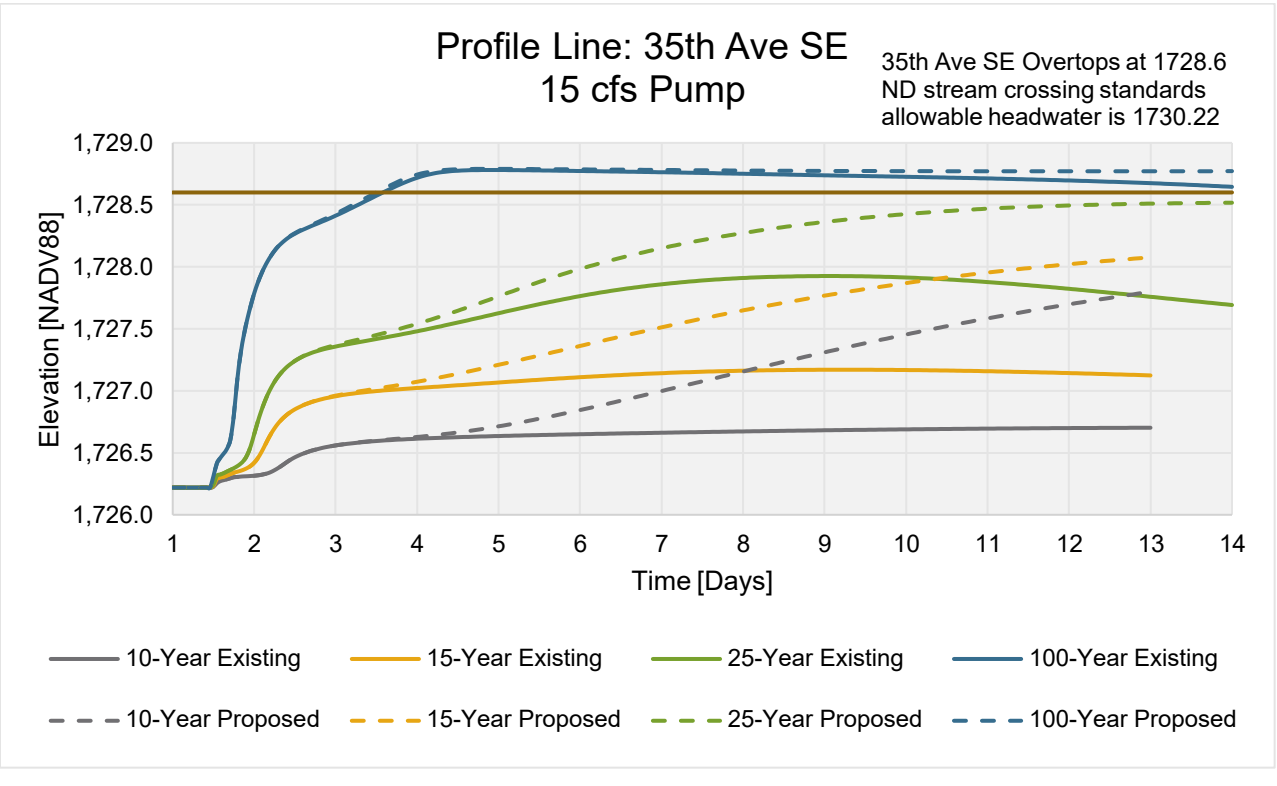
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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15 cfs Pump
35th Ave SE Overtops at 1728.6
ND stream crossing standards
allowable headwater is 1730.22
Elevation [NADV88]
1,729.0
1,728.5
1,728.0
1,727.5
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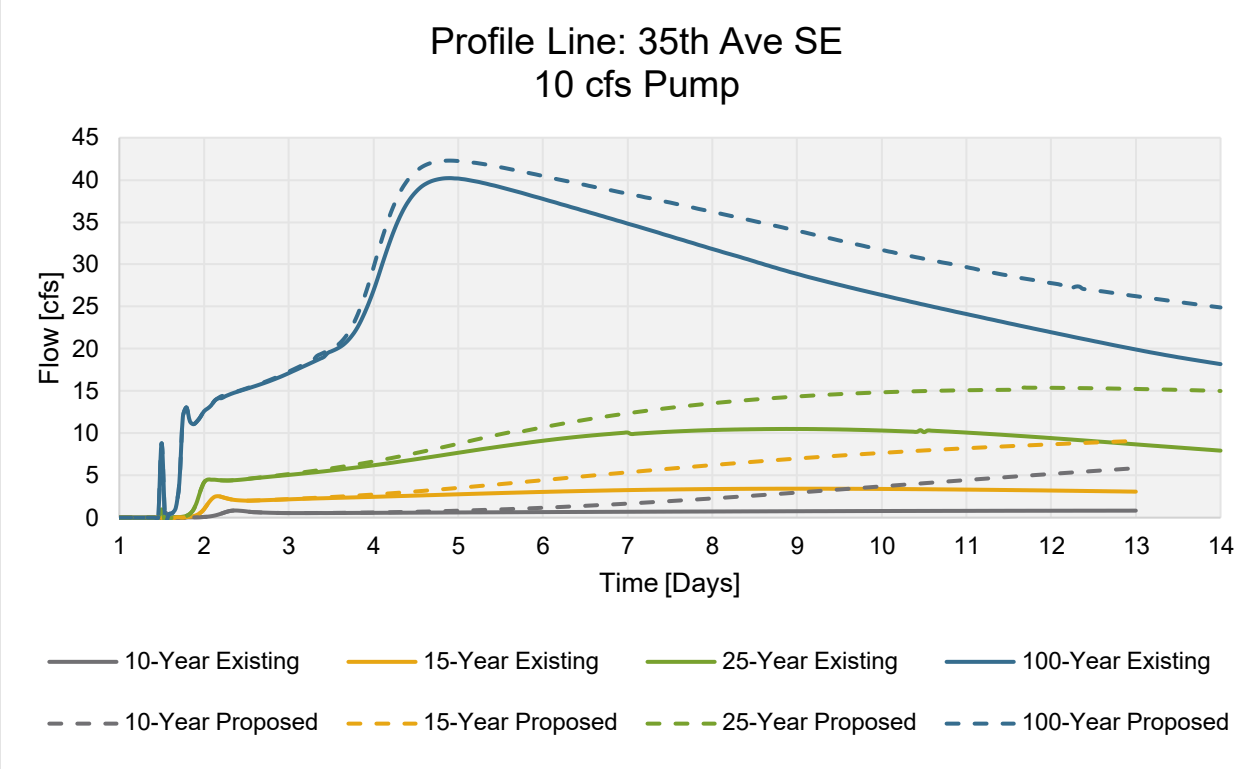
1,726.5
1,726.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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10 cfs Pump
Flow [cfs]
Time [Days]
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15-Year Existing
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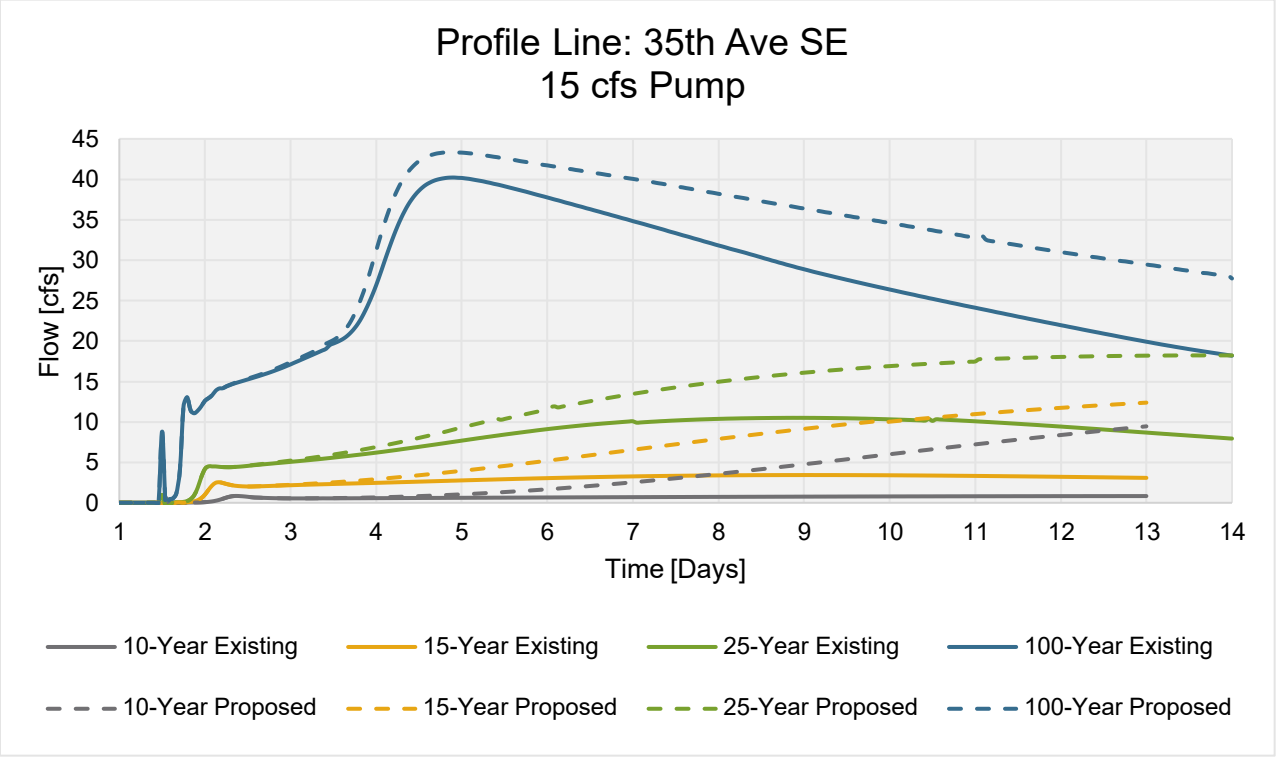
15-Year Proposed
25-Year Proposed
100-Year Proposed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Flow [cfs]
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15-Year Existing
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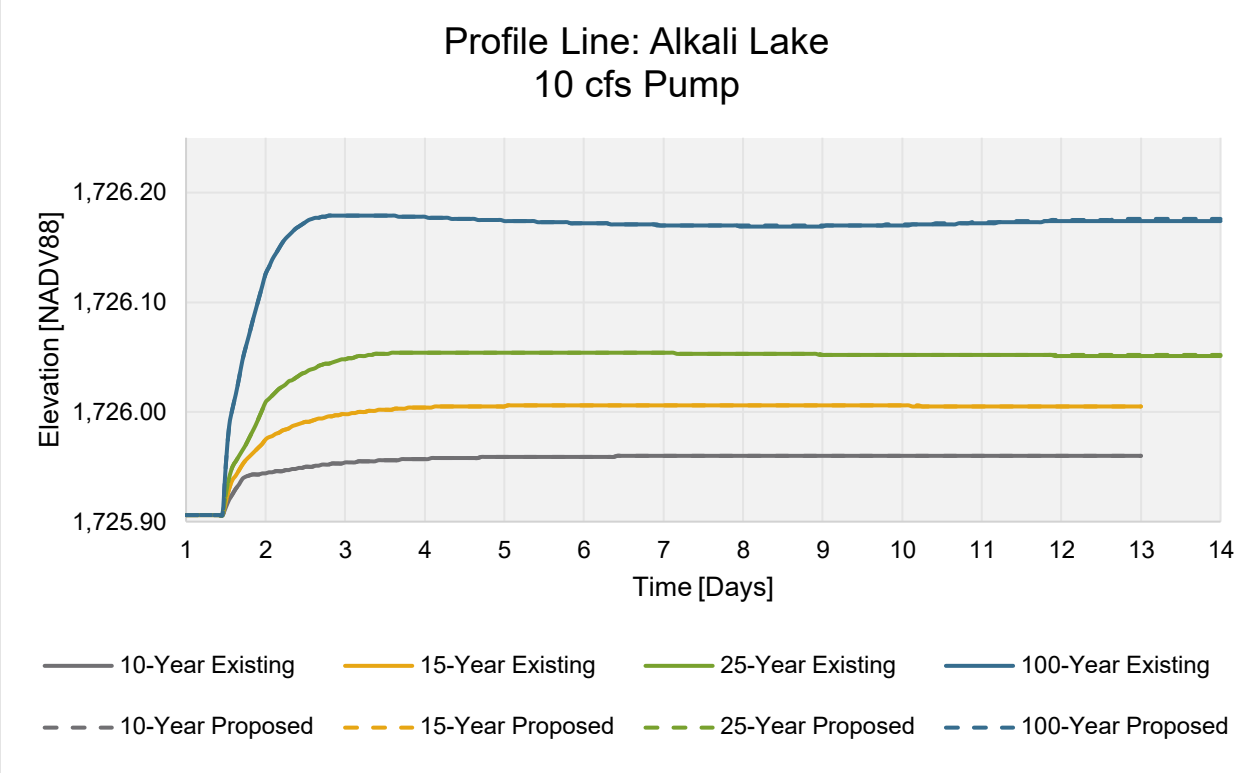
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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15-Year Existing
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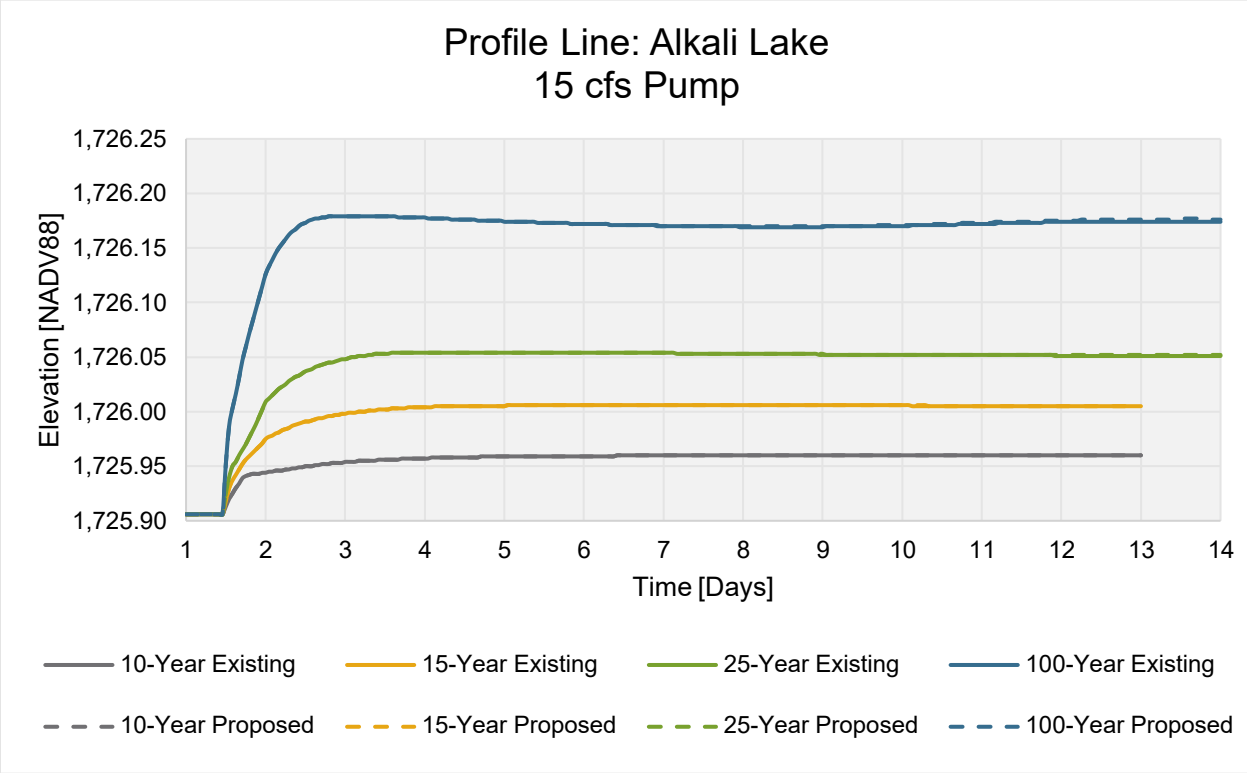
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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1,726.05
1,726.00
1,725.95
1,725.90
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
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15-Year Existing
25-Year Existing
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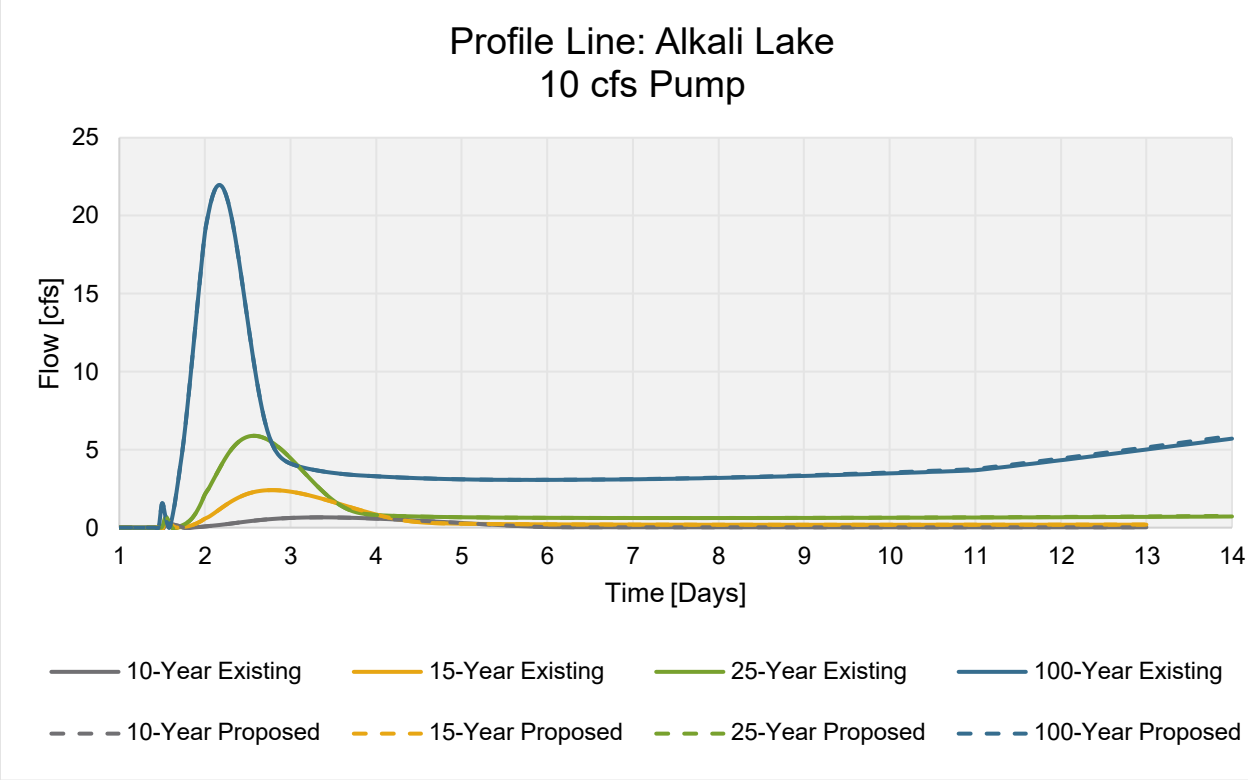
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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10 cfs Pump
Flow [cfs]
Time [Days]
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15-Year Existing
25-Year Existing
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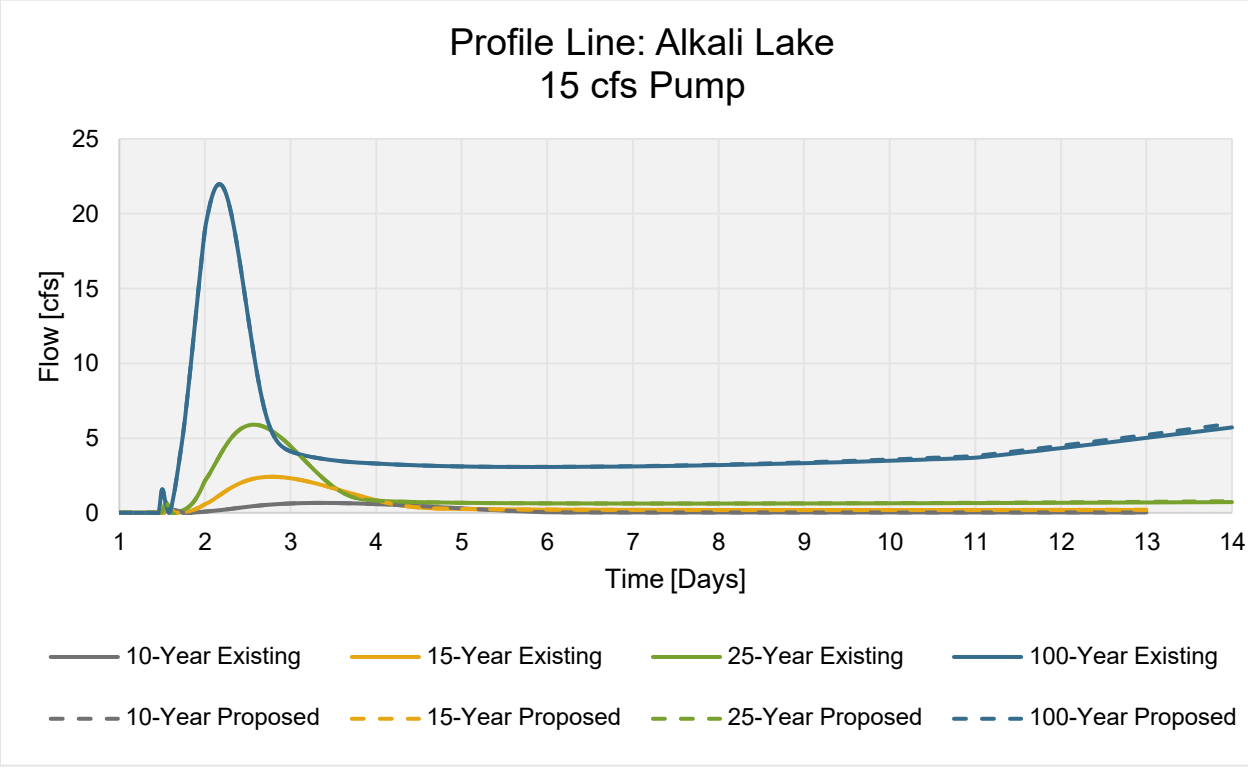
100-Year Proposed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15 cfs Pump
Flow [cfs]
Time [Days]
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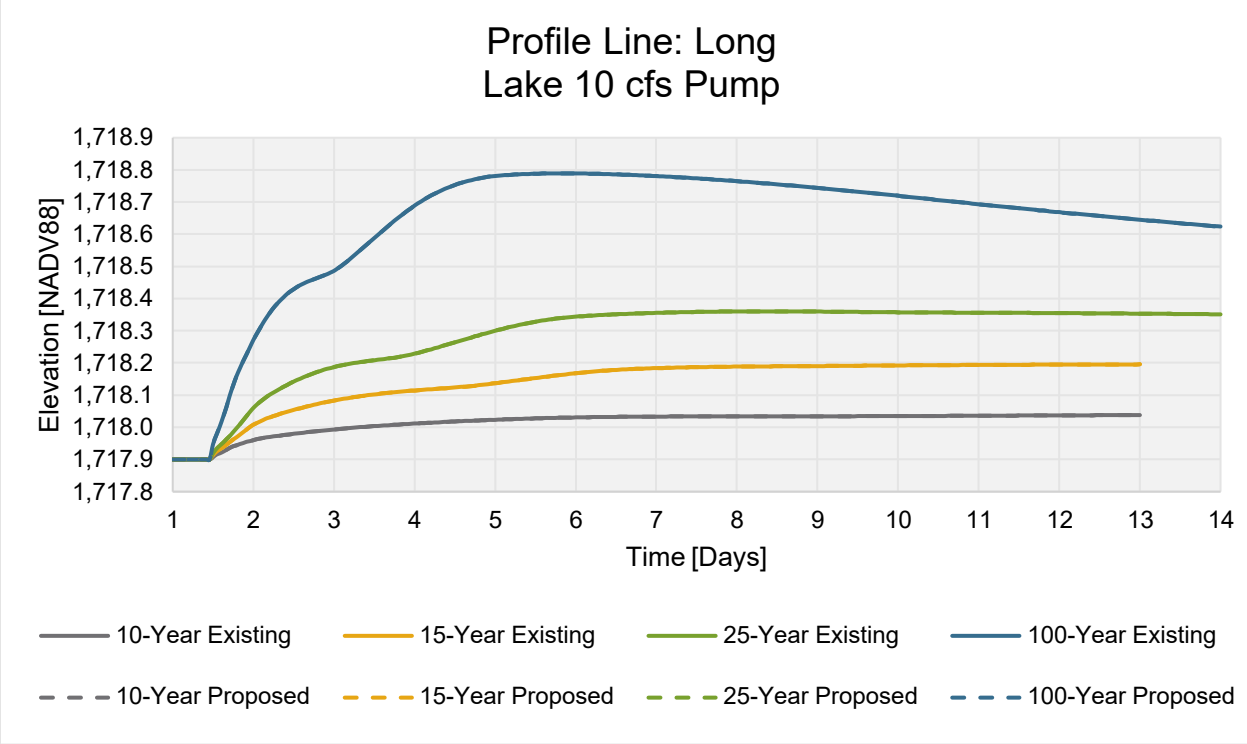
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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1,718.2
1,718.1
1,718.0
1,717.9
1,717.8
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
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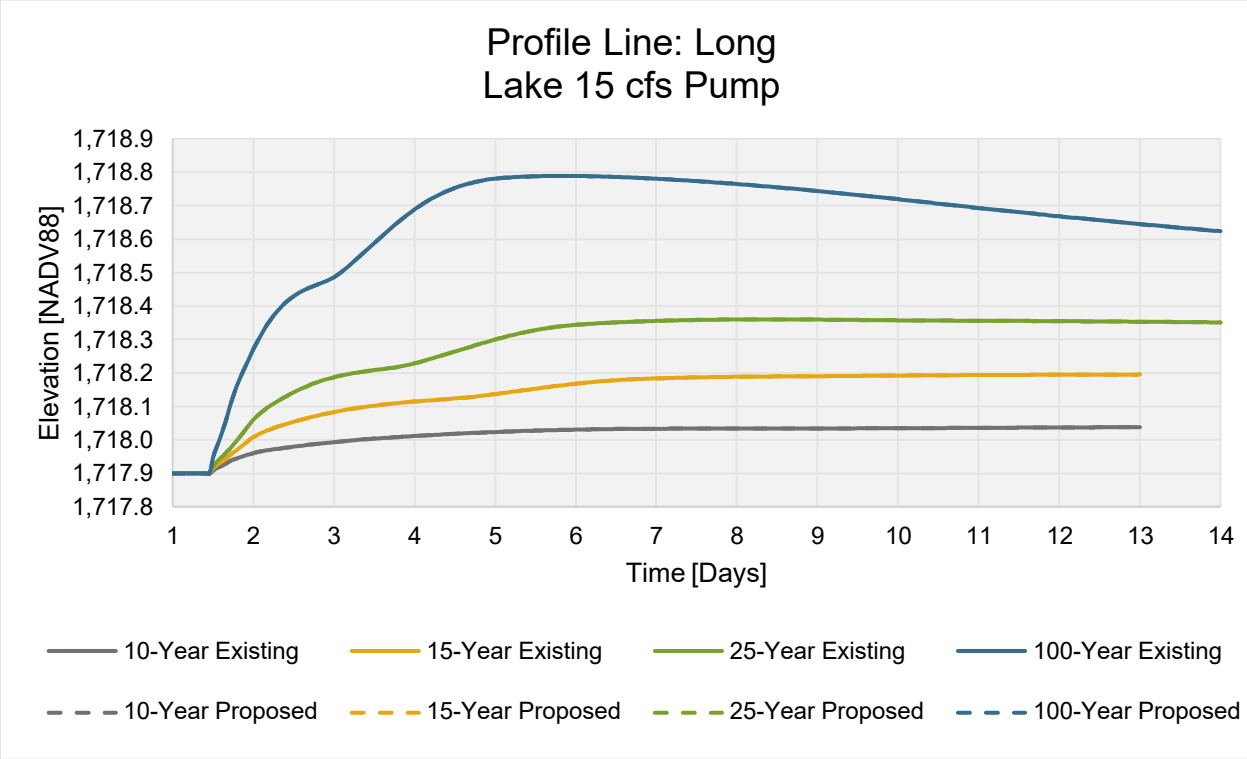
100-Year Proposed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1,718.3
1,718.2
1,718.1
1,718.0
1,717.9
1,717.8
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
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15-Year Existing
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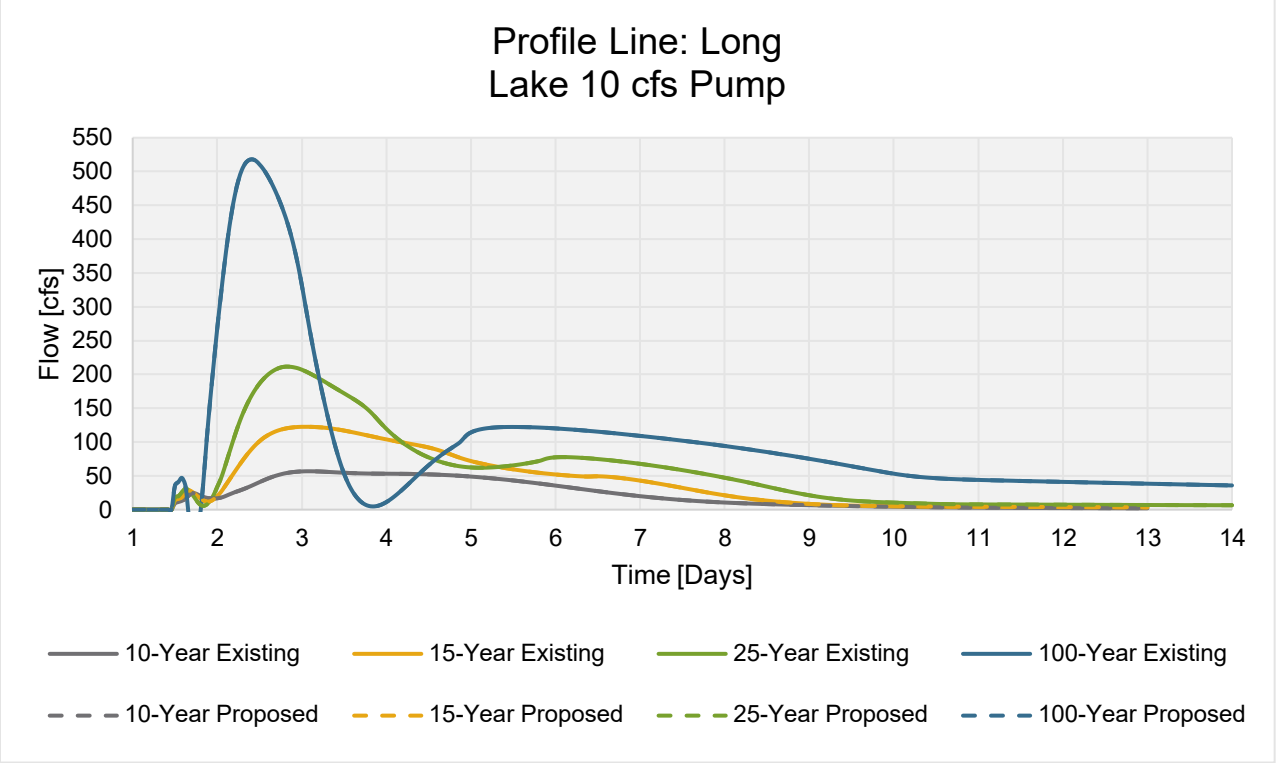
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Flow [cfs]
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500
450
400
350
300
250
200
150
100
50
0
1
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4
5
6
7
8
9
10
11
12
13
14
Time [Days]
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15-Year Existing
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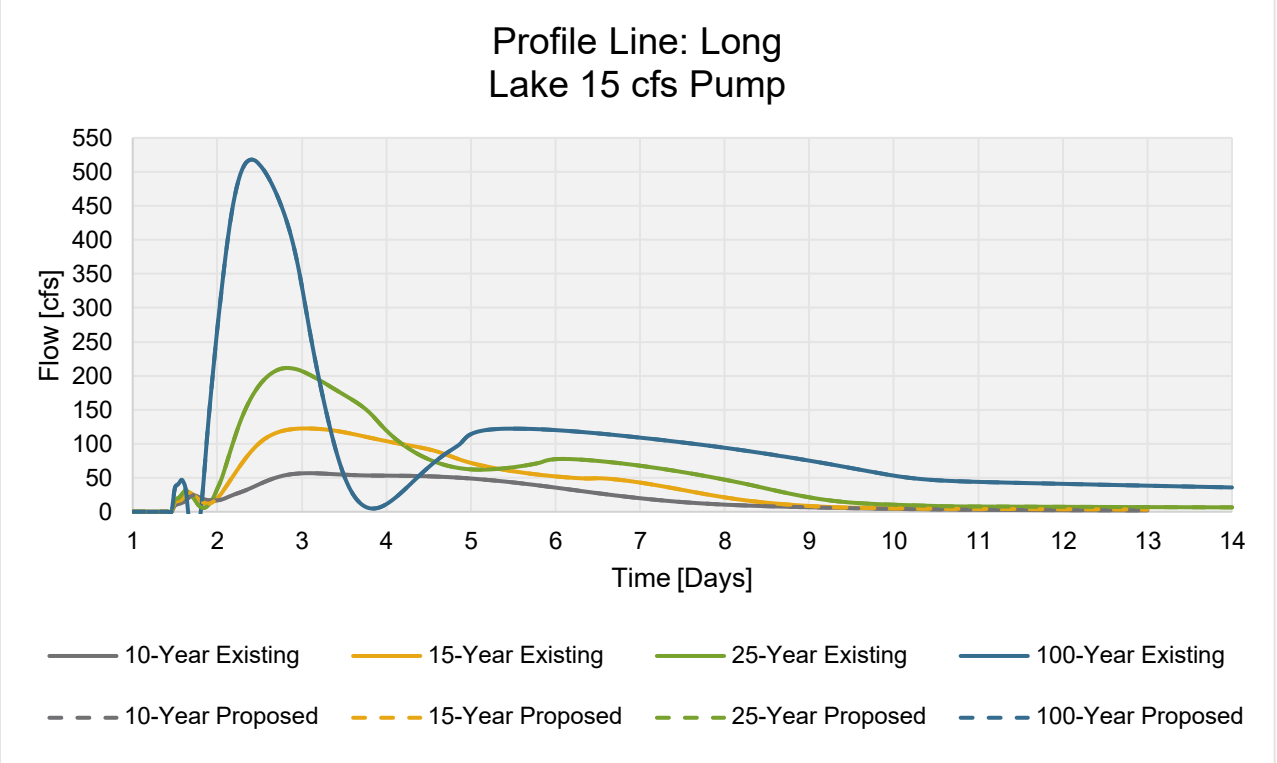
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450
400
350
300
250
200
150
100
50
0
1
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4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
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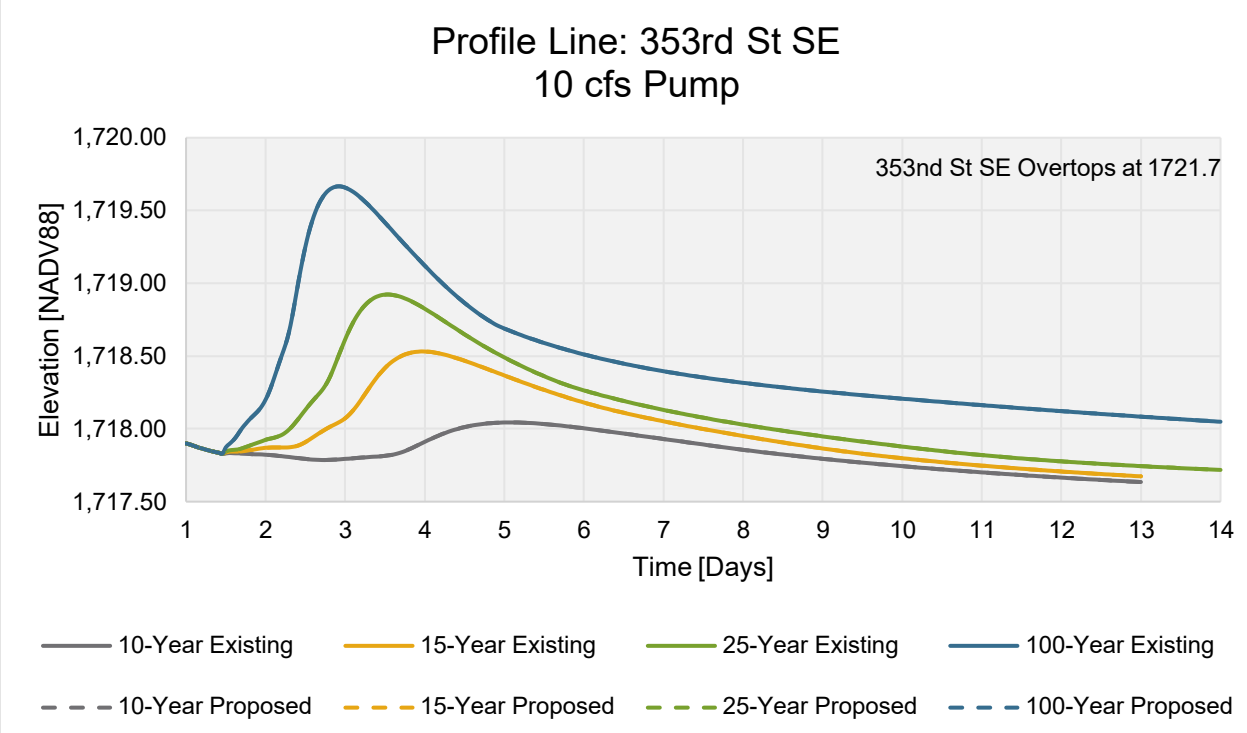
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed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353nd St SE Overtops at 1721.7
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1,719.00
1,718.50
1,718.00
1,717.50
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
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15-Year Existing
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100-Year Existing
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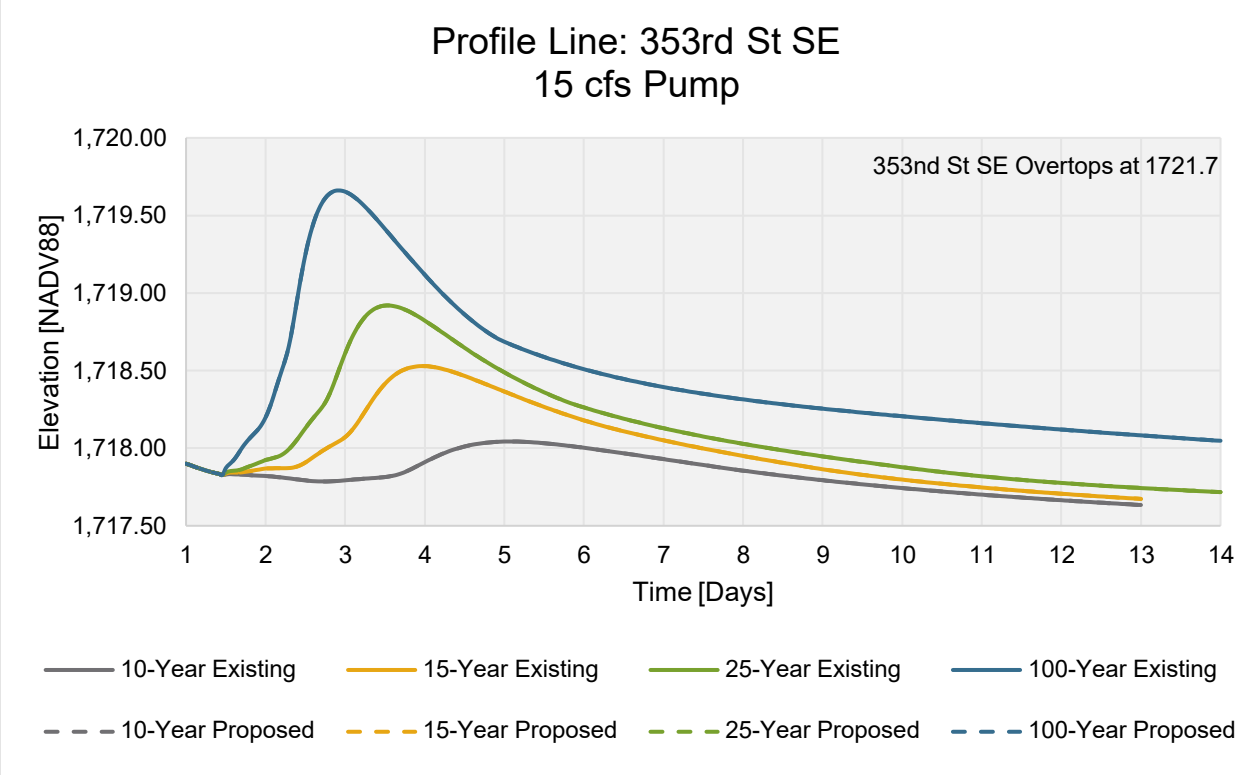
25-Year Proposed
100-Year Proposed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15 cfs Pump
353nd St SE Overtops at 1721.7
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1,719.50
1,719.00
1,718.50
1,718.00
1,717.50
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
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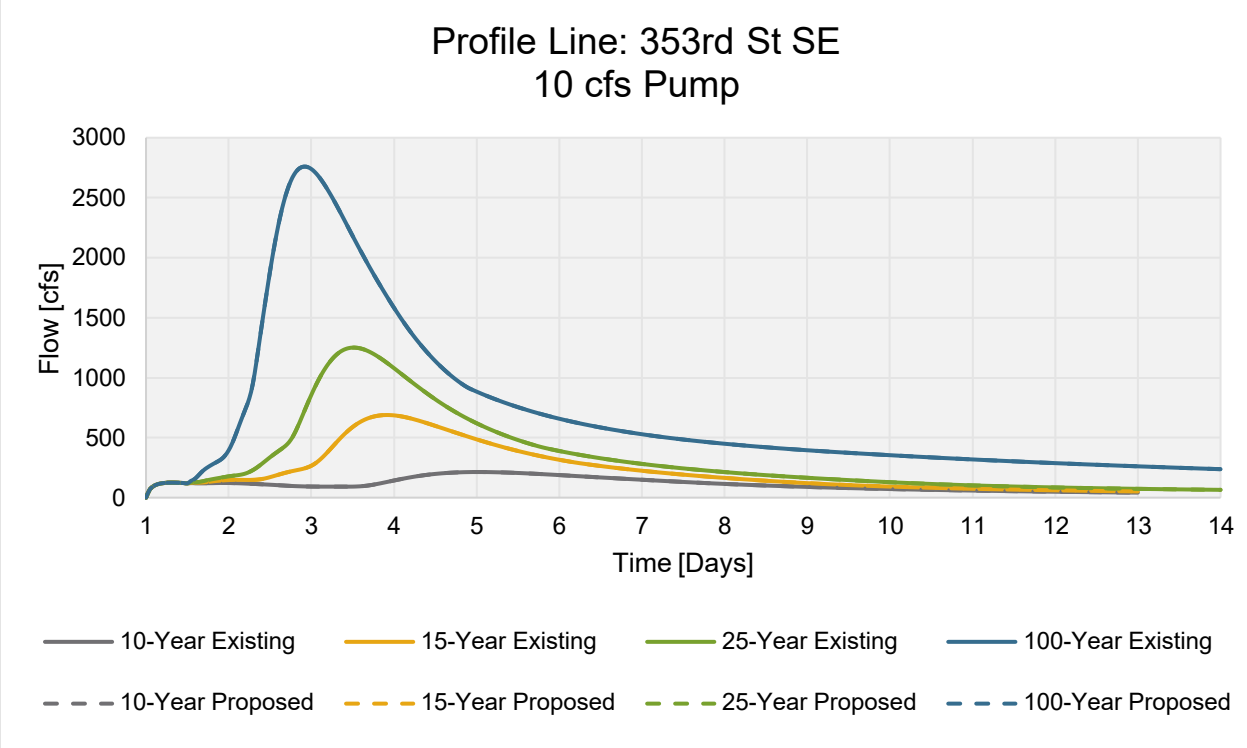
25-Year Proposed
100-Year Proposed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10 cfs Pump
Flow [cfs]
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2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
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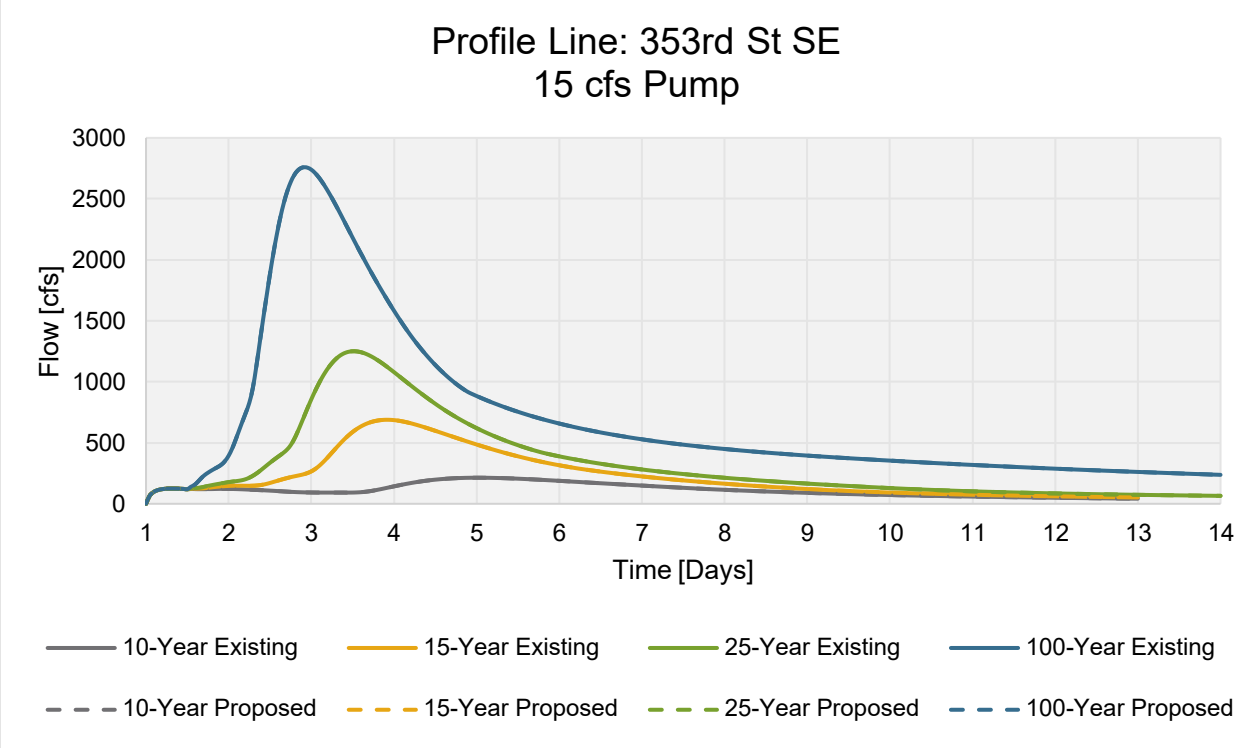
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2
3
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6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
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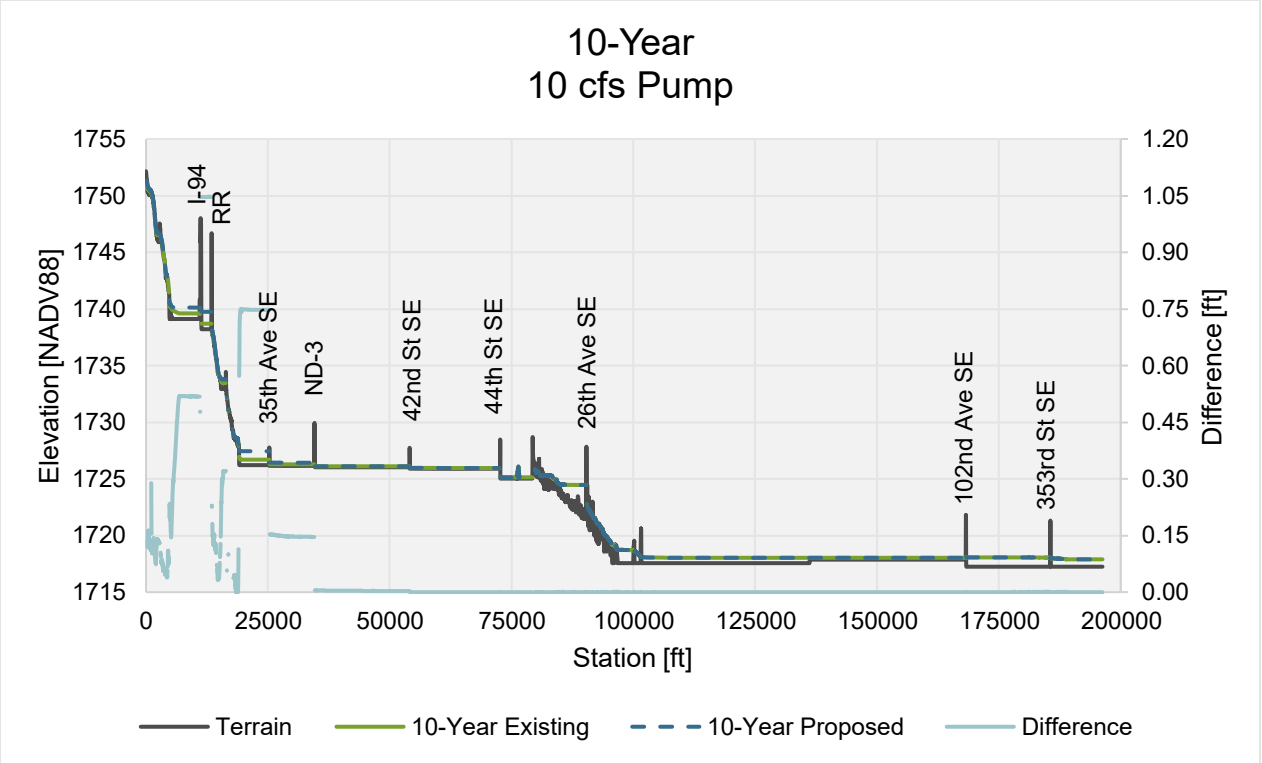
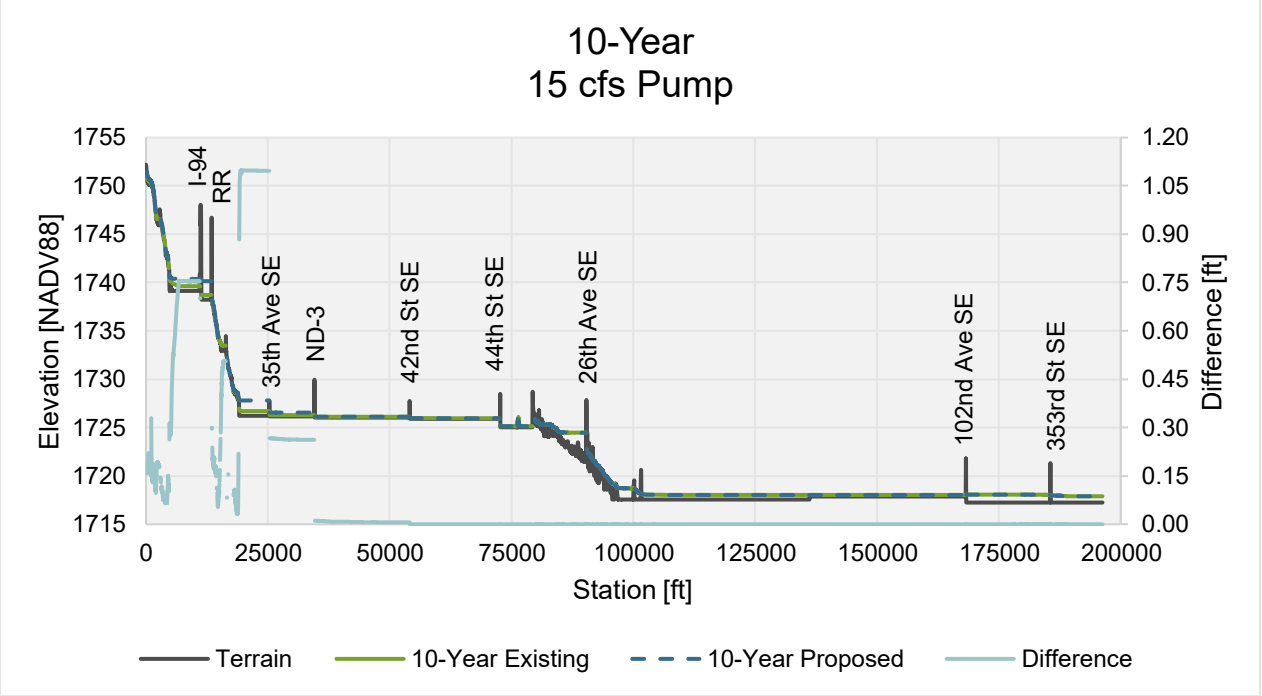
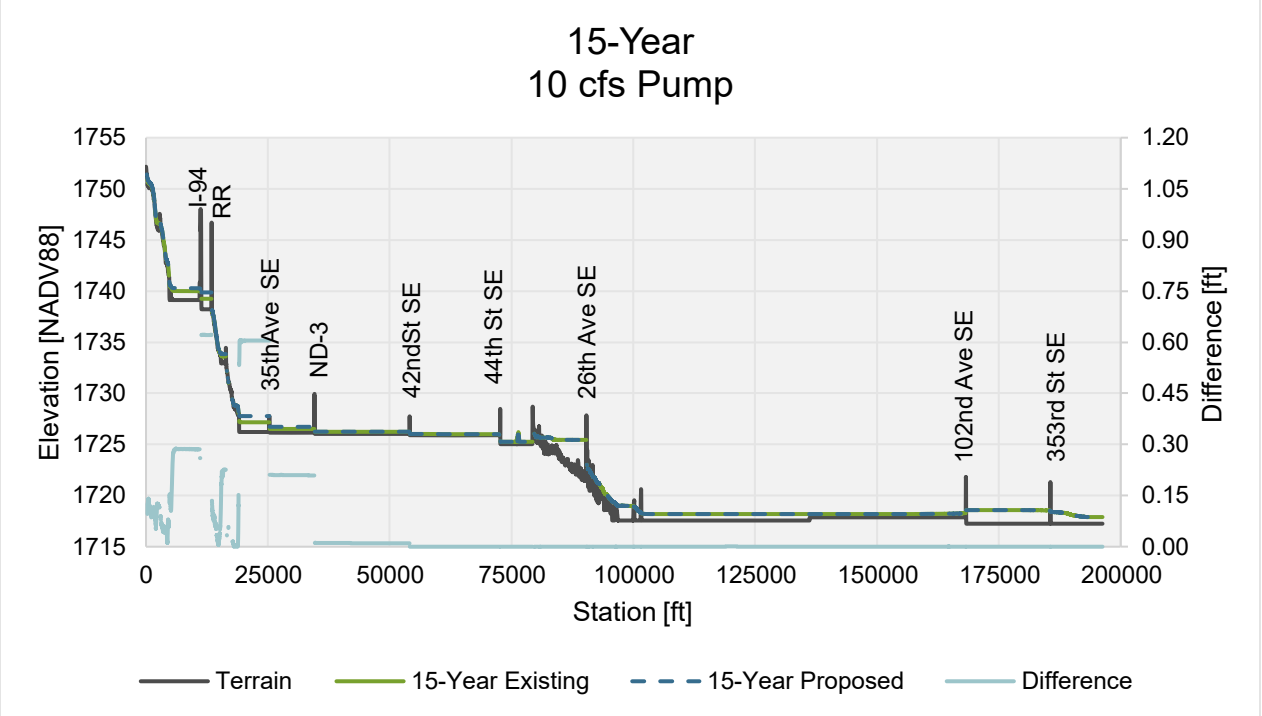
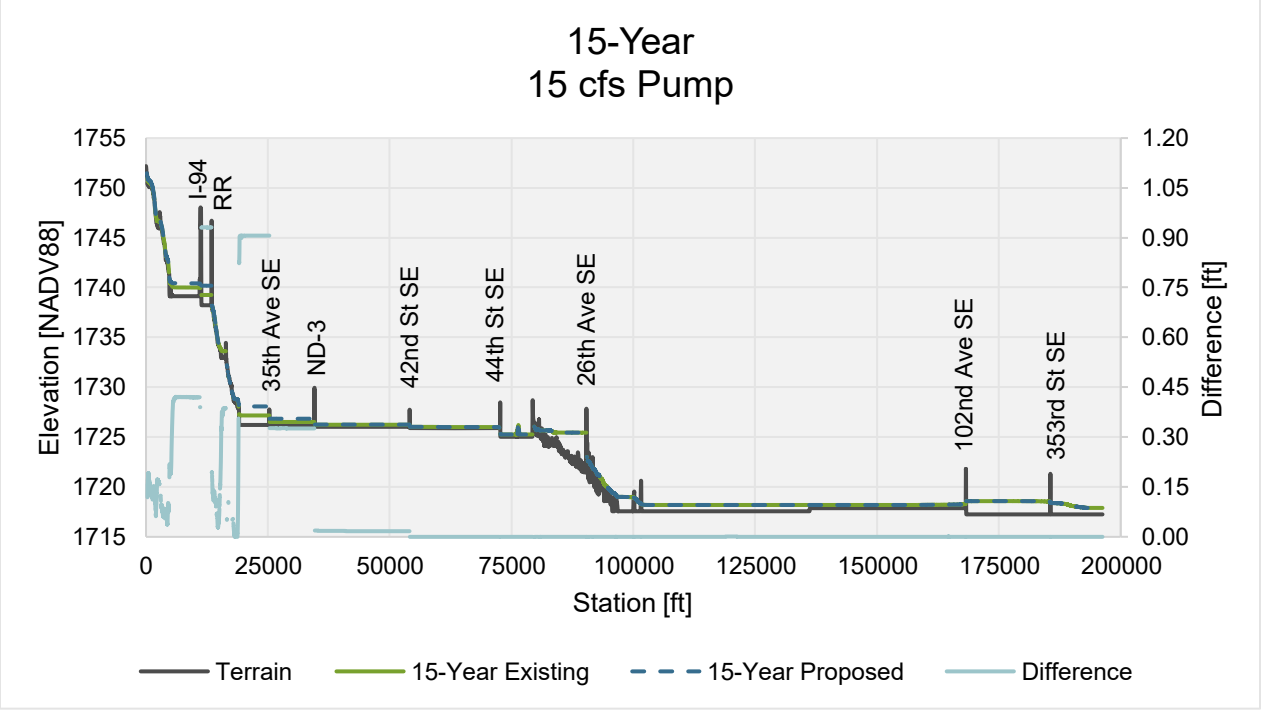
100-Year Proposed

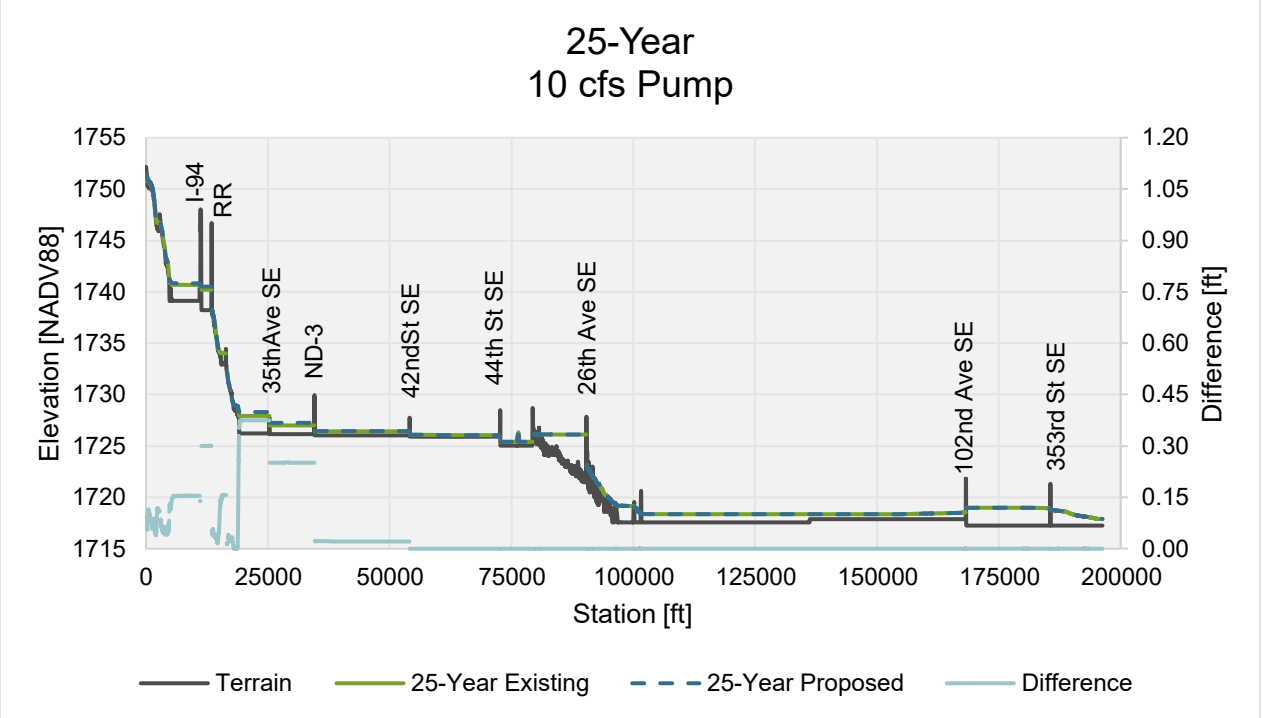
OUTLET STREAM CENTERLINE CHARTS






15-Year
10 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35thAve SE
ND-3
42ndSt SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
15-Year Existing
15-Year Proposed
Difference


15-Year
15 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
15-Year Existing
15-Year Proposed
Difference


25-Year
10 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
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Terrain
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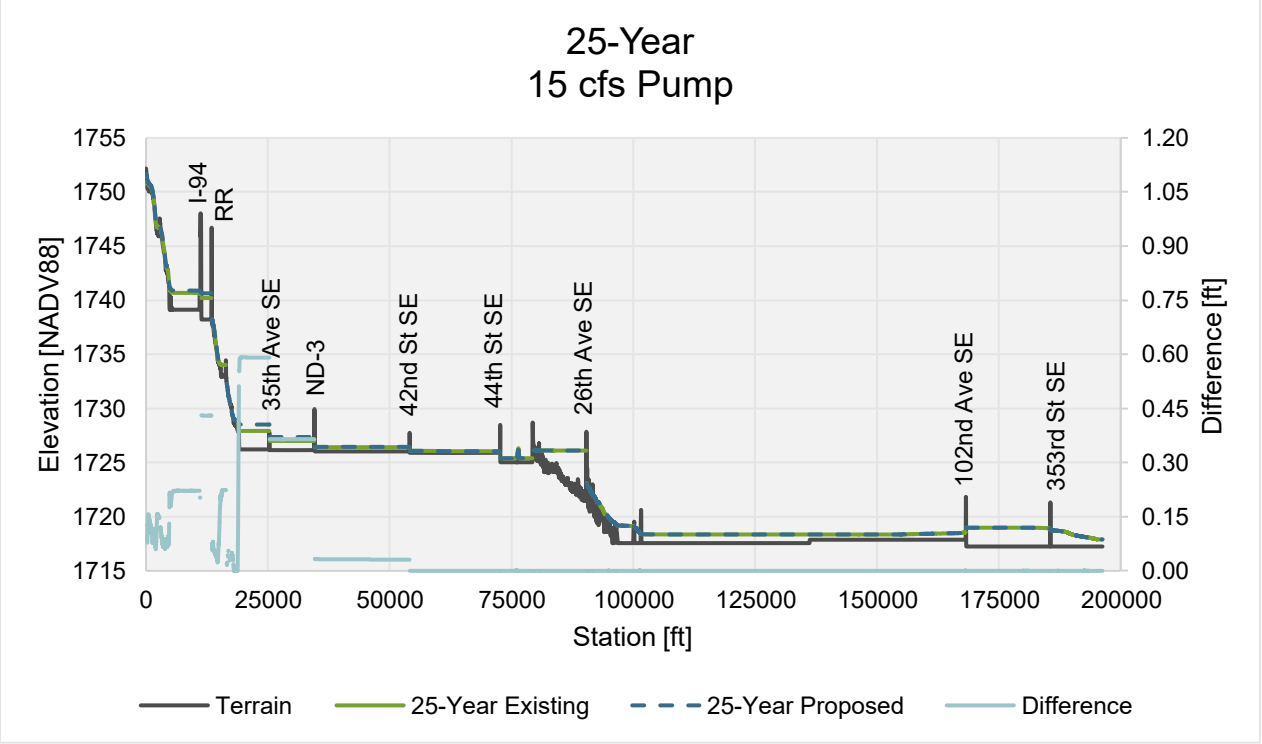
25-Year Proposed
Difference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Terrain
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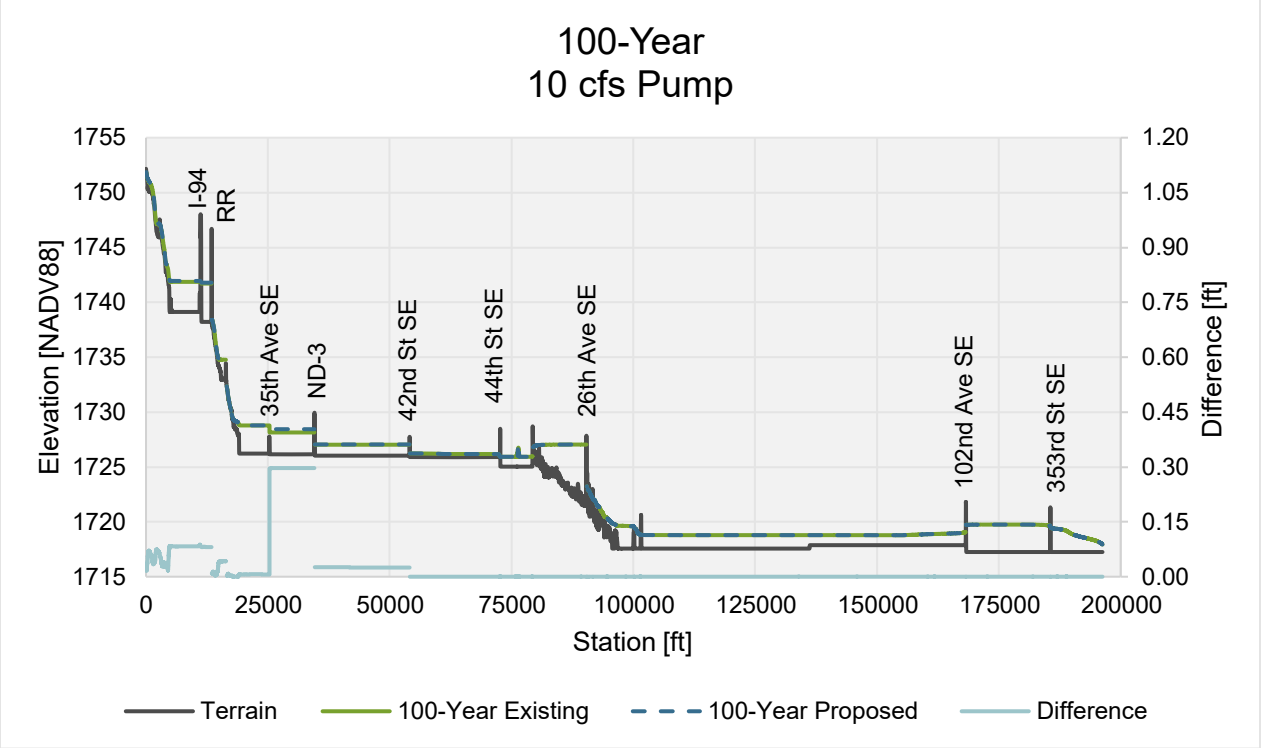
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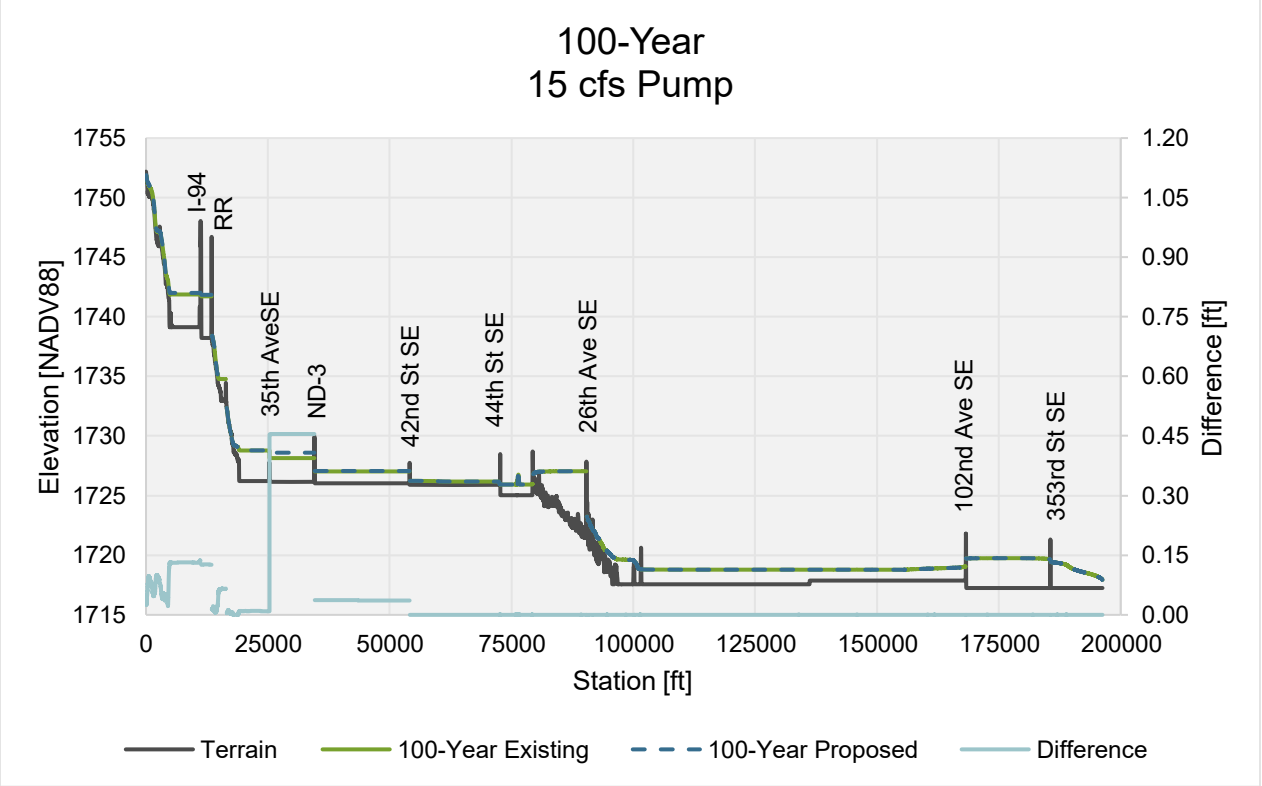
100-Year
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Terrain
100-Year Existing
100-Year Proposed
Difference

Appendix GW

Hydrogeological Analysis Technical Memorandum

HOUSTON engineering, inc.

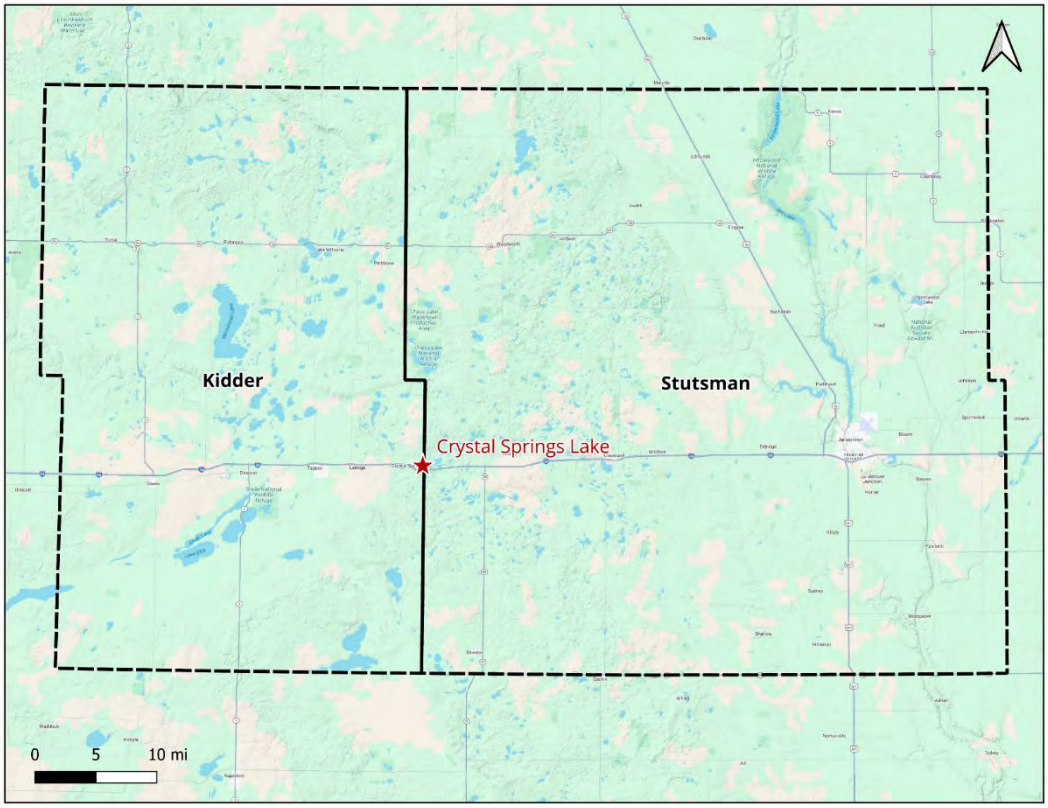
Appendix (HA) - Hydraulic Analysis Technical Memorandum

To:	Michael Gunsch, P.E., Senior Civil Engineer, Houston Engineering, Inc. Josh Loosmore, President, Peritiacon LLC
From:	**Thad Kuntz, P.G., Principal Hydrogeologist and Jason Yuill, G.I., Staff Hydrogeologist - Adaptive Resources, Inc.**
Date:	9/5/2025
Re:	Feasibility Study: Crystal Springs Hydrogeologic Investigation and Future Study and Analysis

Introduction

Houston Engineering, Inc. (HEI) commissioned Adaptive Resources, Inc. (ARI) to conduct a hydrogeological study of the Crystal Springs Lakes region and surrounding areas in Kidder and Stutsman Counties (refer to ***Figure 1***). Since the early 2000s, Crystal Springs and adjacent lakes have experienced significant water level increases, primarily attributed to elevated groundwater levels in nearby aquifers.

Figure 1: Location of Crystal Springs Lake, North Dakota



The investigation focused on two key aspects: (1) mapping the current potentiometric surface to assess groundwater levels and flow directions, and (2) characterizing the regional hydrogeology. The potentiometric surface provides critical insights into groundwater dynamics, while recent airborne electromagnetic (AEM) survey data, funded by the State of North Dakota and covering the Crystal Springs Lake area, supported the analysis of subsurface hydrogeological conditions.

Spring 2025 Potentiometric Surface Analysis

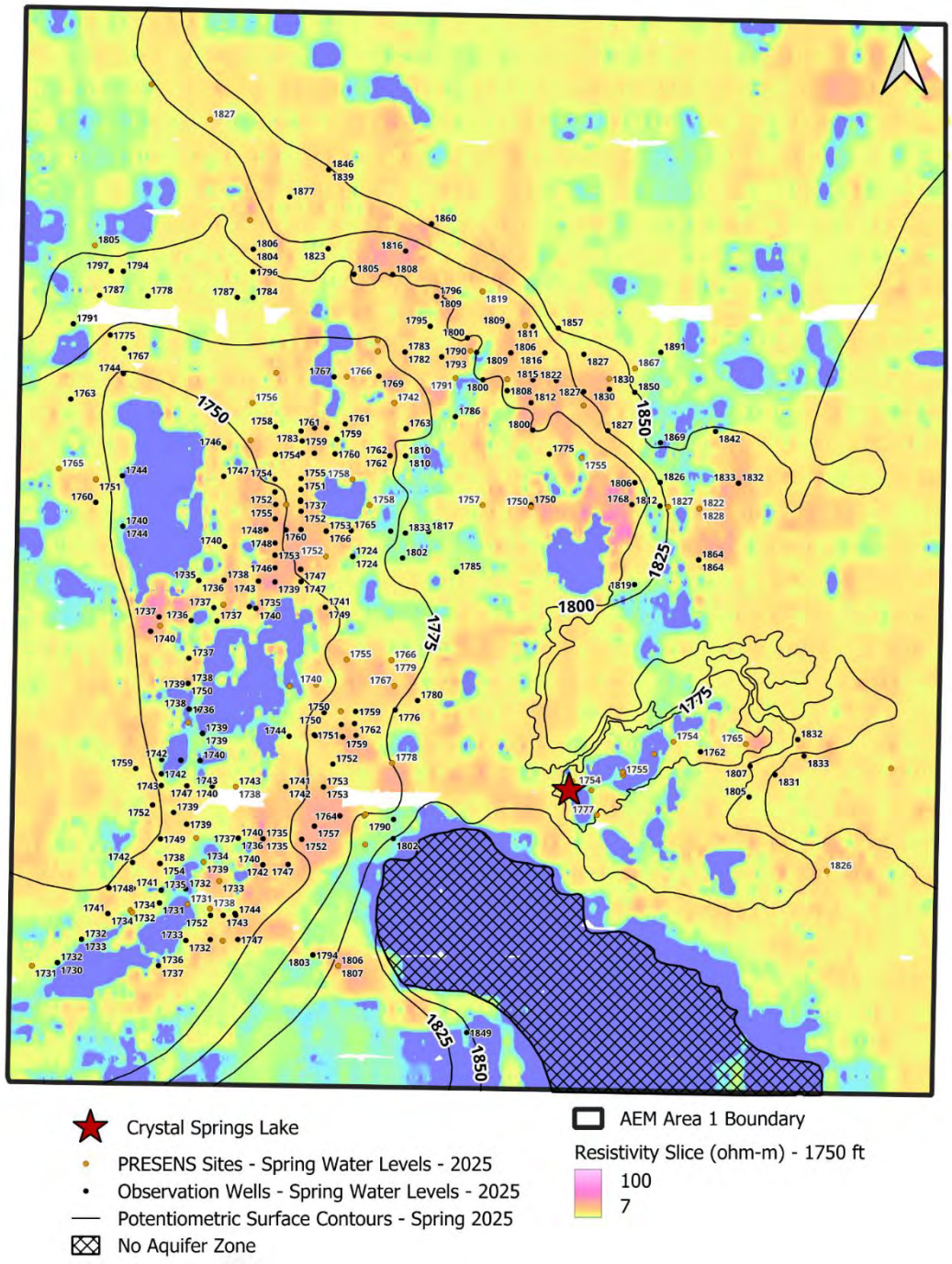
To develop the spring 2025 potentiometric surface, groundwater level data were sourced from observation wells and PRESENS sites, accessed via the North Dakota Department of Water Resources data portal: https://www.dwr.nd.gov/info_edu/map_data_resources/waterresourcesites/

Only measurements recorded between March 20, 2025, and June 20, 2025, were included. For wells and PRESENS sites with multiple measurements, data were averaged over this period to ensure consistency.

The regional hydrogeology was characterized by using AEM data from the Aqua Geo Frameworks (AGF) report and datasets (Abraham and Asch, 2025). This report provided resistivity data at various subsurface depths, enabling differentiation of materials: higher resistivity indicates sands and gravels, while lower resistivity suggests clays and silts. Additionally, AGF supplied 1/3 Arc-Second Digital Elevation Model (DEM) data, which were used to establish a consistent elevation reference for both AEM and observation well datasets.

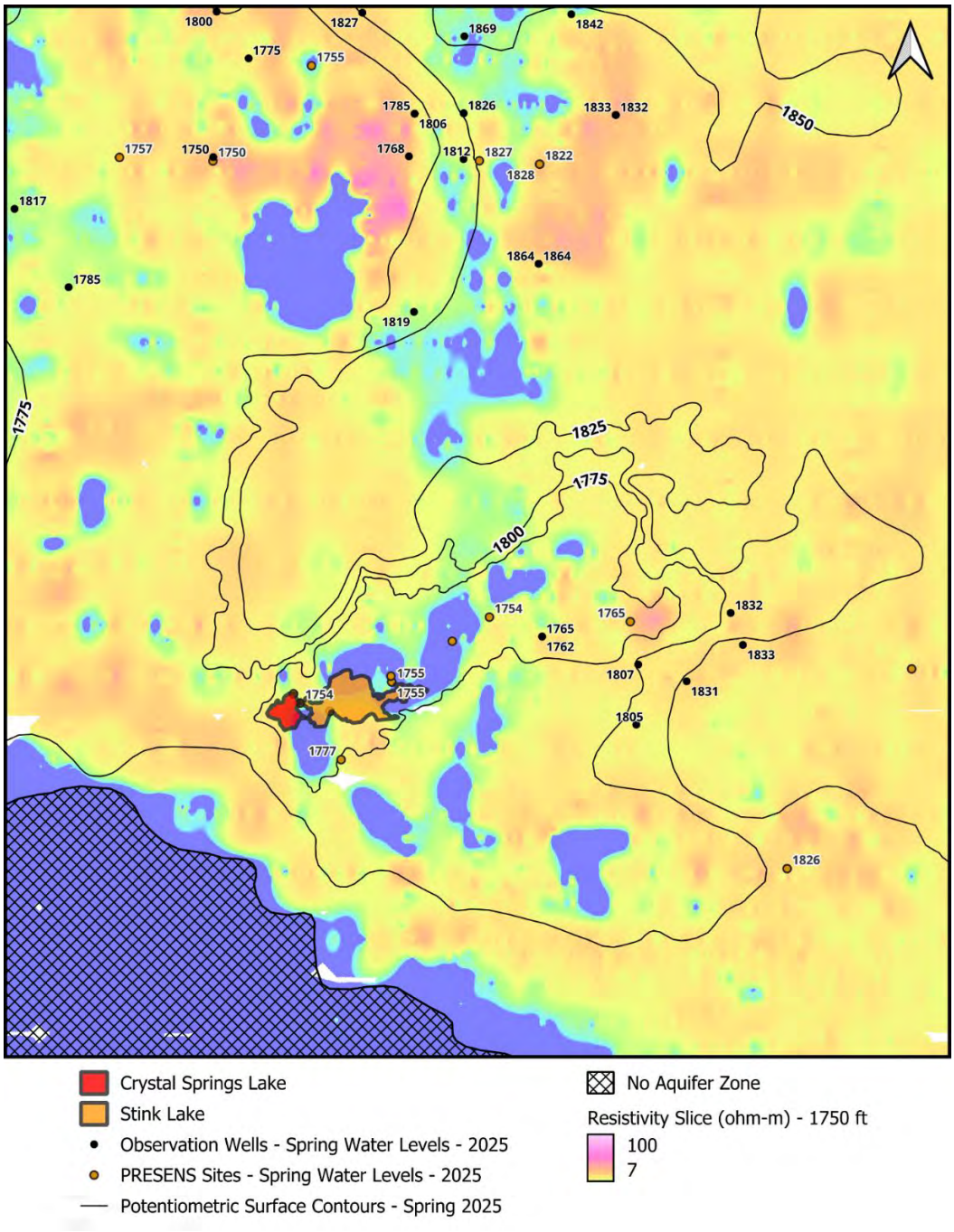
The potentiometric surface was developed using the QGIS Inverse Distance Weighting (IDW) interpolation tool to generate an initial surface based on observation well data. This surface was subsequently refined through manual contouring, integrating AEM-derived hydrogeological data to enhance accuracy. The surface was further validated against the DEM data to ensure that groundwater elevations did not exceed ground surface elevations. Analysis of AEM data revealed a complex subsurface composed of interbedded sands, gravels, and clays, consistent with glacial depositional environments. A notable feature identified south of Crystal Springs Lake is a region with shallow bedrock, likely the Cretaceous Pierre Shale, resulting in a minimal or absent aquifer. This area is designated as a "No Aquifer Zone" and is represented by cross-hatching on the accompanying maps. ***Figure 2*** provides a map showing the 2025 spring potentiometric surface contours, the 1750-foot elevation resistivity, the location of Crystal Springs Lake, the spring 2025 groundwater level observations, and the No Aquifer Area. The reds and yellows represent resistive materials or sands and gravels, while the greens and blues represent conductive materials such as clays and silts.

Figure 2: 2025 Potentiometric Surface and 1750-foot Elevation Resistivity



As illustrated in ***Figure 2***, groundwater flow in the eastern three-quarters of the study area predominantly occurs from east to west. However, a distinct feature is observed in the Crystal Springs Lake area, where the potentiometric surface exhibits a localized depression. ***Figure 3*** provides a detailed view of this area, highlighting the potentiometric surface contours specific to the Crystal Springs Lake region.

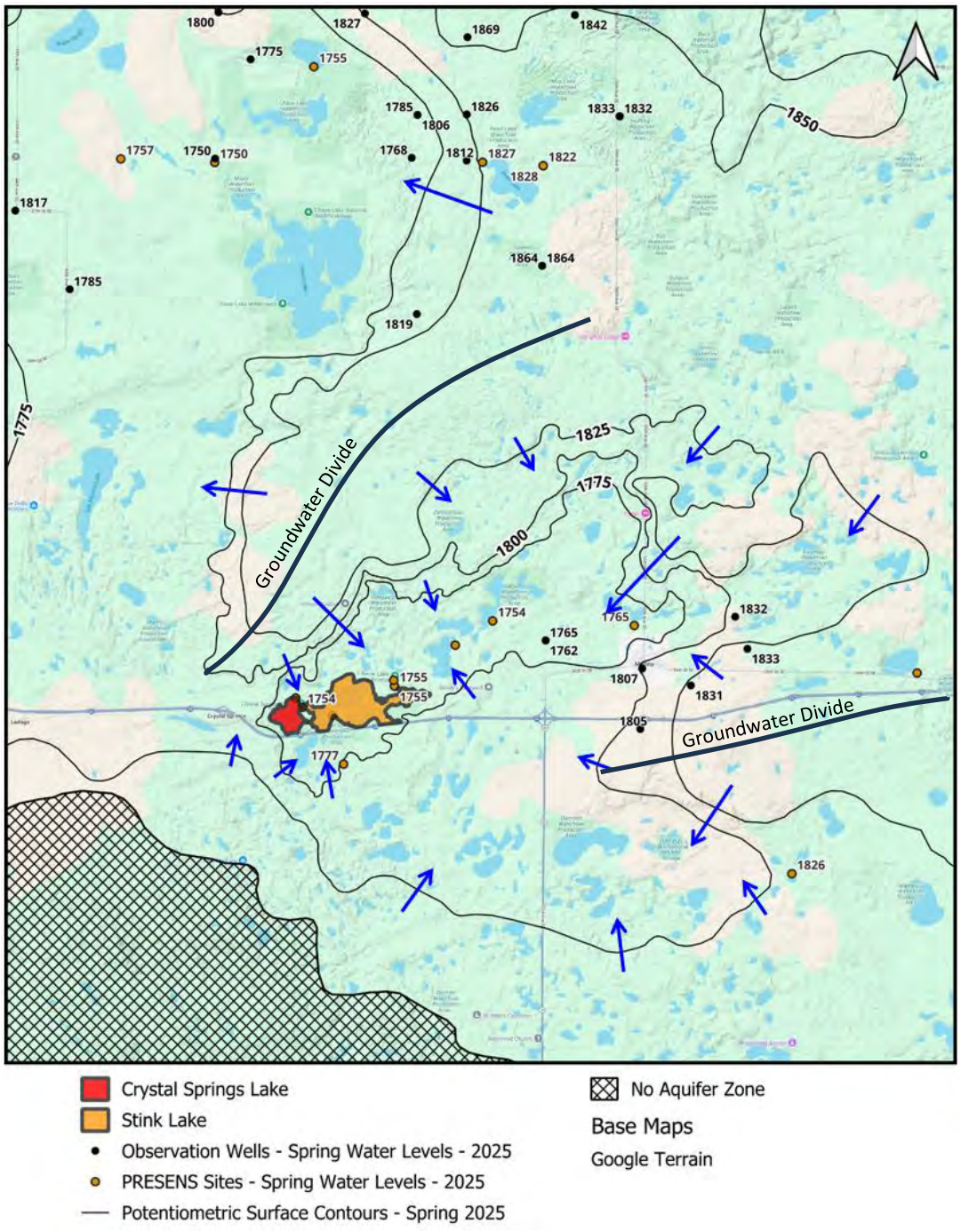
Figure 3: Detailed View of Crystal Springs Potentiometric Surface



Groundwater Flow Direction Analysis

With the potentiometric surface established for the Crystal Springs area, the direction of groundwater flow can be determined. Groundwater moves downgradient, from areas of higher hydraulic head to lower hydraulic head. Flow paths were delineated by placing arrows perpendicular to the potentiometric surface contours, extending from higher to lower elevations. ***Figure 4*** illustrates the potentiometric surface with these groundwater flow arrows, visually representing the direction of groundwater movement in the study area. Additionally, two groundwater divides have been identified, with flow diverging northwest and southeast from these areas.

Figure 4: Groundwater Flow Direction



Based on the potentiometric surface and associated flow directions, groundwater converges toward Crystal Springs and nearby Lakes from nearly all surrounding areas.

Appendix A provides all the maps created, including those showing the potentiometric surface and AEM resistivity data at different elevations. It also provides hydrographs of observation well 30179 (Site Index) and several local PRESENS Sites.

Water Mass Balance for Crystal Springs and Adjacent Lakes

According to the mass balance calculations provided by HEI for Crystal Springs and nearby lakes (Reule Lake, Stink Lake North, and Stink Lake South), these lakes have collectively gained approximately 51,369 acre-feet of groundwater from 2010 to 2024, averaging 3,669 acre-feet per year. Lake elevations increased from 1,744 feet in 2010 to 1,755 feet in 2024, with a corresponding expansion in surface area of approximately 2,000 acres.

Hydrogeological Conclusions

Several key observations can be drawn regarding the local hydrogeology, potentiometric surface, and rising lake water levels:

1. **Groundwater Flow Dynamics**: The potentiometric surface and groundwater flow directions confirm that Crystal Springs and adjacent lakes receive groundwater inflow from nearly all directions. The lakes occupy a topographic low, with 2024 lake elevations at 1,755 feet, compared to surrounding groundwater levels of 1,775 feet or higher, as shown in ***Figures 2*** through ***4***. This hydraulic gradient drives groundwater toward the lakes, where it emerges at the surface. Excess groundwater not removed by evaporation or plant uptake contributes to rising lake levels.

2. **Subsurface Characteristics**: AEM data reveal that portions of the lakebeds are underlain by conductive materials, such as clays and silts. However, these materials do not form a continuous barrier across the subsurface, allowing groundwater to flow into the lakes.

Opinions and Future Considerations

Based on the potentiometric surface, local hydrogeology, and the observed increase in lake levels, it is our assessment that Crystal Springs and nearby lakes are likely to continue rising due to sustained groundwater inflow. However, the rate and extent of future lake level increases require further investigation using advanced tools and analyses. While potentiometric maps, AEM-derived hydrogeological data, and mass balance calculations provide a robust foundation, a calibrated groundwater flow model is essential to help predict future lake level changes, which are likely influenced by climatic conditions. This modeling would take place during the next phase of project development via the Preliminary Engineering Report.

Recommended Next Steps

This study was conducted at a feasibility level, focusing on collecting baseline data, performing preliminary analyses, and drawing initial conclusions. To assess future lake level changes under varying climatic scenarios, the following advanced tools are recommended**:**

1. **Groundwater Flow Modeling:** Develop a sub-regional to regional groundwater flow model using the USGS MODFLOW-6 code to simulate groundwater levels, flow patterns, and lake level rise. This model should integrate datasets such as AEM-derived hydrogeological data, groundwater observations, surface water features, and other relevant information to provide a comprehensive analysis.

2. **Soil Water Balance Modeling:** Couple the groundwater model with a soil water balance model to evaluate vegetation water uptake and deep percolation below the root zone. This model should incorporate soil characteristics, weather station climatic data, and land use data (e.g., native vegetation, dryland farmland, and irrigated farmland).

3. **Surface Runoff Modeling:** The hydrologic watershed model developed as part of the Feasibility Study provides estimates and projected surface water contributions from precipitation events, that will enable a holistic understanding of the hydrological dynamics affecting the lakes and the surrounding region.

Data Collection and Refinement

To support the proposed modeling efforts, the following datasets should be collected, compiled, and refined:

- **AEM Data Enhancement:** Refine AEM data to derive additional parameters, such as hydraulic conductivity, which governs the rate of groundwater movement through the aquifer and movement into the lakes.

- **Aquifer Testing:** Conduct aquifer tests across the study area to obtain ground-truthed data for parameters such as hydraulic conductivity, specific yield, and storativity. These tests will validate and enhance the AEM-derived datasets, improving model accuracy.

- **Other Datasets:** During model construction, additional data may need to be gathered and analyzed.

Proposed Analyses

Upon completion of the groundwater, soil water balance, and runoff models, the following analyses should be conducted:

- **Climatic Scenario Evaluation**: Assess groundwater discharge into the lakes under diverse climatic conditions, including:
    - Wet, dry, and average climate scenarios.
    - Projections extrapolating historical climate patterns into the future.
    - Additional scenarios to explore varied groundwater inflow conditions.

- **Hydraulic Head Differential Investigation:** Examine whether proposed lake water pumping will, over time, widen the hydraulic head difference between lake levels and the aquifer, potentially amplifying groundwater inflow to the lakes. This groundwater model analysis can help ensure that adequate pipeline and pump design considerations are in place.

- **Pipeline Design Optimization**: Determine the volume of water to be extracted from the lakes under each climatic scenario to protect:
    - Local properties.
    - Interstate infrastructure.
    - Railroad assets.

- **Discharge Impact Assessment**: Evaluate the impacts of pipeline discharge on:
    - Potential influences on aquifer levels in the discharge area
    - Surface water removal and management in the discharge area.

- **Other Analyses:** This is not an exhaustive list. As the models are developed and the project is refined, additional analyses may be deemed necessary considering regulatory permitting requirements.

Long-Term Simulations

To support long-term planning and inform local, state, and other stakeholders and entities about the potential magnitude of impacts, the models should simulate conditions over a 50- to 100-year period. These simulations will provide critical insights into future lake level trends, groundwater dynamics, and infrastructure management under varying climatic conditions.

Work Cited:

Abraham, J.D. and Asch, T.H., Aqua Geo Frameworks. *Final Spatially-Constrained Inversions Report and Data Delivery for the Airborne Electromagnetic Survey of Area 1 and Area 2, North Dakota for the North Dakota Department of Water Resources.* February 4, 2025.

Appendix SC

Steering Committee Meetings and Kidder Public Information Meeting

Steering Committee Members – May 2026

Meeting #1 – October 8, 2024

Meeting #2 – February 17, 2025

Meeting #3 – July 25, 2025

Kidder Public Information Meeting – December 22, 2025

Meeting #4 – April 27, 2026

HOUSTON engineering, inc.

Crystal Lake Feasibility Study
Stutsman County Commission and Water Resource District
Steering Committee Updated: 1-19-2026

1. **Stutsman County Commission**
   Levi Taylor, Chairman
   511 2nd Avenue SE, Suite #102
   Jamestown, ND 58401
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2. **Stutsman County Water Resource District**
   Anthony Roorda , Chairman
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3. **Kidder County**
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   Steele, ND 58482
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   Email: danmittleider@yahoo.com
   Ph: 701-5950-1820
   Email: Grant.m.benz@gmail.com

4. **Stutsman County Highway Department**
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5. **ND Department of Transportation**
   Jay Praska, District Engineer
   NDDOT Valley City District
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   Valley City, ND 58702-4200
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   Email: jpraska@nd.gov

6. **Burlington Northern Sante Fe**
   Dan Peltier, Manager Engineering
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   Minneapolis, MN 55421
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7. **Crystal Springs Bible Camp**
   Tim Brenner, Director
   4848 36th St SE
   Medina, ND 58467
   Ph: 701-426-8141
   Email: tim@csbcamp.org

8. **Recreational Properties**
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   Eric Haas, President
   Aaron Bjusgstad, Vice President
   Ph: 701-320-7597 (Eric Haas)
   Email: Reulelakehoa@gmail.com

9. **Agricultural Impacts**
   Brian Knetter
   P.O. Box 309
   Medina, ND 58467
   Ph: 701-320-8489
   Email: batwarmer@daktel.com

Agency/Engineering Contacts

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Stutsman County Commission
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Michael Gunsch, PE, CFM
Senior Project Manager
Houston Engineering, Inc.
3712 Lockport Street
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Alt: Josh Loosmore, Peritiacon, LLC
Email: josh.loosmore@peritiacon.com

Crystal Lake Watershed Initiative
Steering Committee - Organizational Meeting #1

To: Steering Committee
From: Michael H. Gunsch, PE, CFM, Senior Project Manager
Josh Loosmore, Peritiacon
Subject: Local Funding and Initial Lake Level Discussions
Date: October 8, 2024 ***(ACCEPTED at Second Meeting February 17, 2025)***
Project: HEI No. 12808-0001-007

The following is a summary of the September 12, 2024 organizational Steering Committee Meeting. These minutes are a tabulation versus a transcript of the various discussions. A Steering Committee agenda and outline was created and sent. This was followed by a topic related summary regarding various lake hydraulic connections and topographic information. See attached documents for information provided during the meeting for discussion. Some elements were updated since the meeting (e.g. drainage area, etc…).

Six members of the Steering Committee were present. Those not in attendance included Les Ressler (Ruele Lake), Don Mittleider (Kidder County), and Tim Brenner (Crystal Springs Bible Camp) who was represented by several Board Members (Vaughn Rhodes and Steve Singer).

Local Fund Discussion

The County Commission has requested local entities (e.g. property owners, etc.) participate in the Feasability Study cost. At the time of the meeting, it was noted approximately $40,000 was committed with the tentative distribution noted in the attached. One unknown in this listing was that from Lake Reule, for which the number was based on comments outside the meeting. Discussions are occurring with others to determine potential sources for additional funds. BNSF was asked about its contribution status, who stated it was being discussed internally and they were attempting to determine if funds might be available. It was noted BNSF has provided background technical infromation from their records valued at around $20,000. They will continue to provide information to the project as requested.

The desire was to have formally committed local funds by the September 24th County Commission meeting, recognizing this may not be practical as it will take time for some to consider the purpose value and opportunity. It was generally thought the amount required by the County Commission would near the 50% level, or near $62,000. Local discussions would continue to locate additional funding. The County Commission will not authorize the study work to proceed until the SWC funding has been approved and an adequate local funding committed.

FEASABLIY STUDY SCHEDULE – SUMMARY OF NEXT STEPS:

1. Web Grant Approval (Pending) – Sponsor Approval **{Completed}**

2. Local Funding to be secured to level acceptable to the County Commission **{ongoing}**

3. County Commission to provide notice to proceed **{pending}**
    a. Their notice to proceed would be followed by letters to local contributors to send their funds to the County Auditor. It was clearly noted any local contribution would NOT be a commitment or measure of a future assessment of potential cost share participation related to project implementation.

LAKE TOPOGRAPHIC DATA – ELEVATION CONNECTIONS

Several exhibits were shared relative the lake system. The North Dakota Game and Fish supplied topographic data below the water levels based on their (bathymetric) fishery maps. This combined with the available LiDAR topographic data will be utilized to determine the area-capacity data for each lake and the volume of water to potentially be removed from each to control the expanse of floodwaters. There was a general discussion of the various other contacts that have occurred with the USFWS, NDDWQ, NDDWR and others related to the project. At this point there were no obvious identified showstoppers.

When considering the lake interconnects and flows it was identified that utilizing Stink Lake would likely be used as the sump, as it was the lowest in the system. This would provide several system benefits. *First,* it would result in removal of the lower quality waters, though still better than downstream in Long Lake. This could potentially freshen the overall lake system. **Second,** there is a natural overflow elevation from Lake Ruele. If this would provide an adequate lowering in flood waters to the recreational lot owners, then the elevation could be established at that level and protect the recreation value. **Third,** significant inflows enter Stink Lake from the west through Crystal Springs Lake, which appears to have the best water quality. The design elevation of Crystal Springs Lake will consider the impacts and risks to Camp infrastructure and ability to move waters to though and out of the system. A pump station located east of the camp entrance roadway is an initial consideration to facilitate Operation and Maintenance access as well and a potential and electrical service connection. The intake line into Stink Lake remains unknown.

The drainage area created map for a 2020 BNSF study was provided and discussed. This mapping map indicates the drainage area is approximately 94.3 square miles. This is less than the overall 250 square mile mapping for this pothole region. It is anticipated this is understated and the actual contributing watershed to the lake complex is far greater. Once culverts are placed into the GIS mapping review this drainage area will be updated as part of the study effort. A graph of the historic water level increases in Stink Lake and the recent BNSF grade raises was provided and discussed.

The NDDOT grade raises were discussed and noted that we already have the hydrology study reports. It was requested that NDDOT provide the recent grade raise plans be provided. When asked about the roadway centerline culverts it was noted the original or lower ones were likely abandoned during the grade raise construction.

BNSF noted that their Right-of-way (ROW) in this reach was 200 ft and there was considerable room for track expansion to fit additional grade raises. The ROW will be provided to be included in the report discussion and mapping. BNSF noted that small grade increases were not that costly, however larger grade increases would have much higher costs, and if avoidable would be beneficial.

MEETING ACTION ITEMS…

Stutsman County Commission and Water Resource District

- ✓ Approve Engineering Services Agreement – Completed

HEI - Web Grants Submittal Completed – Awaiting Approval

- ✓ Prepare local fund contributor letter {pending approval to proceed}
- ✓ Work with Stutsman County Emergency Management related to placing the project in the County Hazard Mitigation Plan and options for a future HMGP. If eligible the funding is 75% federal, 10% state and 15% local.

NDDOT – Provide Interstate Grade Raise Plans {complete}

BNSF – Provide ROW mapping and Culverts {completed}

Stutsman County Highway Department {pending}

Provide projected cost to raise county or township roadways per mile, at one and two-foot.

Others – Fund Rasing Updates as available, beyond those noted in the attached.

These minutes were approved by consent by the Steering Committee at their February 17, 2025 meeting. These minutes are to be included in the Second Meeting summary.

If there are questions, please contact Michael Gunsch at 701-527-2134 or mgunsch@houstoneng.com.

Please refer to current listing as this version is dated

Crystal Lake Feasability Study
Stutsman County Commission and Water Resource District
Steering Committee Established: 8-28-2024

1. **Stutsman County Commission**
   Jerry Bergquist, Commissioner
   511 2nd Avenue SE, Suite #102
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   Ph: 701-320-0401
   Email: jlbergquist@stutsmancounty.gov

2. **Stutsman County Water Resource District**
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   Alt: Anthony Roorda
   Email roordaranch@daktel.com

3. **Kidder County**
   Dan Mittleider, Chairman
   Kidder County Commission
   120 Broadway E
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   Email: danmittleider@yahoo.com

4. **Stutsman County Highway Department**
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   Email: jwentland@stutsmancounty.gov

5. **ND Department of Transportation**
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   Email: jpraska@nd.gov

6. **Burlington Northern Sante Fe**
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   Minneapolis, MN 55421
   Ph: 763-782-3495 (office)
   Email daniel.peltier@bnsf.com

7. **Crystal Springs Bible Camp**
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   Ph: 701-426-8141
   Email: tim@csbcamp.org

8. **Recreational Properties**
   Les Ressler
   Reule Lake Landowners (HOA)
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9. **Agricultural Impacts**
   Brian Knetter
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   Medina, ND 58467
   Ph: 701-320-8489
   Email: batwarmer@daktel.com

Agency/Engineering Contacts

Stutsman County Water Resource District
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Crystal Lake Feasability Study
Stutsman County Commission and Water Resource District
Steering Committee Established: 8-28-2024

Steering Committee (SC) Agenda
First Meeting {Date and Time TBD}

- Introductions
- Project Scope, Direction and Schedule
- Discussion and Determination of Local Funding Participation
  - Total Cost $222,000 – $99,900 (SWC Grant) = $122,100 (Local Share)
- Funding recommendation/request to Stutsman County Commission
  - September 3rd Meeting (or a special meeting, as necessary)
- Next SC meeting to occur after SWC grant funds are approved

Crystal Springs Watershed Initiative Cost Share Partners

o Stutsman County Commission and WRD (Roadway Contribution)	
o Kidder County Commission and WRD	NA
o Burleigh County WRD - Notified	NA
o State Water Commission (i.e., SWC Secretary/DWR Director approval)	45% Grant - $99,900
o USFWS Local & Regional – Long Lake NWR (easement & WPA considerations)	NA
o BNSF – St. Paul	$20,000+ In Kind Data Share
o NDDOT – State Office referred to Valley City District	NA
o Ruele Lake Landowners	
o Crystal Springs Bible Camp (and Supporters)	
o Crystal Springs & Stink Lake Homeowners & adjacent Landowners (Via Camp)	
o City of Medina	

Others - Undetermined

Scheduling Notes:

1. The Stutsman County WRD (SCWRD) reviewed and approved the Engineering Services Agreement at their August 28th meeting. This will now go before the Stutsman County Commission for consideration at their September 3rd meeting.

2. The SCWRD established the Steering Committee, who will at their first meeting (noted above) provide their findings relative to local cost participation funding commitments for consideration and recommendation to the Stutsman County Commission.

3. After the Engineering Services Agreement is approved a Web Grant Application can be submitted to the State Water Commission. After the SWC grant funding is approved the local partners would be requested to submit their participation funds to the Stutsman County Auditor. Then the engineer would be authorized to proceed with the Feasability Study.

Crystal Springs Watershed Initiative
Lake Elevation Evaluation Criteria – 9/12/2024
What are we here to solve?

Harold Hamm (Game Changer)

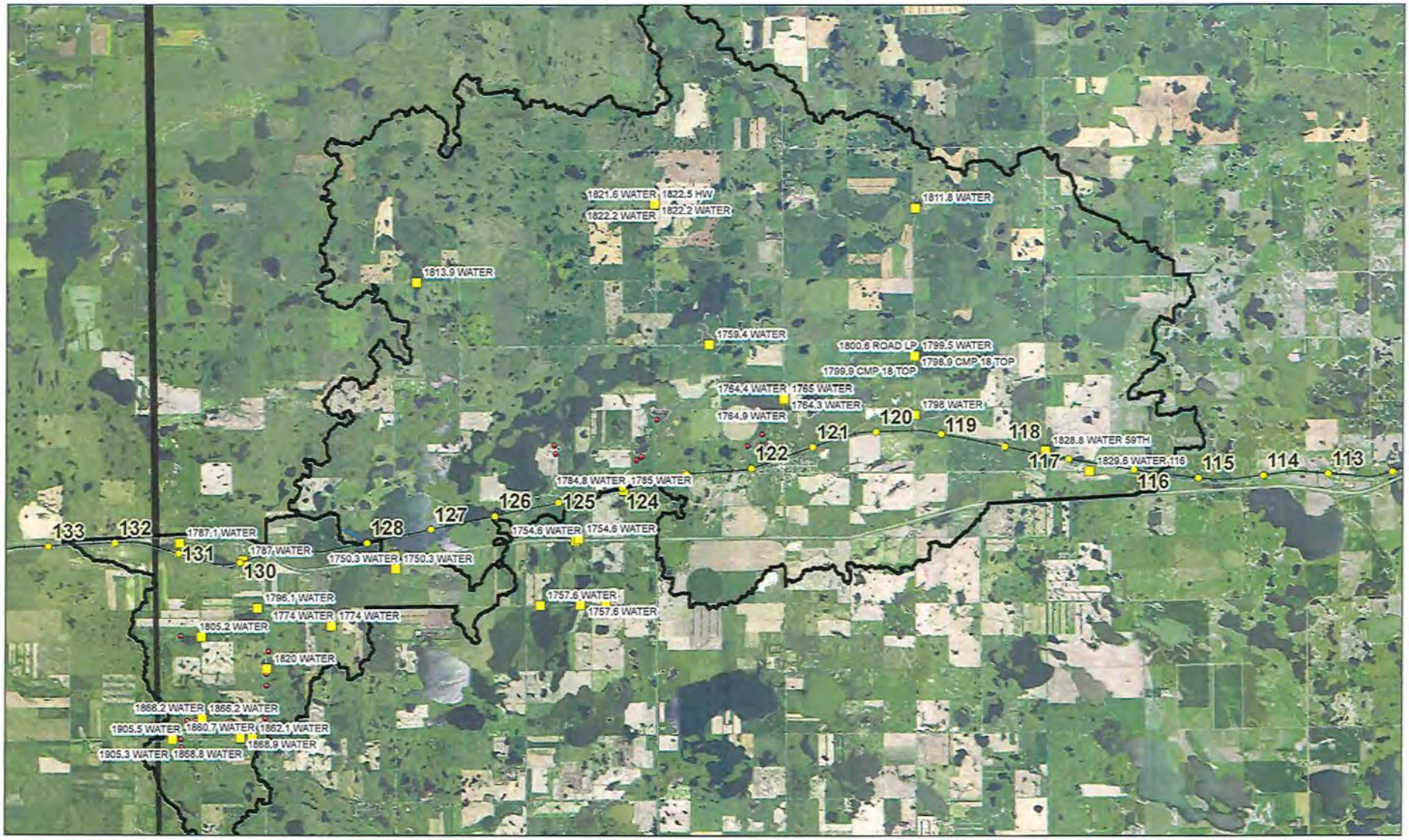
Focus topics for discussion:

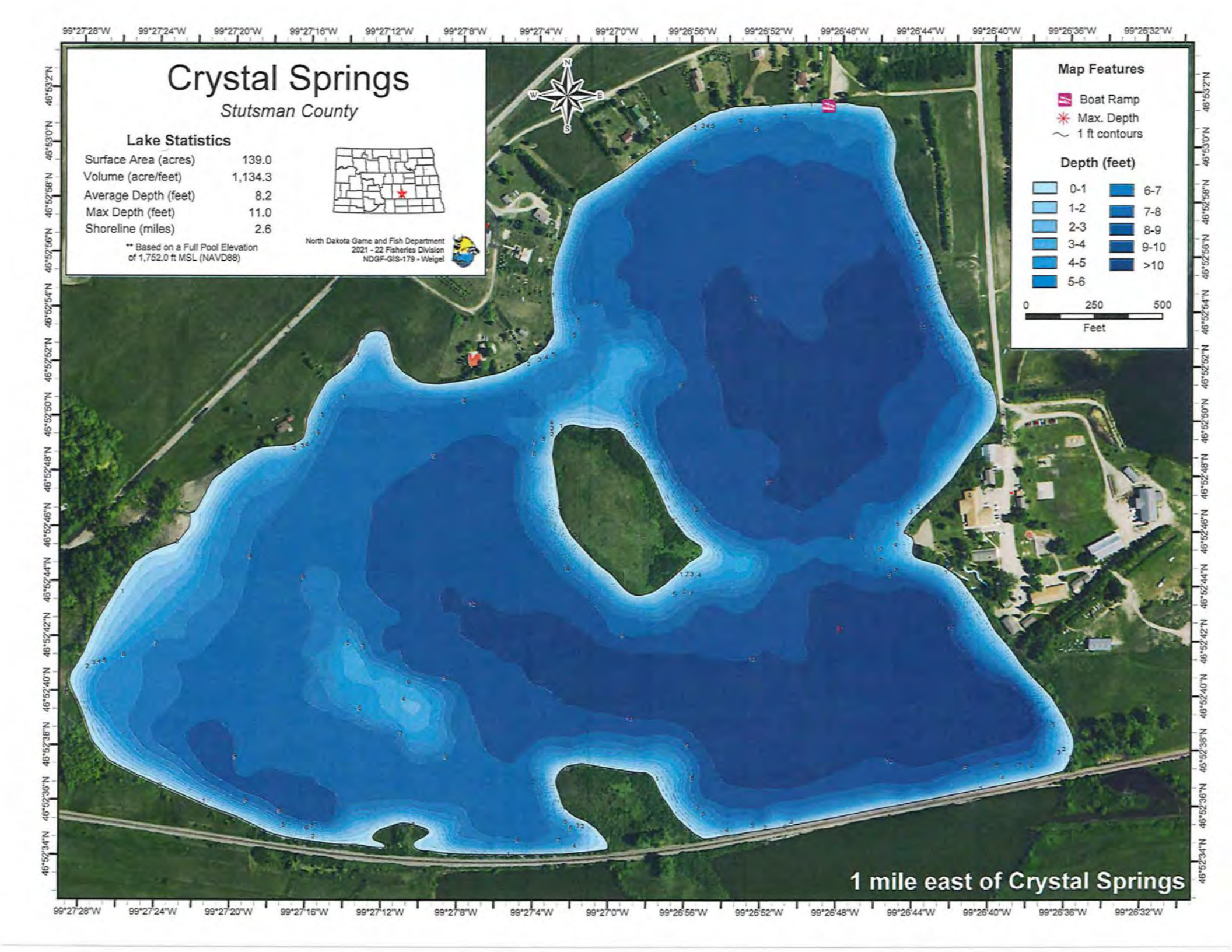
- ✓ **Stink Lake** - lowest basin in the watershed (NDRAM – 1746.8 100-yr)
  - North and South Stink Lake - Need to define connection elevation
  - Infrastructure Risks - Impacts
    - Hwy 39 (Old Highway #10 -grade raise connection to Reule Lake)
    - I-94 and BNSF
    - Agricultural Lands
    - Boat Ramp
  - Option to use this lake as the sump
    - Water removal (pump) and system flood storage
  - Water quality is the poorest of these lakes?

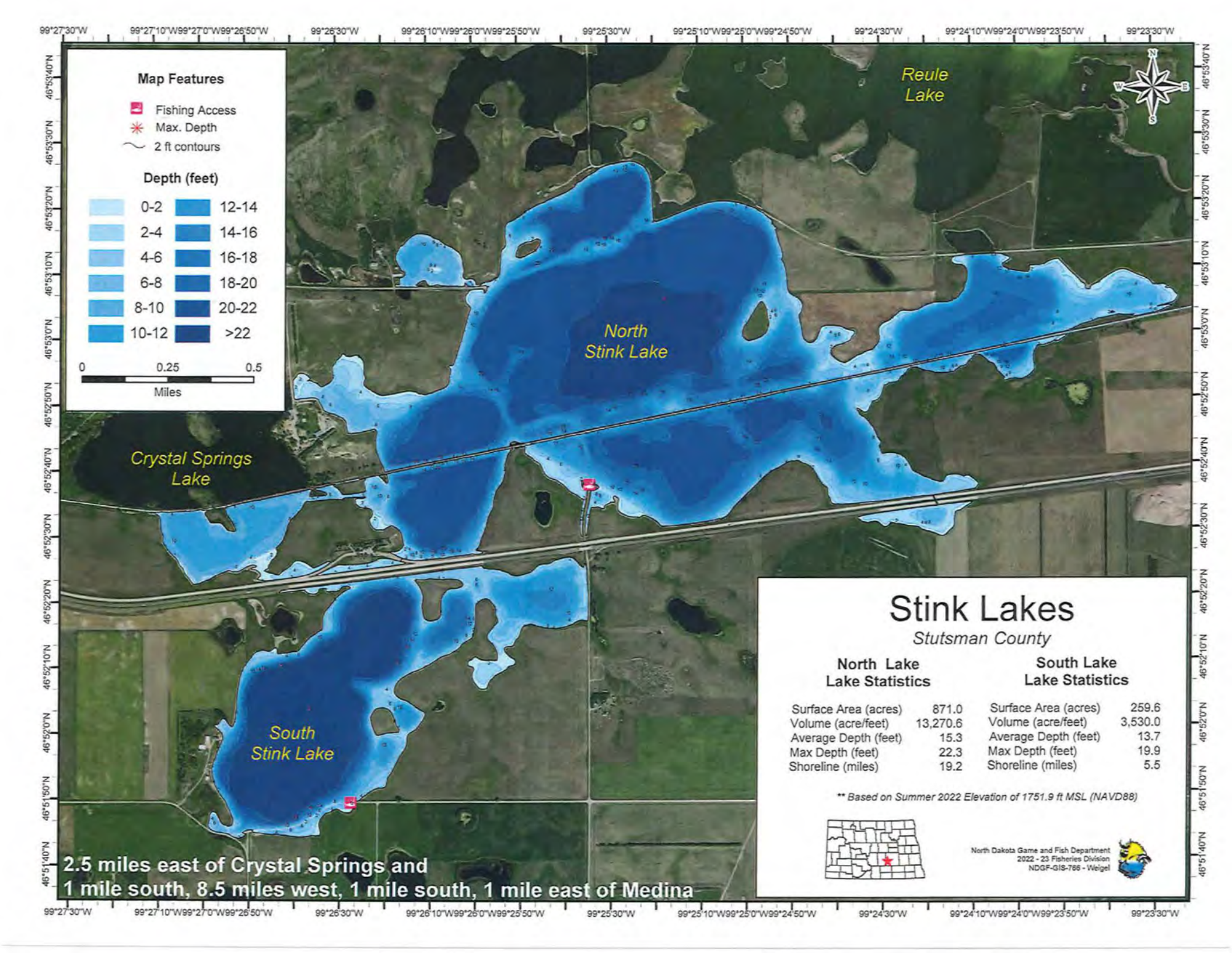
- ✓ **Crystal Springs** - waters flow east into Stink Lake (NDRAM – 1749.6 100-yr)
  - One connection is the Bible Camp Roadway culvert
    - This was closed when the roadway was raised
  - Second connection is the excavated channel south of I-94 and culverts under I-94
  - Infrastructure Risks - Impacts
    - Bible Camp and Facilities
    - I-94, and BNSF
    - Some recreational lots
    - Agricultural Lands
  - Verify connection elevations to Stink Lake (Lower level ~ 4 feet?)
  - Best lake water quality (option to preserve this) – Stink Lake pump removal

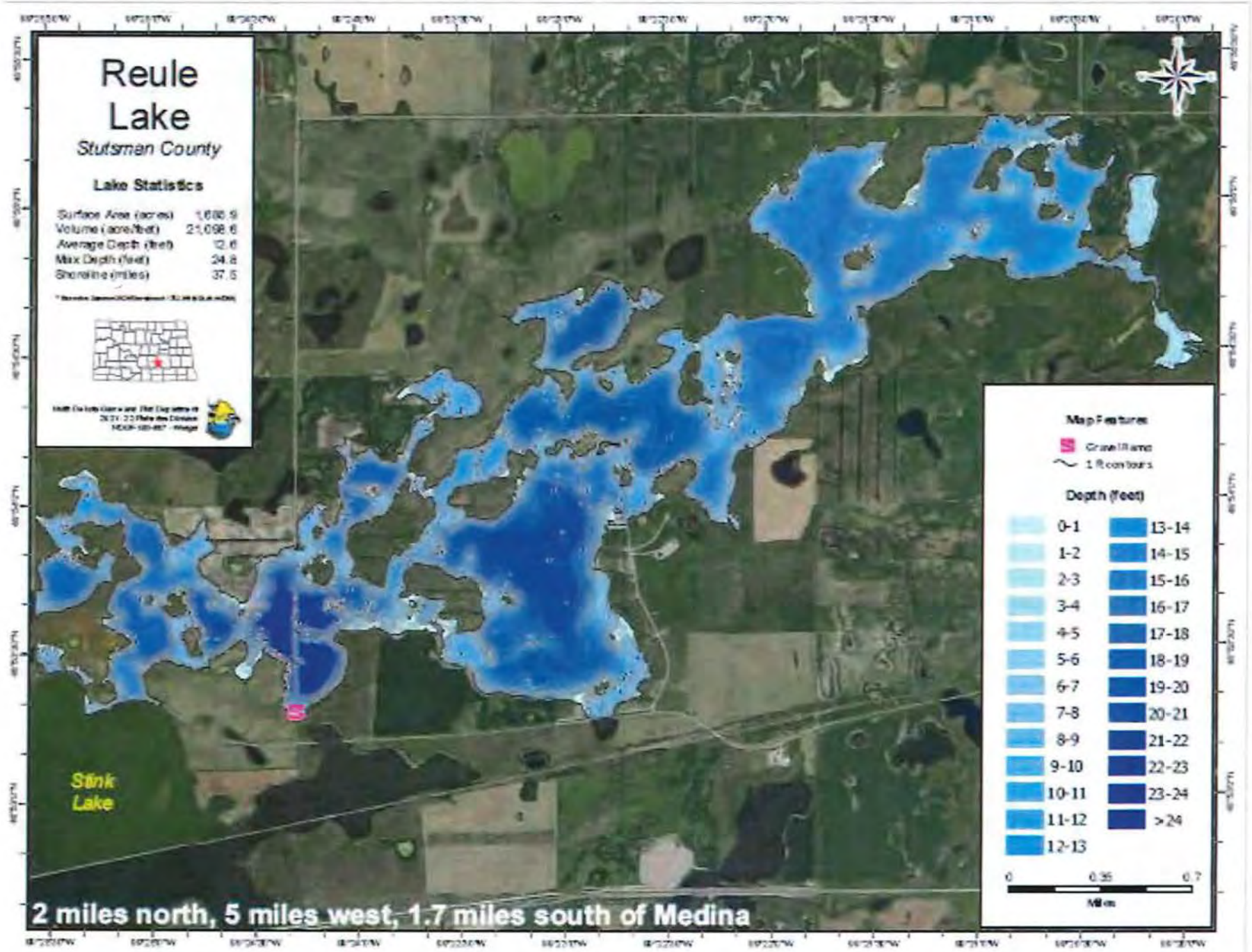
- ✓ **Reule Lake** - Recreational lake and the upper lake (NDRAM – 1746.9 100-yr)
  - Natural overflow connection to Stink Lake – Verify Elevation
  - Impacts to lower to only lower water natural overflow?
    - Preservation of natural conditions and recreational value
  - Infrastructure Risks - Impacts
    - Recreational lots - review lot elevation and inundation
    - 34th Street SE, Farmstead access, Hwy 39
    - Agricultural Lands

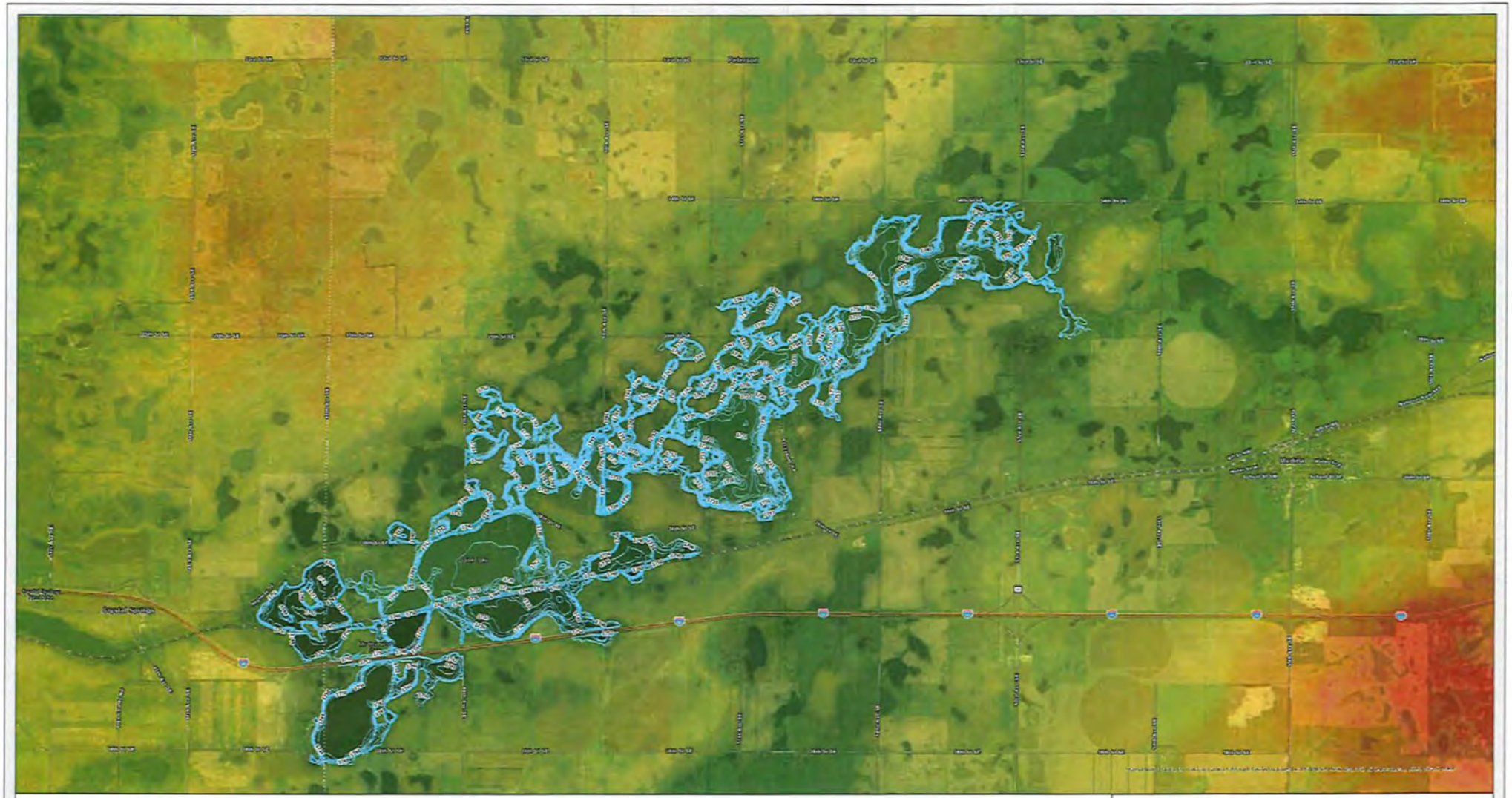
- ✓ **Medina Lake** – Community Groundwater Issues
  - 55th Avenue SE – Condition (need to raise?)
    - Recent culvert improvements
    - Need for a grade raise to protect roadway
  - Control overflow elevation is to the west, above current lake complex elevation
    - 54th Avenue SE (Twp Roadway?)
  - Option to lower lake elevation with downstream outlet
    - Limited projection to lower 2 feet (controlled release)


1821.6 WATER
1822.5 HW
1822.2 WATER
1822.2 WATER
1811.8 WATER
1813.9 WATER
1759.4 WATER
1800.6 ROAD LP
1799.5 WATER
1798.9 CMP 18 TOP
1799.9 CMP 18 TOP
1764.4 WATER
1765 WATER
1764.3 WATER
1764.9 WATER
1798 WATER
120
119
118
121
122
1828.8 WATER 59TH
117
1829.6 WATER 116
115
114
113
116
1784.8 WATER
1785 WATER
126
125
124
127
128
133
132
131
130
1787.1 WATER
1787 WATER
1750.3 WATER
1750.3 WATER
1754.6 WATER
1754.6 WATER
1796.1 WATER
1774 WATER
1774 WATER
1805.2 WATER
1820 WATER
1757.6 WATER
1757.6 WATER
1866.2 WATER
1866.2 WATER
1905.5 WATER
1860.7 WATER
1862.1 WATER
1868.9 WATER
1905.3 WATER
1868.8 WATER


Crystal Springs
Stutsman County
Lake Statistics
Surface Area (acres) 139.0
Volume (acre/feet) 1,134.3
Average Depth (feet) 8.2
Max Depth (feet) 11.0
Shoreline (miles) 2.6
** Based on a Full Pool Elevation of 1,752.0 ft MSL (NAVD88)
North Dakota Game and Fish Department
2021 - 22 Fisheries Division
NDGF-GIS-179 - Weigel
Map Features
Boat Ramp
Max. Depth
1 ft contours
Depth (feet)
0-1
1-2
2-3
3-4
4-5
5-6
6-7
7-8
8-9
9-10
>10
0
250
500
Feet
1 mile east of Crystal Springs


Map Features
Fishing Access
Max. Depth
2 ft contours
Depth (feet)
0-2
2-4
4-6
6-8
8-10
10-12
12-14
14-16
16-18
18-20
20-22
>22
0
0.25
0.5
Miles
Reule Lake
North Stink Lake
Crystal Springs Lake
South Stink Lake
2.5 miles east of Crystal Springs and
1 mile south, 8.5 miles west, 1 mile south, 1 mile east of Medina
Stink Lakes
Stutsman County
North Lake Lake Statistics
Surface Area (acres) 871.0
Volume (acre/feet) 13,270.6
Average Depth (feet) 15.3
Max Depth (feet) 22.3
Shoreline (miles) 19.2
South Lake Lake Statistics
Surface Area (acres) 259.6
Volume (acre/feet) 3,530.0
Average Depth (feet) 13.7
Max Depth (feet) 19.9
Shoreline (miles) 5.5
** Based on Summer 2022 Elevation of 1751.9 ft MSL (NAVD88)
North Dakota Game and Fish Department
2022 - 23 Fisheries Division
NDGF-GIS-766 - Weigel


Reule Lake
Stutsman County
Lake Statistics
Surface Area (acres) 1,696.9
Volume (acre/feet) 21,098.6
Average Depth (feet) 12.6
Max Depth (feet) 24.8
Shoreline (miles) 37.5
Stink Lake
Map Features
Depth (feet)
0-1
1-2
2-3
3-4
4-5
5-6
6-7
7-8
8-9
9-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
19-20
20-21
21-22
22-23
23-24
>24
0
0.35
0.7
Miles
2 miles north, 5 miles west, 1.7 miles south of Medina



Legend

Lakebed Contours

DEM Elevation

Value

1903.03

1727.35

N

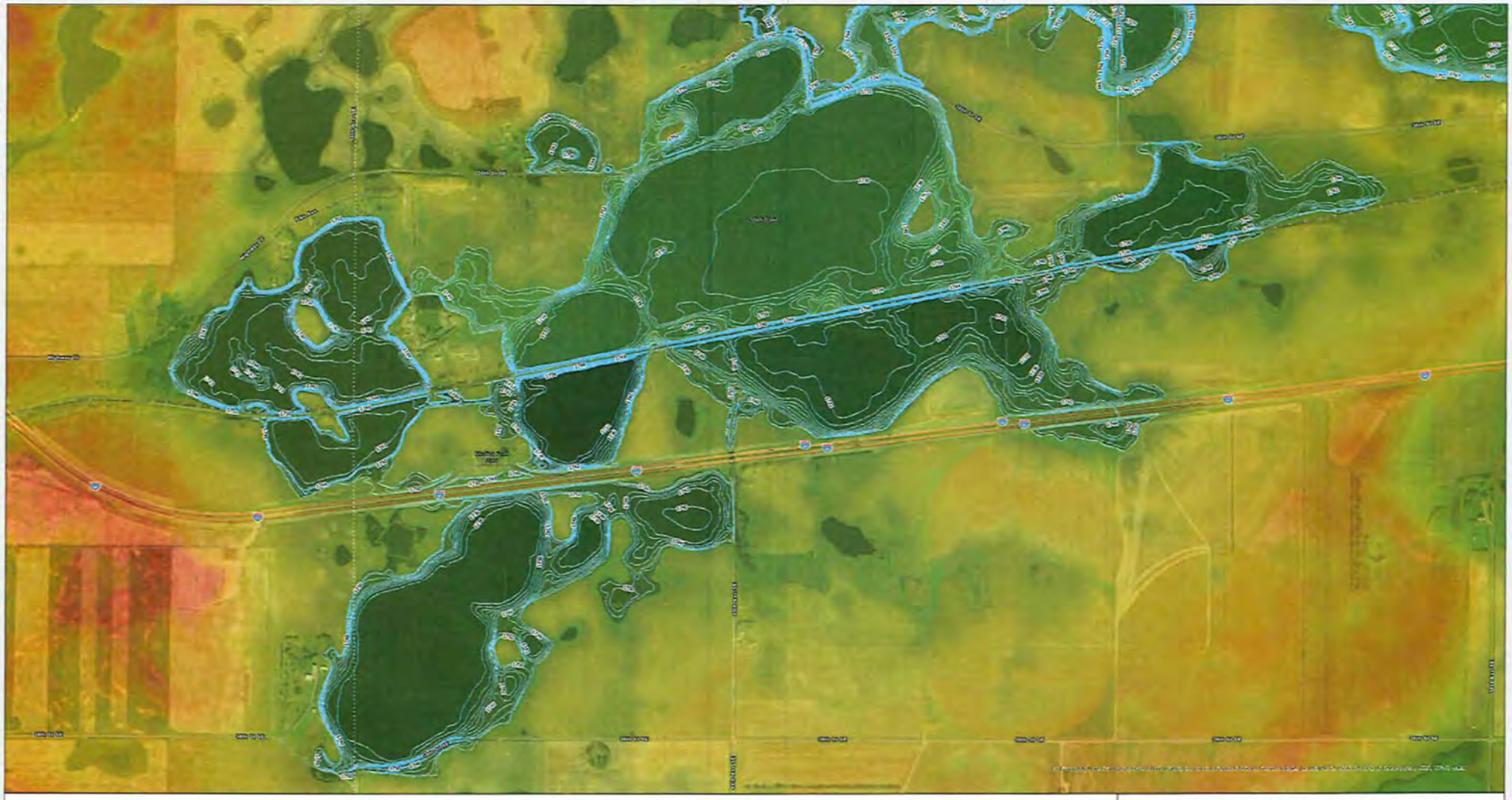
0 0.38 0.75 1.5

Miles

Overall Project Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	1

HOUSTON engineering, inc.



Legend

Lakebed Contours

DEM Elevation

Value

1903.03

1727.35

N

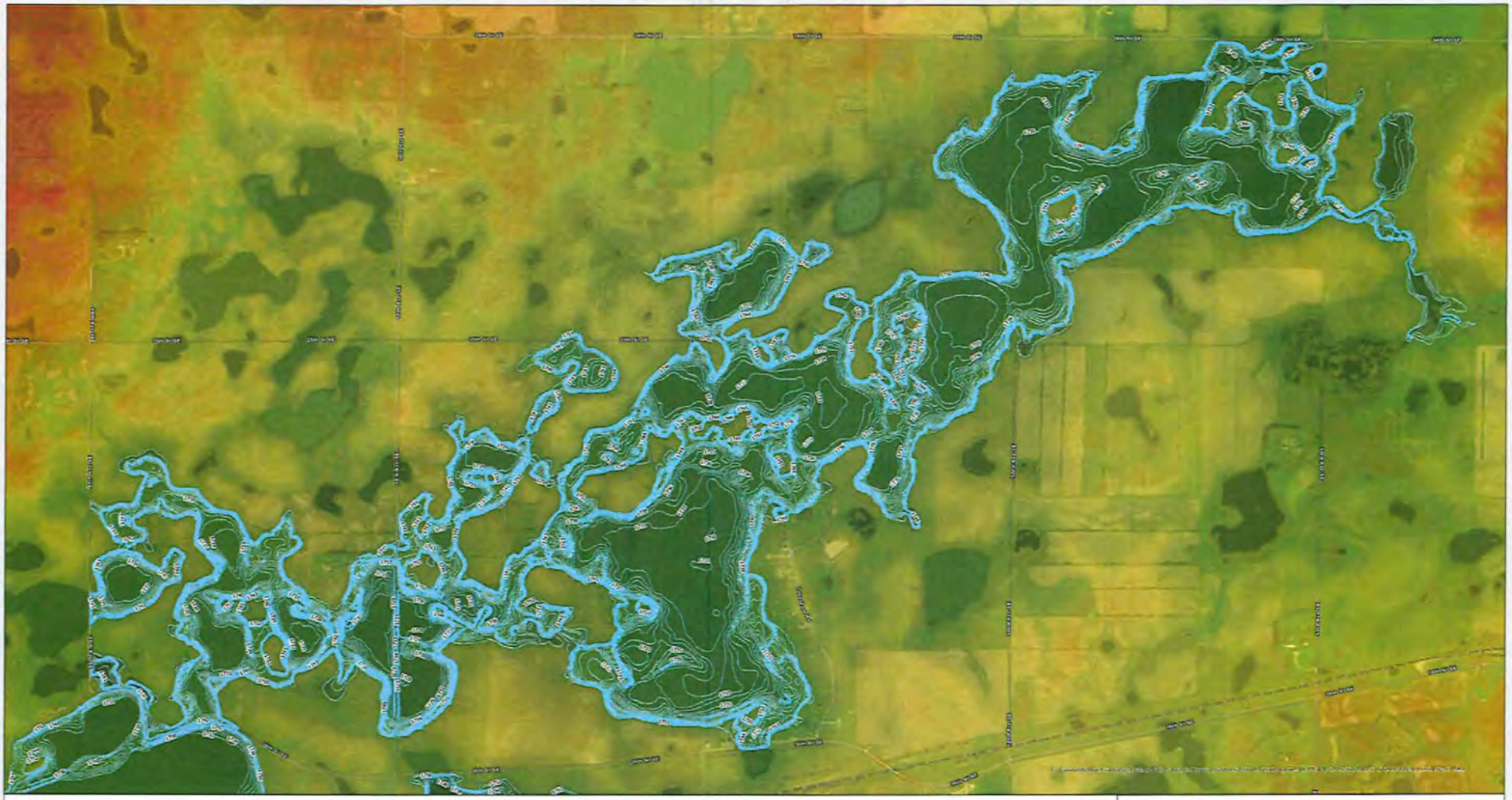
0 0.13 0.25 0.5

Miles

Crystal Springs & Stink Lake Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	2

HOUSTON engineering, inc.



Legend

Lakebed Contours

DEM Elevation

Value

1903.03

1727.35

N

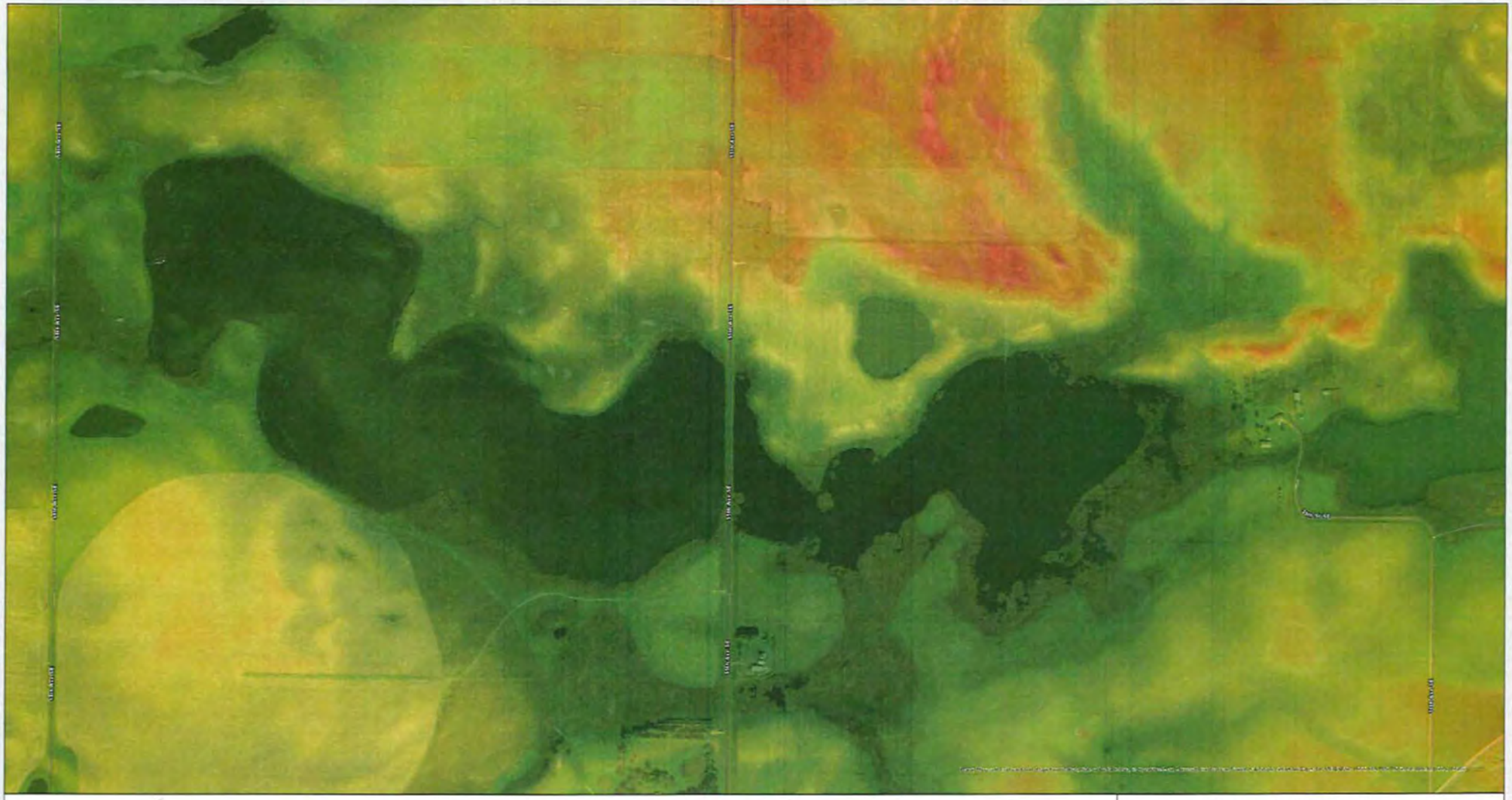
0 0.13 0.25 0.5

Miles

Reule Lake Digital Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	3

HOUSTON engineering, inc.



Legend

Lakebed Contours

DEM Elevation

Value

1903.03

1727.35

N

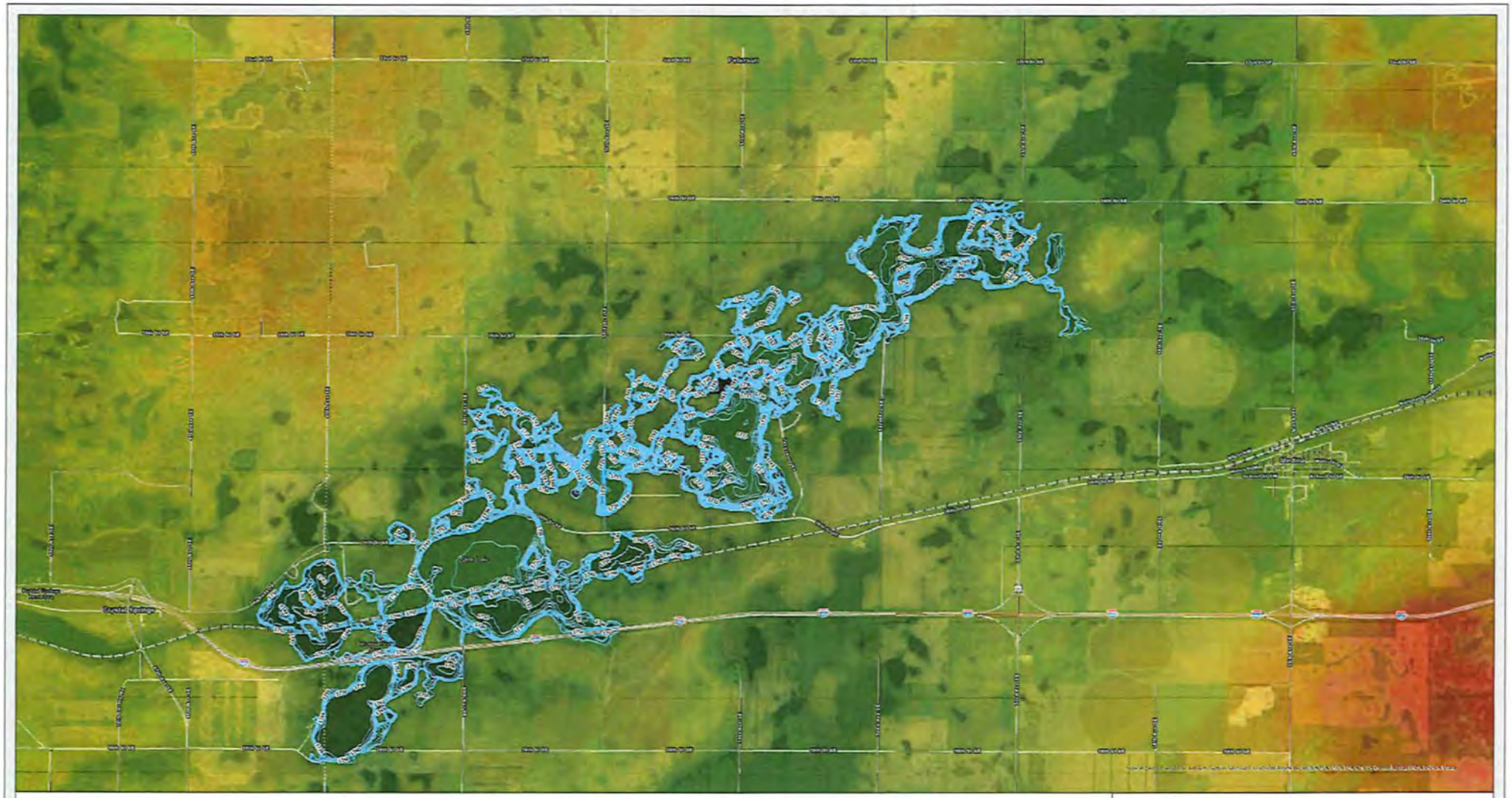
0 0.07 0.15 0.3

Miles

Medina Lake Digital Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	4

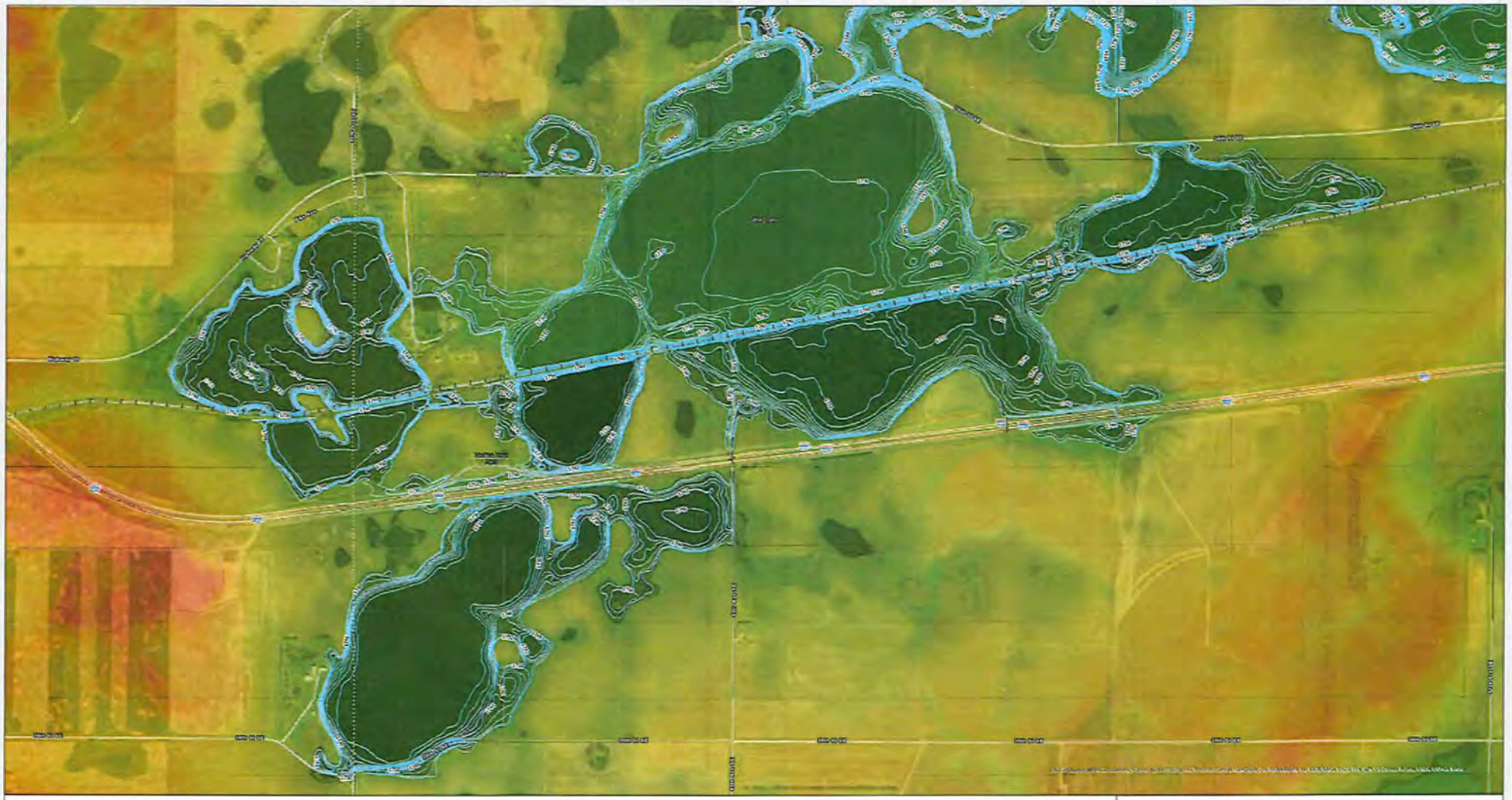
HOUSTON engineering, inc.



Overall Project Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	1

HOUSTON engineering, inc.



Legend

Lakebed Contours

DEM Elevation

Value

1903.03

1727.35

N

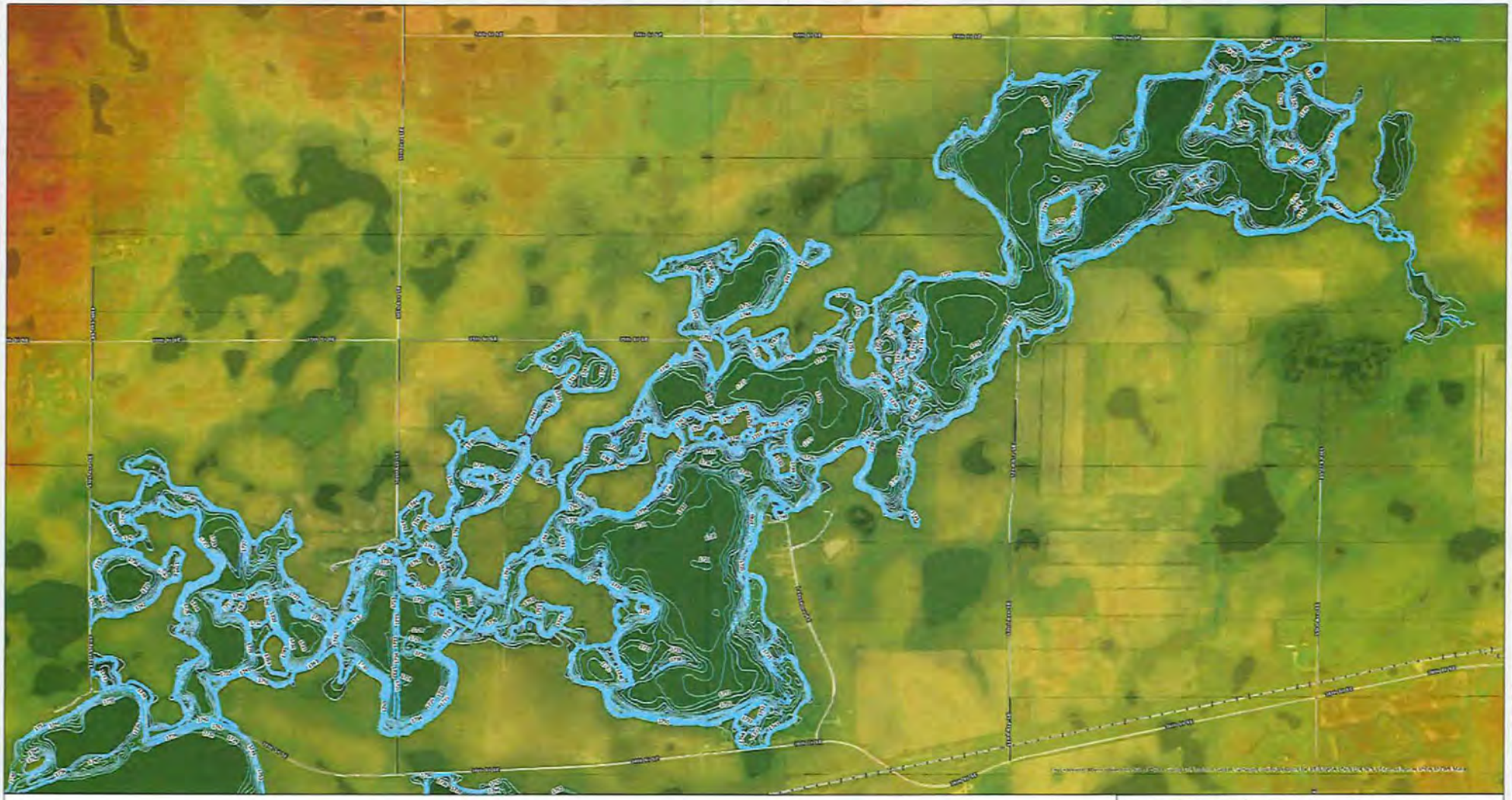
0 0.13 0.25 0.5

Miles

Crystal Springs & Stink Lake Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	2

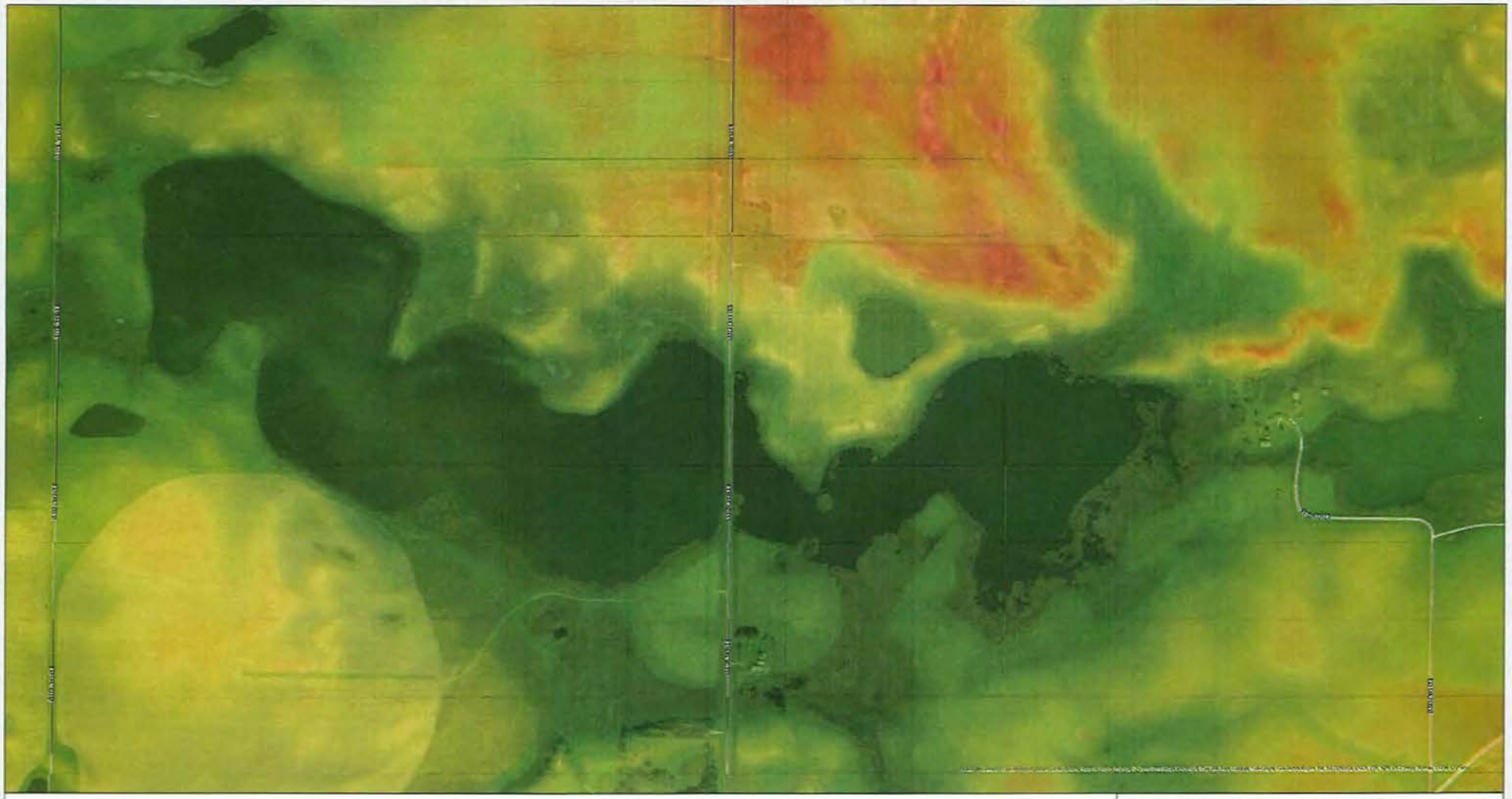
HOUSTON engineering, inc.



Reule Lake Digital Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	3

HOUSTON engineering, inc.



Legend

Lakebed Contours

DEM Elevation

Value

1903.03

1727.35

N

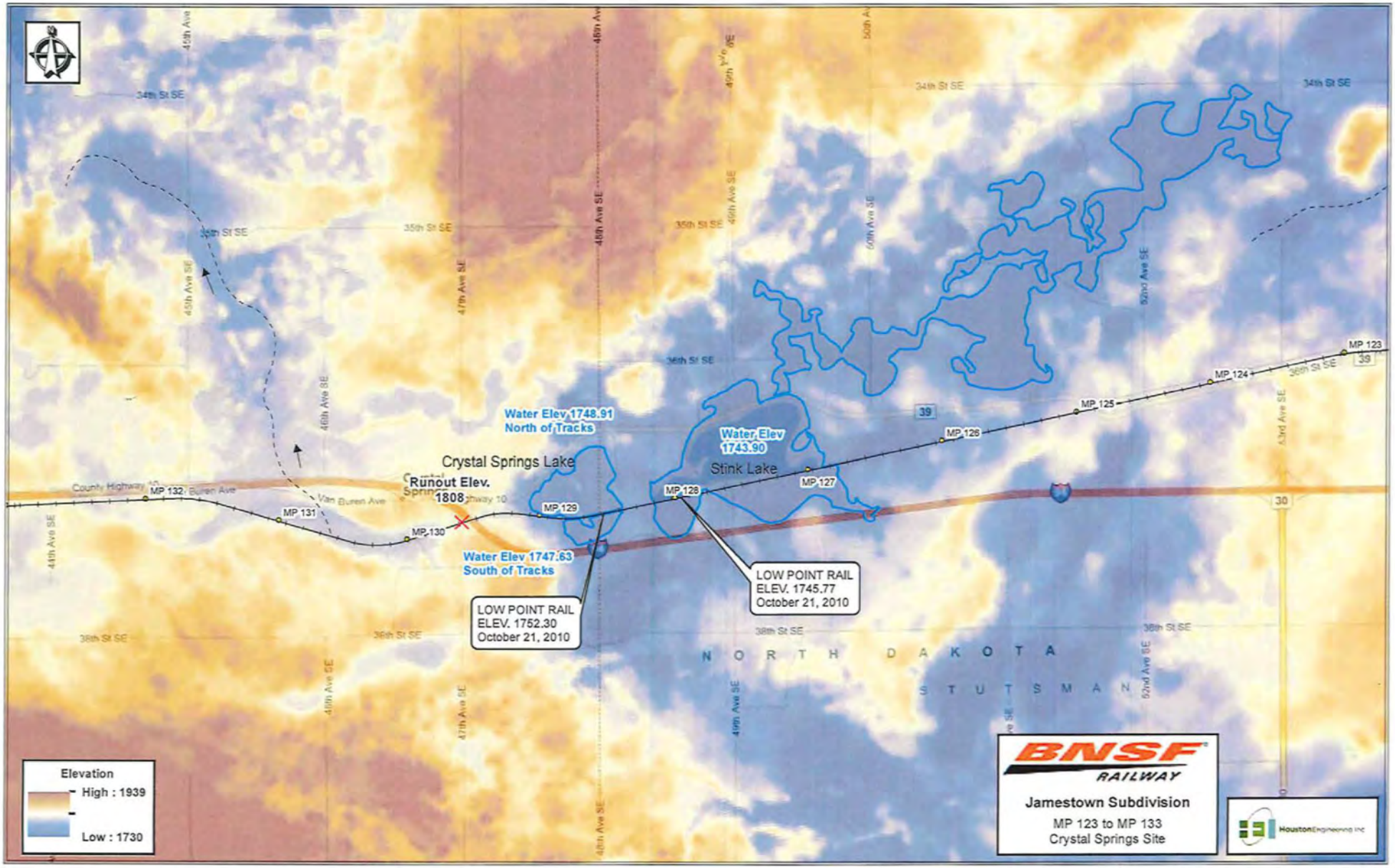
0 0.07 0.15 0.3

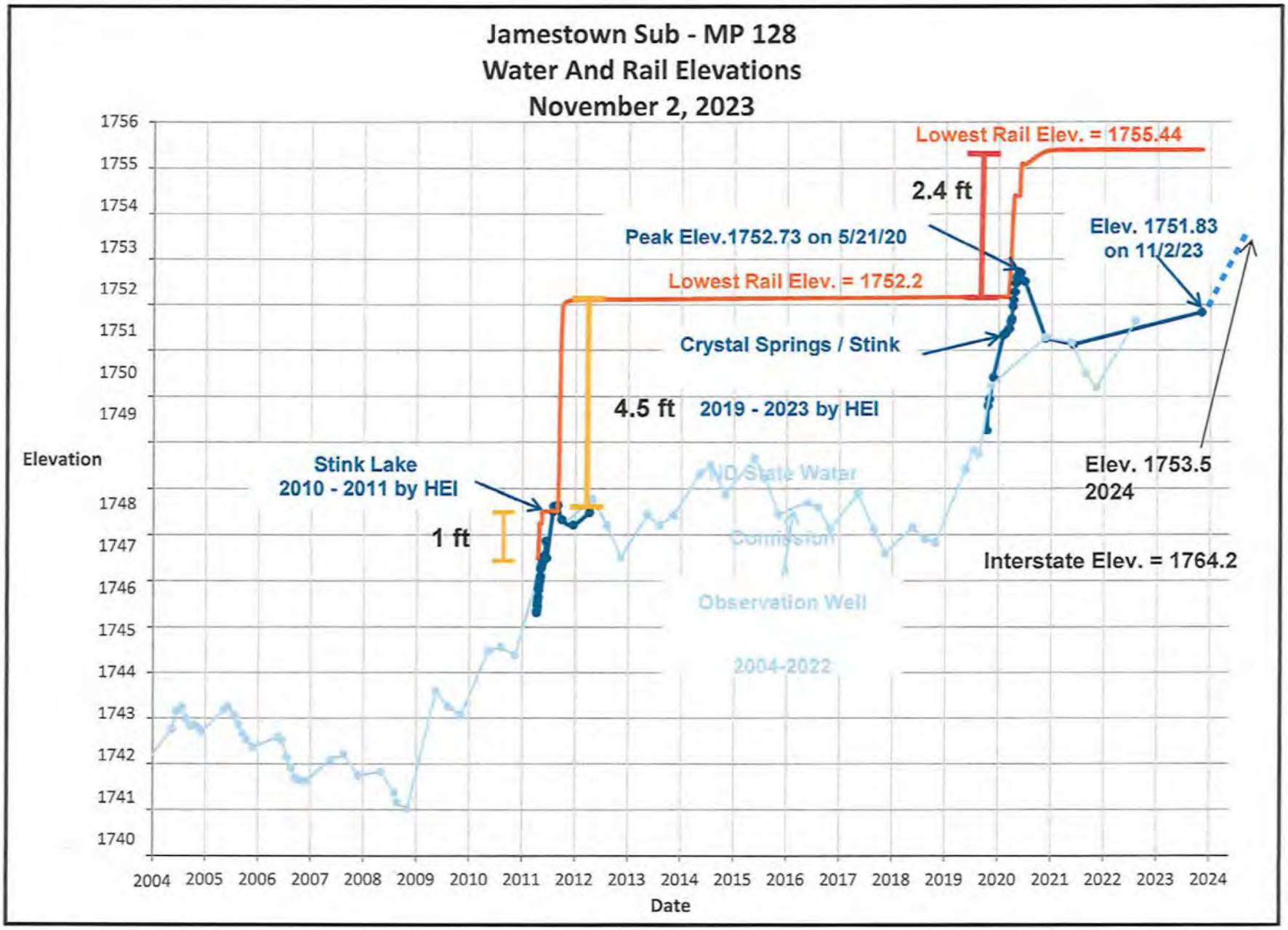
Miles

Medina Lake Digital Elevation Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	9/11/2024	4

HOUSTON engineering, inc.


Water Elev 1748.91
North of Tracks
Water Elev
1743.90
Crystal Springs Lake
Stink Lake
Runout Elev.
1808
Water Elev 1747.63
South of Tracks
LOW POINT RAIL
ELEV. 1752.30
October 21, 2010
LOW POINT RAIL
ELEV. 1745.77
October 21, 2010
MP 123
MP 124
MP 125
MP 126
MP 127
MP 128
MP 129
MP 130
MP 131
MP 132
34th St SE
35th St SE
36th St SE
38th St SE
45th Ave SE
46th Ave SE
47th Ave SE
49th Ave SE
52nd Ave SE
43rd Ave SE
County Highway 10
Van Buren Ave
39
30
N O R T H D A K O T A
S T U T S M A N
Elevation
High : 1939
Low : 1730
BNSF RAILWAY
Jamestown Subdivision
MP 123 to MP 133
Crystal Springs Site
HoustonEngineering Inc


Jamestown Sub - MP 128
Water And Rail Elevations
November 2, 2023
Lowest Rail Elev. = 1755.44
2.4 ft
Peak Elev.1752.73 on 5/21/20
Elev. 1751.83
on 11/2/23
Lowest Rail Elev. = 1752.2
Crystal Springs / Stink
4.5 ft 2019 - 2023 by HEI
Stink Lake
2010 - 2011 by HEI
1 ft
Elev. 1753.5
2024
Interstate Elev. = 1764.2
Observation Well
2004-2022
Elevation
Date
1756
1755
1754
1753
1752
1751
1750
1749
1748
1747
1746
1745
1744
1743
1742
1741
1740
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Crystal Springs Watershed Initiative

	Contribution		Percent of Local	
o Stutsman County Commission and WRD (Roadway Contribution)	$82,100		67%	
o Kidder County Commission and WRD	$0	NA		
o Burleigh County WRD - Notified	$0	NA		
o State Water Commission (i.e., SWC Secretary/DWR Director)	$99,900	45% Cost Share Grant		
o USFWS Local & Regional – Long Lake NWR		NA		
o BNSF – St. Paul	$0	$20,000 In Kind Information	0%	In-kind
o NDDOT – State Office referred to Valley City District		NA		
o Ruele Lake Landowners	$10,000	Unconfirmed	8%	5K limit?
o Crystal Springs Bible Camp (and Supporters)	$25,000		20%	
o Crystal Springs & Stink Lake Homeowners and adjacent Landowners (Via Camp)	$5,000	$0	4%	
o City of Medina	$0	$0	0%	
Total Study Cost	**$222,000**		**100%**	
Local Share Required	$122,100			
Commited	$40,000			
Remaining	$82,100			

222000
0.45
$99,900.00

Crystal Lake Watershed Initiative
Steering Committee - Meeting #2

To: Steering Committee
From: Michael H. Gunsch, PE, CFM, Senior Project Manager
Josh Loosmore, Peritiacon
Subject: Project Status Update and Presentation Information
Date: ***February 17, 2025 Meeting Summary***
Project: HEI No. 12808-0001-007

The following is a summary of the February 17, 2024 Steering Committee Meeting. These minutes are a tabulation versus a transcript of the discussions.

Those in attendance included Anthoney Roorda (Stutsman County WRD), Jerry Bergquist (Stutsman County Commission) Les Ressler (Reule Lake), Don Mittleider (Kidder County), Tim Brenner (Crystal Springs Bible Camp), Jessie Christianson, (Stutsman County Highway Department), Charlie Dronen, Kidder County Commission, Dan Peltier (BNSF – on Teams). Michael May (Interstate Engineering on Teams), Michael Gunsch (HEI), Josh Loosemore (Peritiacon).

PRIOR MEETING UPDATE - LOCAL FUNDING

Adequate local funding was secured, and the County Commission authorized the feasibility study to proceed. Information regarding the study funding is available from the County Commission.

FEASIBILITY STUDY SCHEDULE – SUMMARY

1. Web Grant Approved – DWR Agreement signed
2. Local Funding secured – Including BNSF Participation Agreement
3. County Commission notice to proceed
4. Letters sent to local contributors requiring funds be forwarded to County Auditor
5. Contact letters mailed to parties interested in obtaining project updates (email group)
6. Evaluation of the watershed and outlet alternatives has started.
7. NDDOT hydrology study reports and design/construction plans provided
8. Hydrologic and limited Groundwater Evaluation underway

Hazard Mitigation Plan Updates.

This project is now included in the Stutsman County and Kidder County Hazard Mitigation Plans, which allows future consideration for a Hazard Mitigation Grant Program (HMGP). If the project is eligible the funding split is 75% federal, 10% state and 15% local. We have recently been in contact with State Department of Emergency Services (DES) regarding this funding opportunity.

PROJECT UPDATES:

The following documents were presented and discussed at the meeting are attached.

1. **Crystal Lake – First Steering Committee Meeting Summary**
    a. This document was reviewed and accepted without comment or objection

2. **Project Status Report and Invoice Description**
    a. Work completed through February 1, 2025 was discussed.

3. **Outlet Alternative Alignment Mapping**
    a. General discussion as to the potential viability for each alternative alignment
    b. Additional discussion regarding a western alternative alignment under and south of I-94 with an outfall near Tappen. Concerns regarding system liability near the railroad, Interstate #94 along and railroad crossings (high cost and regulatory considerations) and groundwater impacts at the discharge location were noted. Additional consideration will be given to this alignment.

4. **Western Alignment - North of Interstate #94 along (habitable structures map)**
    a. This map illustrates the route alignment and habitable properties in proximity to the system.

5. **South Central Rural Water District (SCRWD)**
    a. Location of the Western Alignment with respect to the SCWRD rural water system and avoidance options.

6. **Stutsman County Rural Water (SCRW) – Tappen Area Connections**
    a. Location of the Western Alignment with respect to the SCWR rural water system and avoidance options.

7. **Figure 1 – Regional Watershed GIS Spill Mapping (235.4 sq. mi.)**
    a. Watershed #1 - 101.3 sq mi
    b. Watershed #2 - 31.9 sq mi
    c. Watershed #3 - 32 sq mi
    d. Watershed #4 - 70.2 sq mi
    e. Spill Mapping
        i. Based on 2020 LiDAR and approximated lake elevation
        ii. Noncontributing potholes are highwater and post flood elevation

8. **Figure 2 – Contributing Watershed – Single Event Spill Model**
    a. Watershed (101.3 sq mi)
    b. Contributing Surface Area (25.8 sq mi, 5.3” rainfall, 0.1% chance)

9. **Figure 3 - Contributing Watershed – Double Event Spill Model**
    a. Watershed (101.3 sq mi)
    b. Contributing Surface Area (50 sq mi, 11” rainfall)

10. **Culvert mapping for lake connections and elevations**
    a. The available data provides the surface water connection elevations between the lakes and without modification will be the baseline for determining the removal system design. The following are the existing culvert elevation interconnects
        i. Crystal Springs Lake – BNSF Culvert and old railroad grade overflow
            1. Need to establish gated connection through access road
        ii. South Stink Lake – NDDOT culvert (1738 and 1741.1)
        iii. Stink Lake – Lower end of system, elevation TBD
        iv. Reule Lake
            1. Dam Location (natural overflow 1744)
            2. County #39 (48” RCP – Elevation 1746)
    b. There was discussion related to Reule Lake in that the target elevation will need to be the natural overflow as controlling higher may require easement considerations around the lake, which are problematic. That means future modifications to the culvert connection under County #39)

11. **Groundwater Well {CSWI} Observation and Location Map**
    a. The groundwater data on this indicates a direct correlation between lake and groundwater levels.
    b. The influence of groundwater is greater than anticipated and therefore needs to be evaluate further – see summary
    c. This map also provides the general extent of the *Central Dakota Aquifer*

12. **NDDOT Rainfall Data (2010-2019) – Tappen Gage**
    a. This rainfall data provides the direct contribution to the lake system

13. **USGS Harvey Stream Gage (peak flow history)**
    a. Illustrates the mean daily discharges flows since 2010

14. **USGS Stream Gage Data (Runoff per sq. mi. based on stream gage)**
    a. Projected runoff into the CSWI lake system at 25.8 sq. mi.
    b. No events under Item #12 that would indicate greater overflows
    c. The period from 2011 till 2024 will be evaluated for lake elevation trends
    d. The largest inflow is noted as 9486 ac-ft (circa 2011)

15. **Stutsman County Road and Bridge Expenses**
    a. Provided as a benchmark for future cost projections

16. **Public Input Meeting Cleveland, ND**
    a. I-94 grade raise – need and purpose
    b. A CSWR study team member will attend to gather data and answer questions

SUMMARY OF TOPICS

Based on the preliminary findings, it is clear the groundwater influences on the CSWI lake complex are far greater than originally anticipated. This is evidenced in that the surface water drainage area and runoff projections do not support the documented water level increases. As such additional hydrologic and hydraulic evaluation of that element needs to be further evaluated, given its influence on the removal system design. Subsequently, additional out of scope services needs to be approved and completed.

Information regarding the area-capacity of the lake system was discussed, however this data is internal information and not currently available for public dissemination at this time. Therefore, it is not included in this meeting summary.

This summary is being provided to the following via email and posted on the Stutsman County Web Site:

- Crystal Springs Steering Committee
- Stutsman County Commission
- Stutsman County Water Resource District
- Crystal Springs Interested Parties Email Group – Includes doner list

MEETING ACTION ITEMS…

Steering Committee – Second Meeting Summary

HEI to request the Stutsman County Commission and Water Resource District

- ✓ Seeking approval for scope contract revisions and contract timeline extension
- ✓ Amendment to be submitted for consideration
- ✓ Additional Cost Share Request to SWC is pending
- ✓ Invoice #2 – Project Status Report

NDDOT – Provided Interstate Grade Raise Plans, information regarding Cleveland Project. Attendance and review of the data associated with this project to correlate changes with the CSWI watershed.

BNSF – Current update it was noted during the meeting that is was anticipated that they would need to start and update this spring. This grade raise has begun, and we understand they are working on a two-foot grade raise, as increased water levels has already impacted their tracks.

Stutsman County Highway Department - Provide projected cost to raise selected county or township roadways, at one and two-foot. These cost opinions were recently provided, by the County's engineer and are available for use in the study report.

Others – Additional local funds are likely required to support the expanded scope of services and additional cost share request.

These minutes were approved by consent by the Steering Committee at their February 17, 2025 meeting. These minutes are included in the Second Meeting summary.

If there are questions, please contact Michael Gunsch at 701-527-2134 or mgunsch@houstoneng.com.

Steering Committee Meeting #1 - was revmoved from these attachments

HoustonEngineering Inc.
3712 Lockport Street
Bismarck, ND 58503
Phone: 701-323-0200
Fax: 701-323-0300

Project Status and Invoice Description

HEI Project No.:	**12808-00001**
Client	**Stutsman County Commission/Water Resource District**
Project Name:	**Crystal Springs Watershed Initiative**

Billing Period: ***through February 1, 2025***

Professional engineering and consulting services related to the Crystal Springs Watershed Initiative and September 2024 agreement with the Stutsman County Commission/Stutsman County Water Resource District. The following is a summary of the work completed on each task during this invoice period.

Phase 001 – Hydrologic Watershed Evaluation

- Area-Capacity data was created for the four primary lakes based on the ND Game and Fish Bathymetry and most recent LIDAR topography. This has provided insight into the storage capacity of each lake and how it has been utilize by historic runoff and will accommodate future runoff and changes in lake flooding elevations.
- A review was completed for the watershed and contributing areas utilizing updated LiDAR information. This data was integrated into the State of North Dakota's NDRAM 2D Base Level Engineering (BLE) Hydrologic/Hydraulic model. This model was utilized as it uses an existing FEMA/State of North Dakota approved HMS hydrology model. The flow results are then imported into a HEC-RAS hydraulics model which produces resulting changes in the lake system and projected water surface elevations.
- Use of the NDRAM 2D BLE model for event-based runoff, contributing watershed area, rainfall and snowmelt runoff is ongoing.

Phase 002 – Groundwater Influence Review

- A review was conducted of available groundwater wells within the watershed. This provided preliminary conclusions related to the Central Dakota Aquifer and local groundwater levels. A determination of specific groundwater inflows into the lake system is outside the scope of this study, though a generalization its influence on lake levels is being considered. It was noted there is a direct correlation between the lake and the surrounding groundwater levels.
- A meeting with the NDDWR has been scheduled to discuss our preliminary findings.

Phase 003 – Hydraulic Floodwater Removal Alternatives

- Various alternative routings were considered for the removal of excess floodwaters. Most were discounted based on various factors including distance, topography costs and property impacts. The selected preferred alignment is Alternative 4B, which is located along the north side of Interstate #94. This is the shortest system with the least pumping requirements, has available ROW for installation as well as an available natural tributary outfall into the Long Lake Creek watershed.
- A preliminary InfoWater hydraulic pipe and pump system model has been created along the selected alignment, with the proposed system capacity remaining to be determined.

Phase 004 – Regulatory Considerations

- Work on regulatory issues has included contacts with various agencies to determine their concerns and comments regarding the excess floodwater removal project. These related around water quality, stream flows and timing, all which will need to be addressed more during preliminary design. The specifics related to the influence and impacts to properties and USFW easements are outside the scope of this study and would be more fully documented during preliminary design.

Phase 005 – Water Quality Comparison – Influence Area

- A review of available lake water quality was conducted to determine the variables between the CSWI water quality and that of the downstream receiving water bodies. The best removal location for excess floodwaters has been designated at Stink Lake, which has the lowest CSWI system water quality, but is still better than the quality downstream, specifically in the Long Lake National Wildlife Refuge.

Phase 006 – Economic Analysis (Feasibility Level)

- Limited work has been undertaken related to the system installation costs or the damage prevention. NDDOT has provided cost data on the Interstate #94 system, and we have requested information on grade raise costs for roadways and the rail system but are still waiting for that information. The benefit to land on which waters would be removed will be based on acres determined using area-capacity curves and then generalized for agricultural proposes. A second cost inquiry will be made at the second Steering Committee meeting.

Phase 007 – Steering Committee and Feasibility Guidance

- The Steering Committee met for its organizational meeting on September 11, 2024 after which fundraising for the local share started.
- The agenda and presentation at the meeting were drafted and sent to the Steering Committee and will be posted on the County Web Site after committee approval.
- Considerable effort was made to review and determine who should obtain or was interested in obtaining information on the project. Given the public interest an email of those interested was created and will be used to disseminate project status updates.
- While not include in the scope of services, we assisted in the securing of the local cost share funds. This included a review and comments on the BNSF agreement that was create for their participation.
- A status memorandum is being prepared to share with the Steering Committee at their second meeting, which is scheduled for February 11th at the Crystal Springs Bible Camp.

Phase 008 – Future Funding Opportunities

- Services provided in this area was primarily having discussions related to funding options and agencies.
- Assistance was also provided to the Stutsman and Kidder County Emergency Managers to include the CSWI into their Hazard Mitigation Plans, which makes them eligible for future Hazard Mitigation funding opportunities.

Phase 009 - Feasibility Report

- Completed a preliminary layout for the report and some drafting of various sections is ongoing.

Comments and Issues:

- The overall study effort experienced a delayed start due in part to the local fund raising that was requested to offset county expenses. *Therefore, while the targeted completion date remains March 2025, this may need to be extended, based on study findings and coordination time.* A decision on an extension request will occur later in March.
- The second meeting of the Steering Committee has been scheduled. The number of remaining meetings will depend on study results, however, there will be at least one more for the preliminary draft report and potentially one more as part of the final report.
- To control expenses there was no markup on the Peritiacon Invoice.

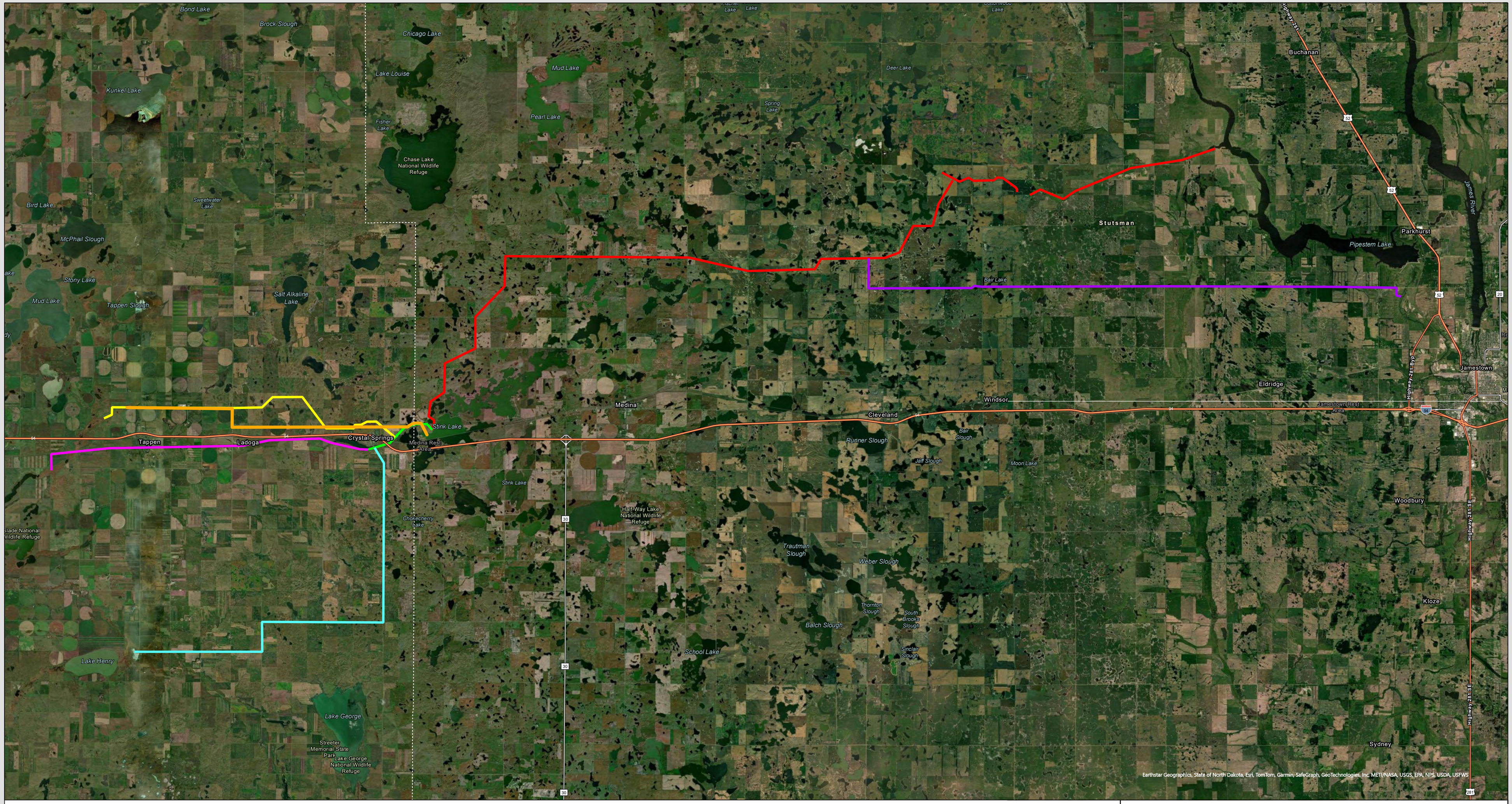
See accompanying invoice for personnel cost breakdown.

HEI Invoice	$ 53.321.00
Peritiacon Invoice	$ 33,195.00
Total Invoice	***$ 88,516.00***

Crystal Springs Watershed Initiative

	Contribution		Percent of Local	
o Stutsman County Commission and WRD (Roadway Contribution)	$82,100		67%	
o Kidder County Commission and WRD	$0	NA		
o Burleigh County WRD - Notified	$0	NA		
o State Water Commission (i.e., SWC Secretary/DWR Director)	$99,900	45% Cost Share Grant		
o USFWS Local & Regional – Long Lake NWR		NA		
o BNSF – St. Paul	$0	$20,000 In Kind Information	0%	In-kind
o NDDOT – State Office referred to Valley City District		NA		
o Ruele Lake Landowners	$10,000	Unconfirmed	8%	5K limit?
o Crystal Springs Bible Camp (and Supporters)	$25,000		20%	
o Crystal Springs & Stink Lake Homeowners and adjacent Landowners (Via Camp)	$5,000	$0	4%	
o City of Medina	$0	$0	0%	
Total Study Cost	**$222,000**		**100%**	
Local Share Required	$122,100			
Commited	$40,000			
Remaining	$82,100			

222000
0.45
$99,900.00



N

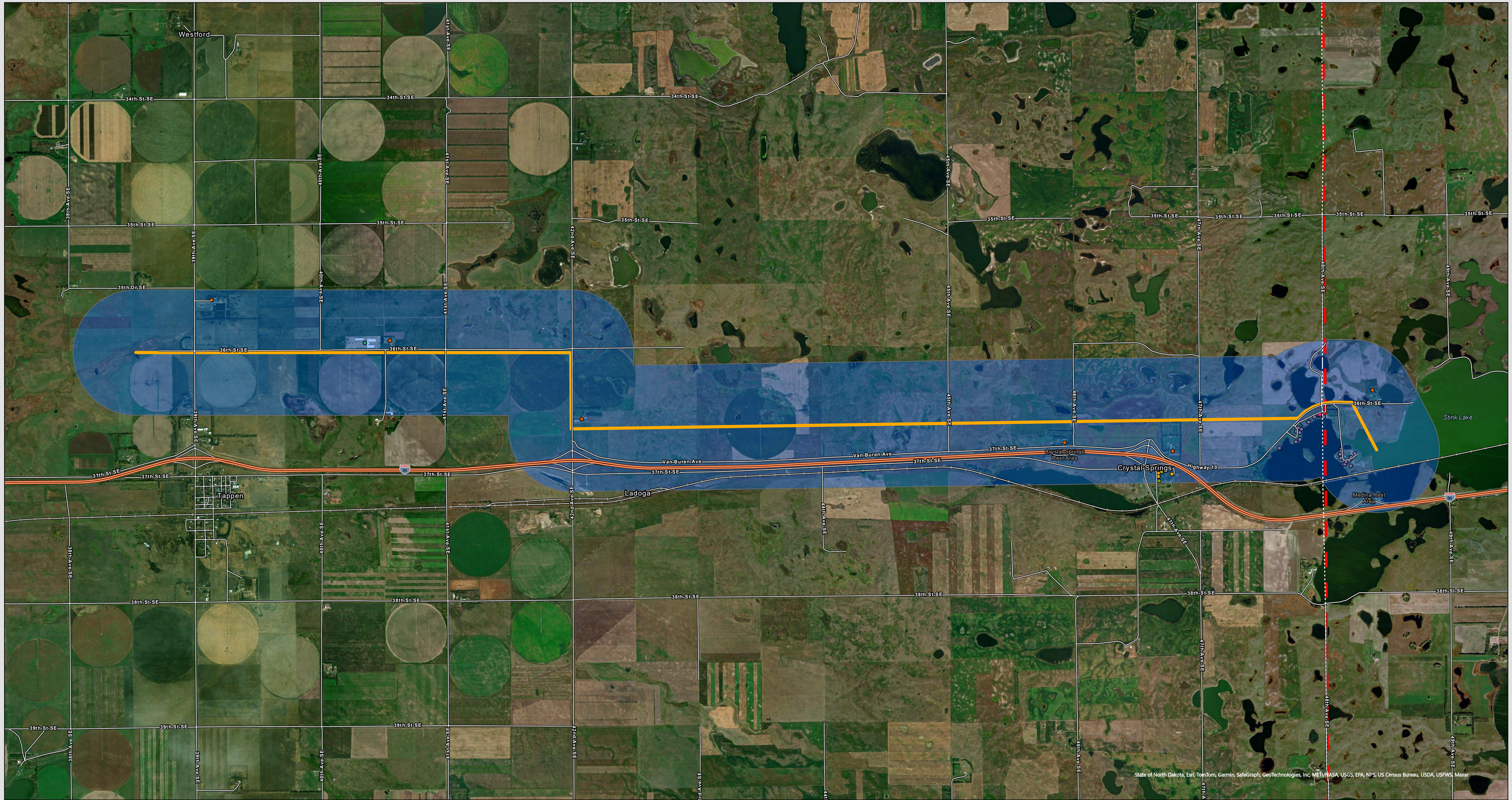
0 1.5 3 6

Miles

Outlet Options

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	TP	MG	9356-0001	1/17/2025	1

HOUSTON engineering, inc.



Habitable Buildings Count
Kidder County: 25
Stutsman County: 13
Total: 38

Legend

Habitable Buildings
Type
- Business
- Farmstead
- Cabin
- Cain
- Church
- House
- Rest Area

- Pipeline Route
- County Boundaries
- Pipeline Buffer - Half Mile

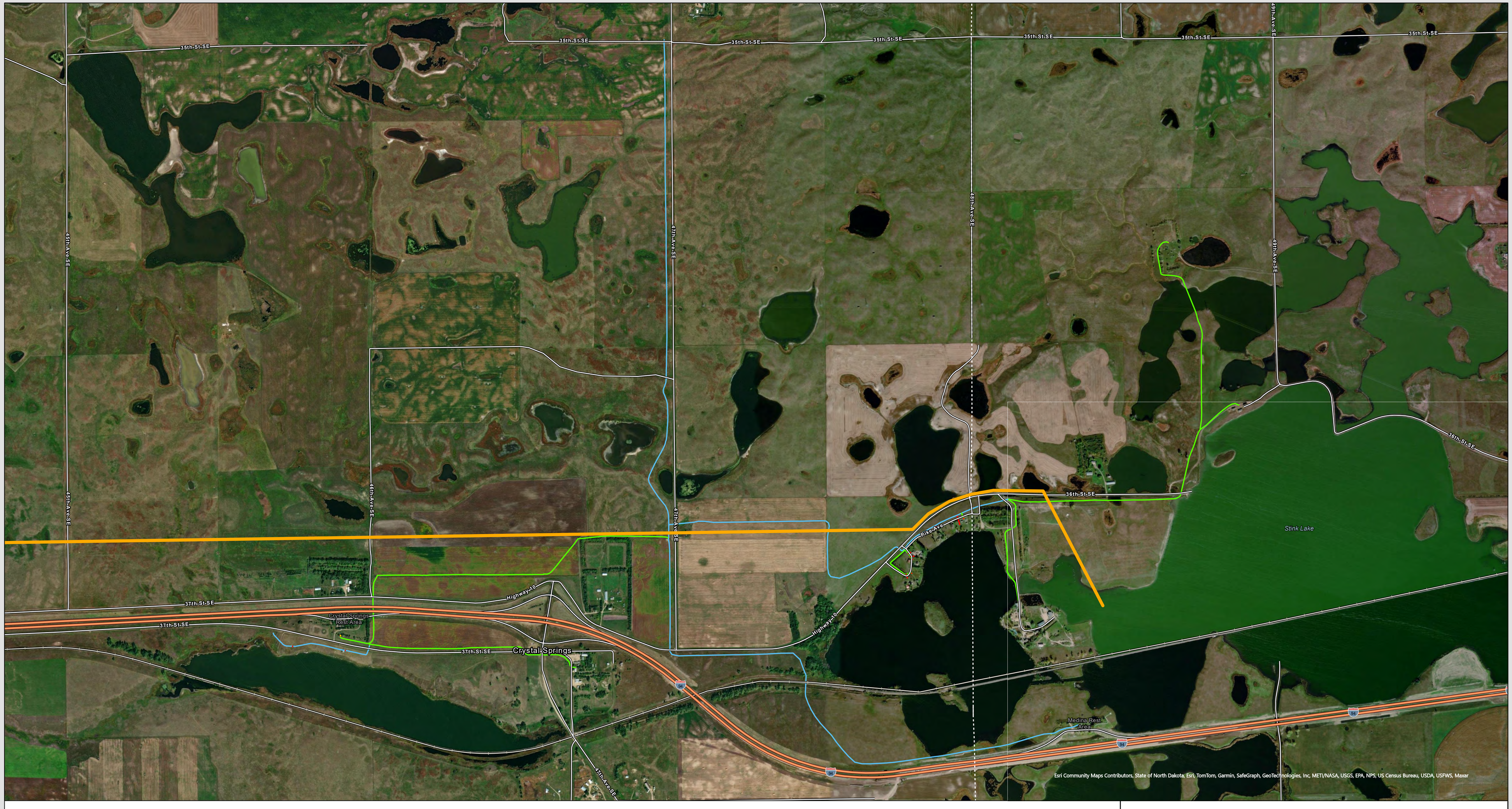
N

0 0.25 0.5 1
Miles

Habitable Buildings Near Crystal Springs Pipeline

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	TP	MG	9356-0001	1/21/2025	1

HOUSTON engineering, inc.



Legend

Pipelines
- 1"
- 1.5"
- 2"
- 3"
- Proposed Crystal Springs Discharge Pipeline Route

N

0 0.13 0.25 0.5
Miles

Stutsman County WRD Pipeline Routes

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	TP	MG	9356-0001	2/11/2025	1

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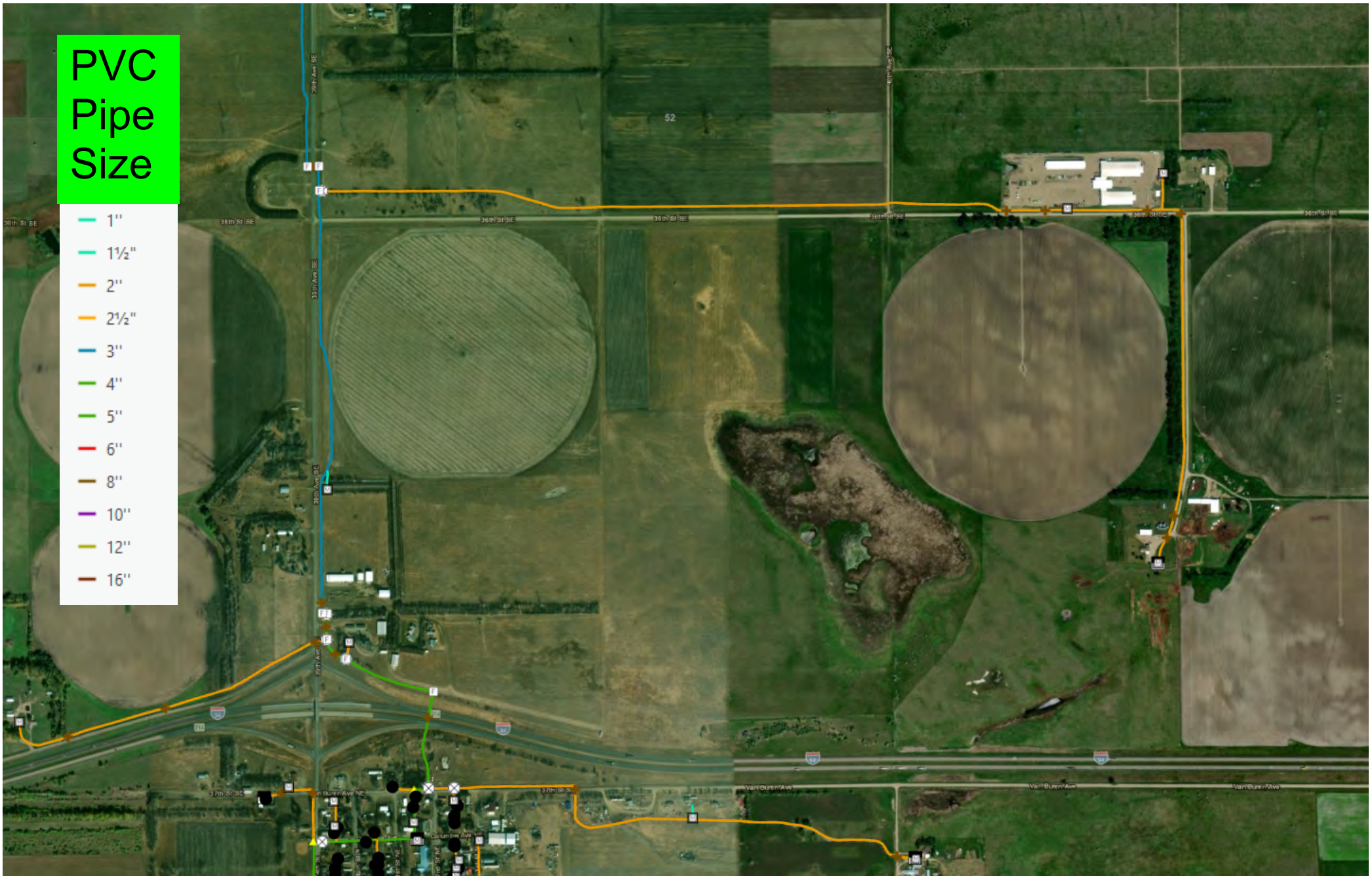
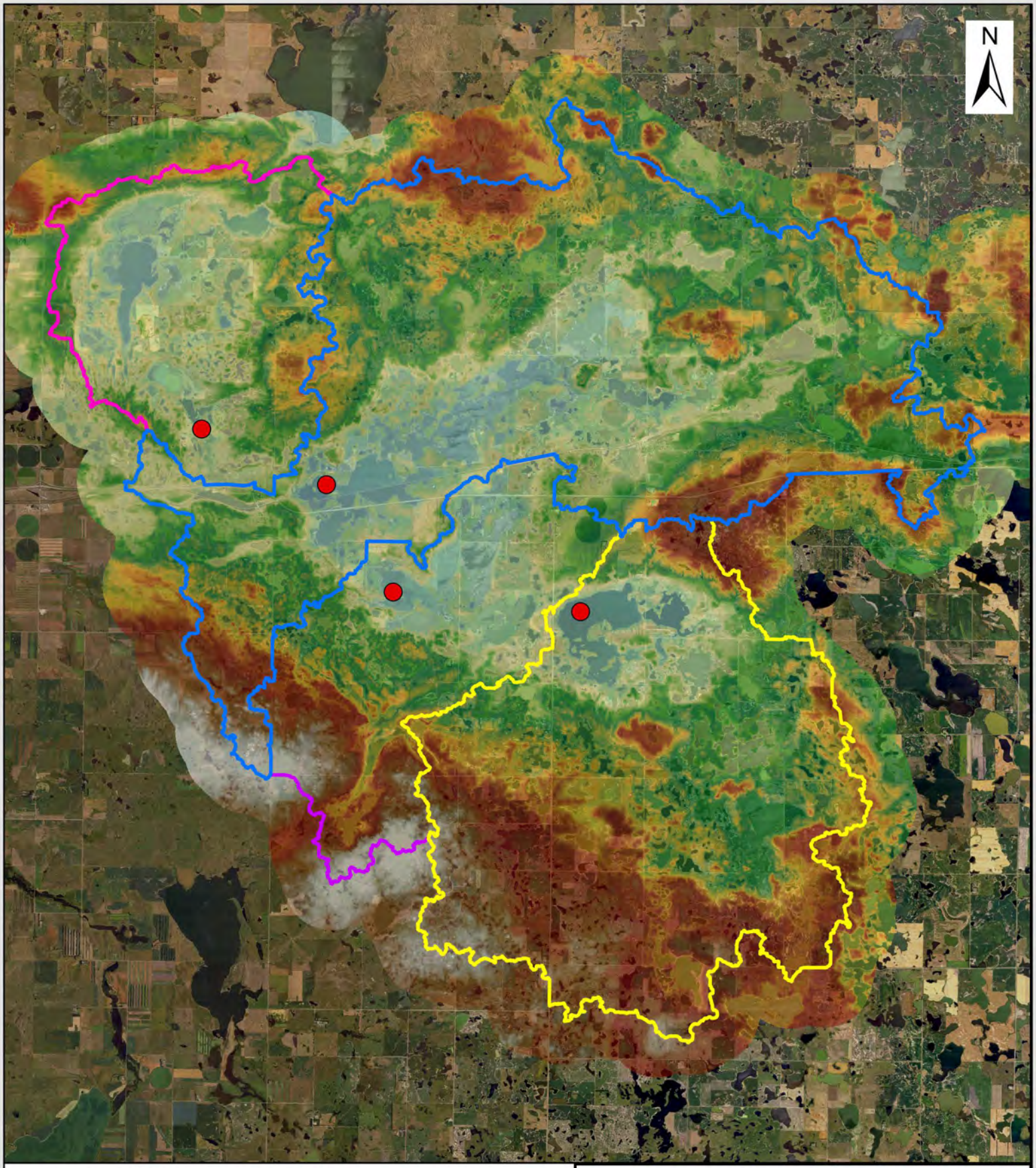
Tappen Area Watelines





Watershed Drain Points

LiDAR DEM (2019-2021)

Elevation in Meters

647.566

531.69

Watersheds

1 (101.3 Square Miles)

2 (31.9 Square Miles)

3 (32 Square Miles)

4 (70.2 Square Miles)

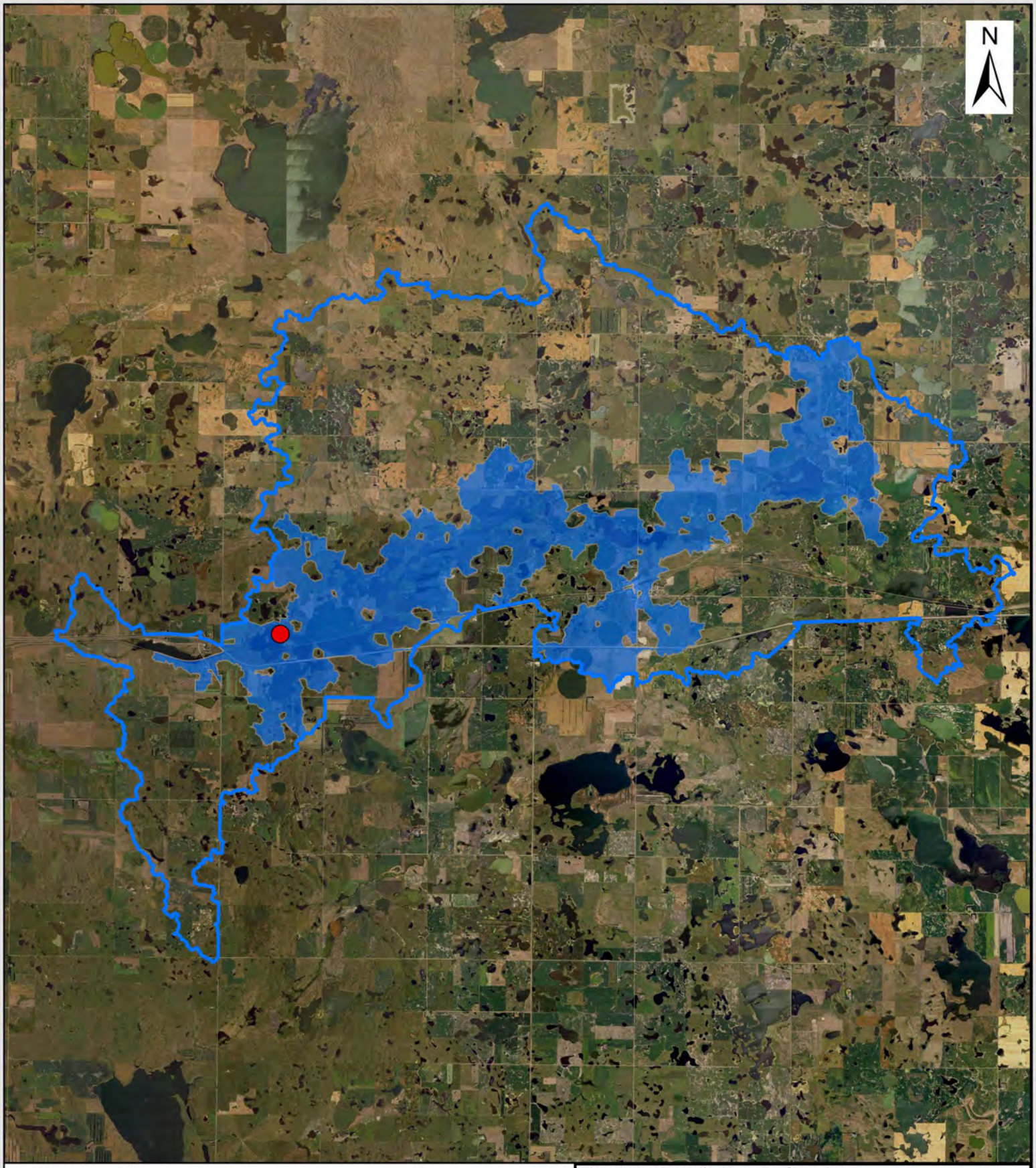
0 0.751.5 3

Miles

Figure 1: Watershed Surface Area

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	KZS	MG	12808-0001	2/14/2025	

HOUSTON engineering, inc.



Watersheds

1 (101.3 Square Miles)

Contributing Surface Area

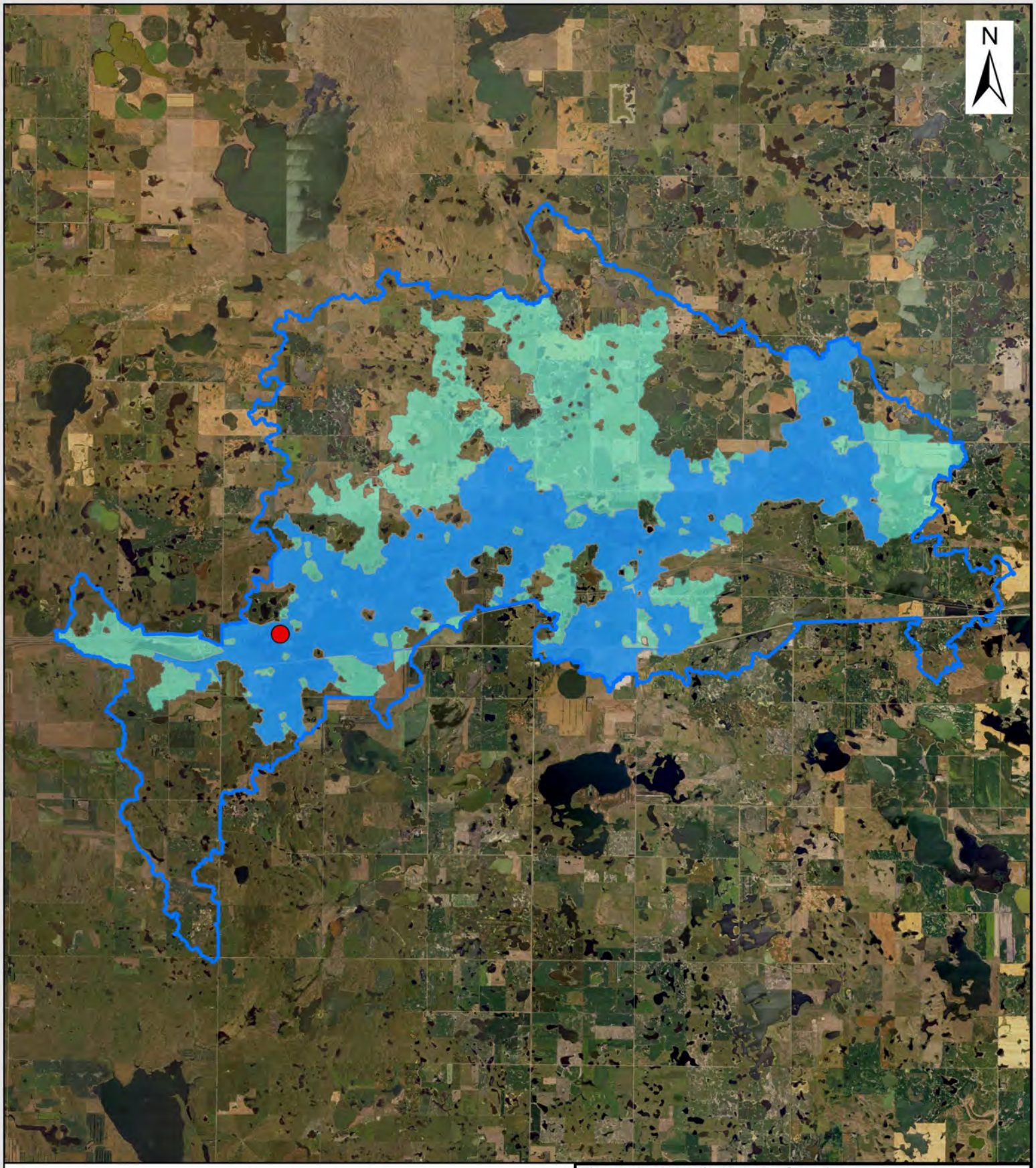
1 (25.8 Square Miles)

0 0.5 1 2 Miles

Figure 2: Contributing Surface Area (5.3 inch Rain Fall)

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	KZS	MG	12808-0001	2/14/2025	

HOUSTON engineering, inc.



Watersheds
1 (101.3 Square Miles)

Contributing Surface Area
1 (25.8 Square Miles)

Contributing Surface Area (Double Rain Fall)
1 (50 Square Miles)

0 0.5 1 2
Miles

Figure 3: Contributing Surface Area (11 inch Rain Fall)

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	KZS	MG	12808-0001	2/14/2025	

HOUSTON engineering, inc.

Surface Water Channel Connection

Stink Lake

4 FT
LENGTH:0 FT
TOP:1748
INLET INV:1744
OUTLET INV:1744

4 FT
LENGTH:0 FT
TOP:1750
INLET INV:1746
OUTLET INV:1746

0 FT
LENGTH:0 FT
TOP:0
INLET INV:0
OUTLET INV:0

1.5 FT RCP
LENGTH:56 FT
TOP:1806.9
INLET INV:1805.4
OUTLET INV:1803.5

2 FT RCP
LENGTH:46 FT
TOP:0
INLET INV:0
OUTLET INV:0

1.25 FT RCP
LENGTH:56 FT
TOP:0
INLET INV:0
OUTLET INV:0

1.5 FT CMP
LENGTH:98 FT
TOP:1813.4
INLET INV:1813.4
OUTLET INV:1799.5

1.5 FT CMP
LENGTH:102 FT
TOP:1816.9
INLET INV:1815.4
OUTLET INV:1795

2.5 FT RCP
LENGTH:220 FT
TOP:1795
INLET INV:1792.5
OUTLET INV:1791.8

3.5 FT
LENGTH:48 FT
TOP:0
INLET INV:0
OUTLET INV:0

1.5 FT RCP
LENGTH:56 FT
TOP:1811.8
INLET INV:1810.3
OUTLET INV:1807

2 FT RCP
LENGTH:68 FT
TOP:0
INLET INV:0
OUTLET INV:0

1.5 FT RCP
LENGTH:56 FT
TOP:1757.7
INLET INV:1756.2
OUTLET INV:1754.6

3 FT
LENGTH:48 FT
TOP:0
INLET INV:0
OUTLET INV:0

2 FT
LENGTH:42 FT
TOP:0
INLET INV:0
OUTLET INV:0

2 FT
LENGTH:59 FT
TOP:0
INLET INV:0
OUTLET INV:0

1.5 FT RCP
LENGTH:78 FT
TOP:1742.8
INLET INV:1741.3
OUTLET INV:1737.5

1.5 FT CMP
LENGTH:98 FT
TOP:1762.1
INLET INV:1760.6
OUTLET INV:1750.5

2.5 FT RCP
LENGTH:252 FT
TOP:1751.2
INLET INV:1748.7
OUTLET INV:1737.8

4 FT RCP
LENGTH:64 FT
TOP:1742
INLET INV:1738
OUTLET INV:1738

4 FT
LENGTH:64 FT
TOP:1742
INLET INV:1738
OUTLET INV:1738

1.5 FT RCP
LENGTH:56 FT
TOP:1779.6
INLET INV:1778.1
OUTLET INV:1776.5

1.5 FT RCP
LENGTH:74 FT
TOP:1777.1
INLET INV:1775.6
OUTLET INV:1769.8

2.5 FT RCP
LENGTH:180 FT
TOP:1759
INLET INV:1756.5
OUTLET INV:1753

1.5 FT RCP
LENGTH:56 FT
TOP:1757.3
INLET INV:1755.8
OUTLET INV:1754.2

Highway-10
Rike Ave
36th St SE
37th St SE
38th St SE
47th Ave SE
48th Ave SE
49th Ave SE
51st Ave SE
70th County Rd
Lake Isabel Rd

Esri Community Maps Contributors, State of North Dakota, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Maxar

Legend

- Culverts

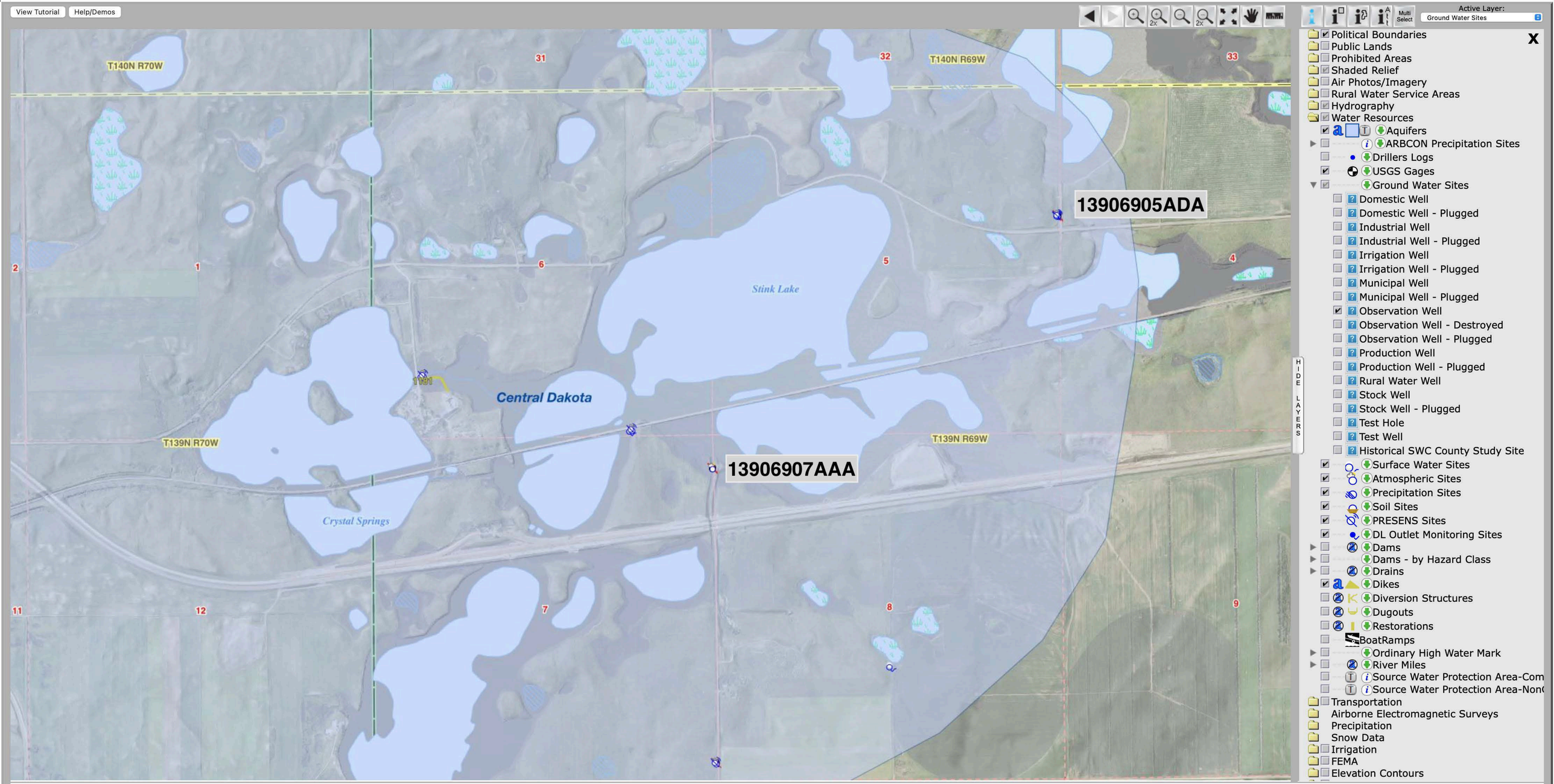
N

0 0.25 0.5 1
Miles

Crystal Springs & Stink Lake Culvert Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	EN TP	MG	9356-0001	2/11/2025	1

HOUSTON engineering, inc.



ND Department of Water Resources MapService

The following table represents the data submitted by the Valley City District for this location along with the annual precipitation from the Tappen Station, located approximately 7 miles west of Stink Lake. Based on the data below, the current 10-year average elevation increase is 8.76" per year, however, this rate does not account for annual precipitation or storage.

Year	Annual Precipitation (in)	Recorded Water Surface Elevation (ft)
2010	19.53	1744.90
2011	17.86	1746.30
2012	14.99	
2013	17.46	
2014	15.02	
2015	14.08	1748.51
2016	17.15	
2017	10.78	
2018	17.72	
2019	23.20	

Interstate 94 RP 223.9 - Historic Water Surface Elevations

Recommendations

This elevation maximizes the protection of the Interstate while minimizing the impacts to the nearby rest area and ramps. This would result in a finished subgrade elevation of approximately 1761.9'. Assuming 18" for aggregate base and 8.5" pavement surfacing, the edge of pavement elevation would be 1764.2'.

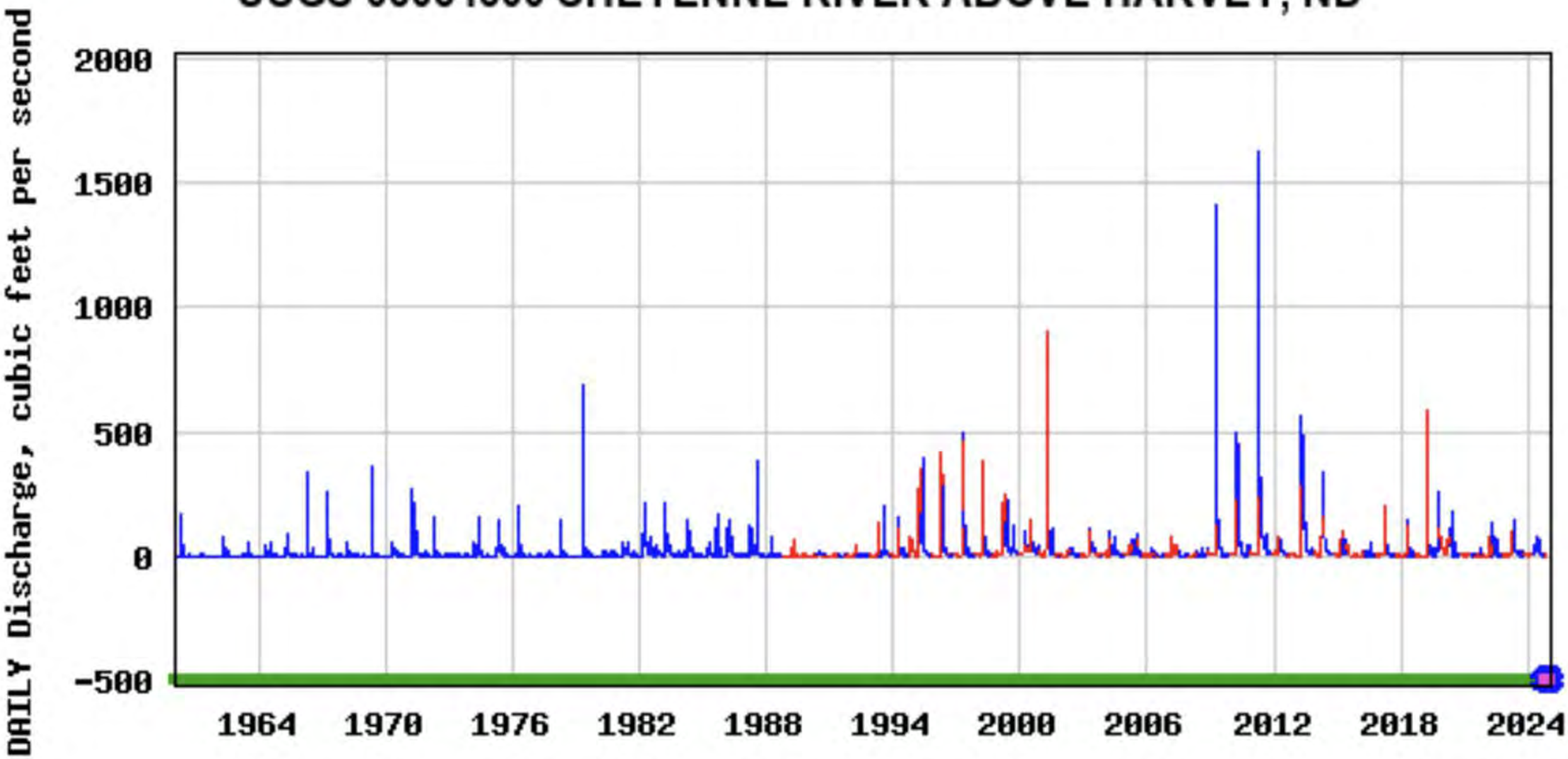
Culvert Recommendations:

As part of the analysis, the 3 existing culverts within the Stink Lake basin were analyzed for compliance with the ND Stream Crossing Standards and the current NDDOT design standards. The NDDOT policy concerning submerged culverts is to extend hydraulically adequate culverts with the use of temporary earthen berms when the depth of water does not exceed 8 feet. Beyond 8 feet of depth, a hydraulically adequate culvert can be replaced instead of extended due to constructability concerns.

Several culvert conditions in the area have changed since the previous grade raise. This increase in tailwater at the crossings resulted in an approximately equal increase in headwater and the culverts no longer meet the allowable headwater values according to the North Dakota Stream Crossing Standards.

USGS

USGS 05054500 SHEYENNE RIVER ABOVE HARVEY, ND

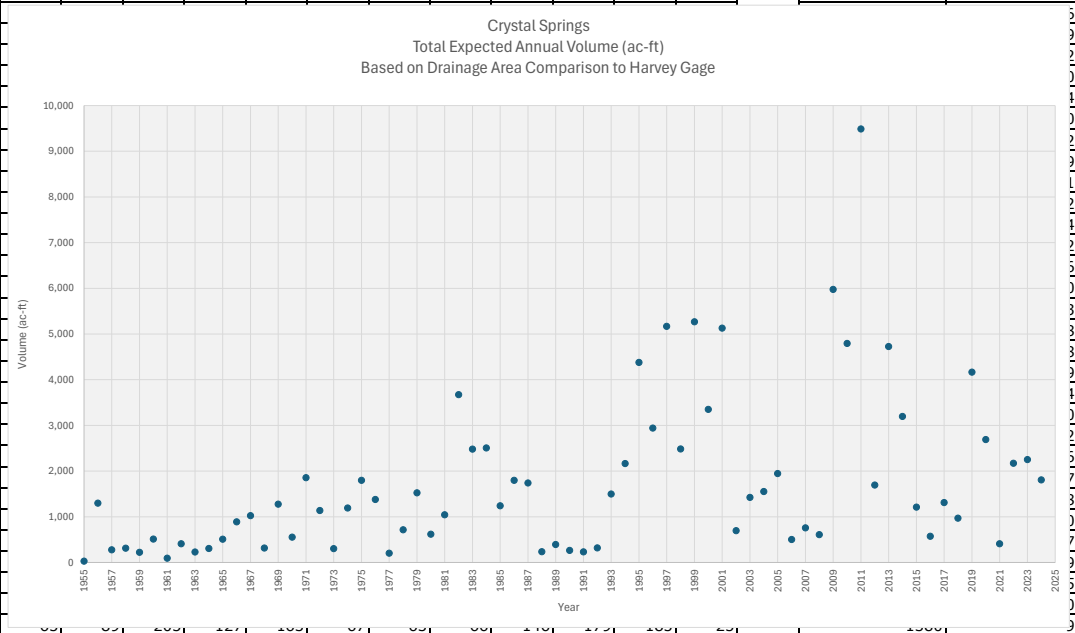


Wells County, North Dakota
Hydrologic Unit Code 09020202
Latitude 47°42'10", Longitude 99°56'55" NAD27
Drainage area 424 square miles
Contributing drainage area 154 square miles
Gage datum 1,548.86 feet above NAVD88

Output formats
HTML table of all data
Tab-separated data
Reselect output format

Convert USGS Mean Monthly Discharges to Monthly Volume Ac-Ft

YEAR	Based on Calendar Year (not water year)												Harvey Gage		crystal springs contributing watershed
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annual Volume	ac-ft / sq.mi.	Total Expected Annual Volume
													Sum - Ac-ft per Calendar year		Translate ac-ft
days	31	28	31	30	31	30	31	31	30	31	30	31		154	25.8
		29													
1955	0	0	0	0	0	0	0	0	0	87	62	16	165	1	28
1956	7	0	676	4124	1174	1142	215	56	94	81	165	23	7757	50	1300
1957	9	0	331	253	263	142	97	65	126	157	146	68	1657	11	278
1958	39	198	440	296	146	123	427	6	26	66	89	6	1862	12	312
1959	0	0	400	178	159	67	25	0	11	366	58	55	1319	9	221
1960	19	0	1882	343	411	202	11	57	44	34	42	10	3055	20	512
1961	2	11	111	184	101	18	4	2	33	29	48	6	549	4	92
1962															410
1963															230
1964															304
1965															508
1966															888
1967															1024
1968															315
1969															1277
1970															554
1971															1857
1972															1135
1973															302
1974															1192
1975															1796
1976															1380
1977															203
1978															715
1979															1522
1980															618
1981															1042
1982															3672
1983															2480
1984															2506
1985															1240
1986															1799
1987															1739
1988															236
1989															391
1990															264
1991															231
1992	29	216	707	181	132	83	93	47	100	93	140	86	1907	12	319
1993	8	25	1672	458	298	756	3622	1383	278	194	181	65	8940	58	1498
1994	19	8	3370	2035	568	649	258	113	153	2121	2321	1304	12919	84	2164
1995	191	35	8965	6480	7176	1624	910	267	118	159	199	2	26126	170	4377
1996	0	0	2214	9866	3136	940	415	257	111	183	226	206	17554	114	2941



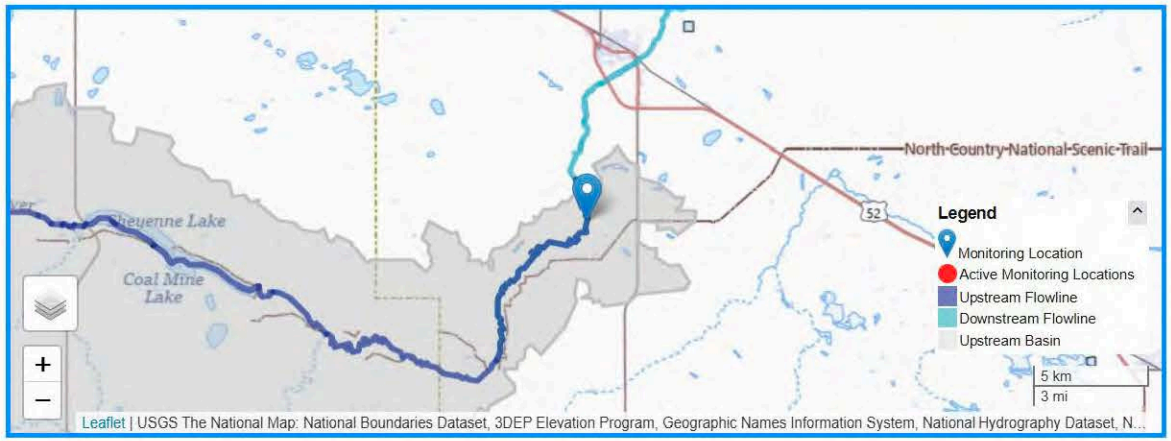
1997	191	157	2687	19303	5429	1095	904	200	69	177	296	330
1998	191	733	5897	4588	1113	436	340	56	180	163	631	505
1999	392	271	5091	6397	6905	2243	1174	3652	2880	1070	750	607
2000	414	1064	2416	1238	1648	4600	4144	1445	970	530	1089	435
2001	176	134	12740	7938	2318	3005	2859	670	180	244	258	95
2002	24	7	118	1041	1236	631	293	125	126	183	233	137
2003	0	0	1451	1440	1549	1738	1094	243	115	174	255	441
2004	713	0	1015	1761	1119	1964	793	371	242	247	414	621
2005	676	540	2195	458	676	1363	3923	830	68	285	384	213
2006	206	194	313	1142	388	186	32	11	35	106	174	211
2007	75	0	1039	348	601	1505	280	95	101	134	189	156
2008	124	97	159	476	215	515	221	172	250	399	678	323
2009	240	217	2091	24444	4519	1845	1058	283	101	290	333	247
2010	244	189	1912	15989	3825	1904	594	266	1119	719	1363	490
2011	539	534	1070	31995	9770	4909	2902	2460	738	584	538	583
2012	544	598	2121	2678	1845	928	328	116	73	283	352	240
2013	176	124	154	3237	9721	8610	2945	713	320	1027	726	449
2014	286	22	1562	7099	5214	1946	1248	515	349	298	268	267
2015	83	179	1396	785	1771	1821	596	84	55	106	192	160
2016	144	227	452	601	221	195	423	298	296	175	198	199
2017	282	329	1383	2880	1310	522	206	102	85	152	325	252
2018	95	7	101	3320	64	982	585	32	127	218	155	105
2019	25	0	1931	3237	1427	833	1051	142	2654	6659	4255	2650
2020	990	765	2687	4588	2798	1000	2146	162	149	274	293	199
2021	82	122	390	365	329	182	90	97	53	422	245	65
2022	0	51	1771	1952	1642	3344	2841	576	205	152	224	209
2023	182	205	239	2458	6186	1553	978	231	244	301	517	347
2024	256	656	664	1089	2484	2416	2398	405	275	145	0	0

30838	200	5166
14833	96	2485
31432	204	5266
19993	130	3349
30617	199	5129
4154	27	696
8500	55	1424
9260	60	1551
11611	75	1945
2998	19	502
4523	29	758
3629	24	608
35668	232	5976
28614	186	4794
56622	368	9486
10106	66	1693
28202	183	4725
19074	124	3196
7228	47	1211
3429	22	574
7828	51	1311
5791	38	970
24864	161	4166
16051	104	2689
2442	16	409
12967	84	2172
13441	87	2252
10788	70	1807

Removal Days

Days	Months
479	**16**
86	**3**
239	**8**
161	**5**
61	**2**
29	**1**
66	**2**
49	**2**
210	**7**
136	**5**
21	**1**
110	**4**
114	**4**
91	**3**
Days Averaage **123**	**4**

1.98 ac-ft/cfs-day
10 cfs system



Open Budget

Operating Expenses
$32.83 Million - 100.00% of all Operating Expenses

Service
Transportation
$9.41 Million - 28.65% of all Operating Expenses

Department
Road and Bridge
$9.39 Million - 28.60% of all Operating Expenses

$9.39 Million 2025

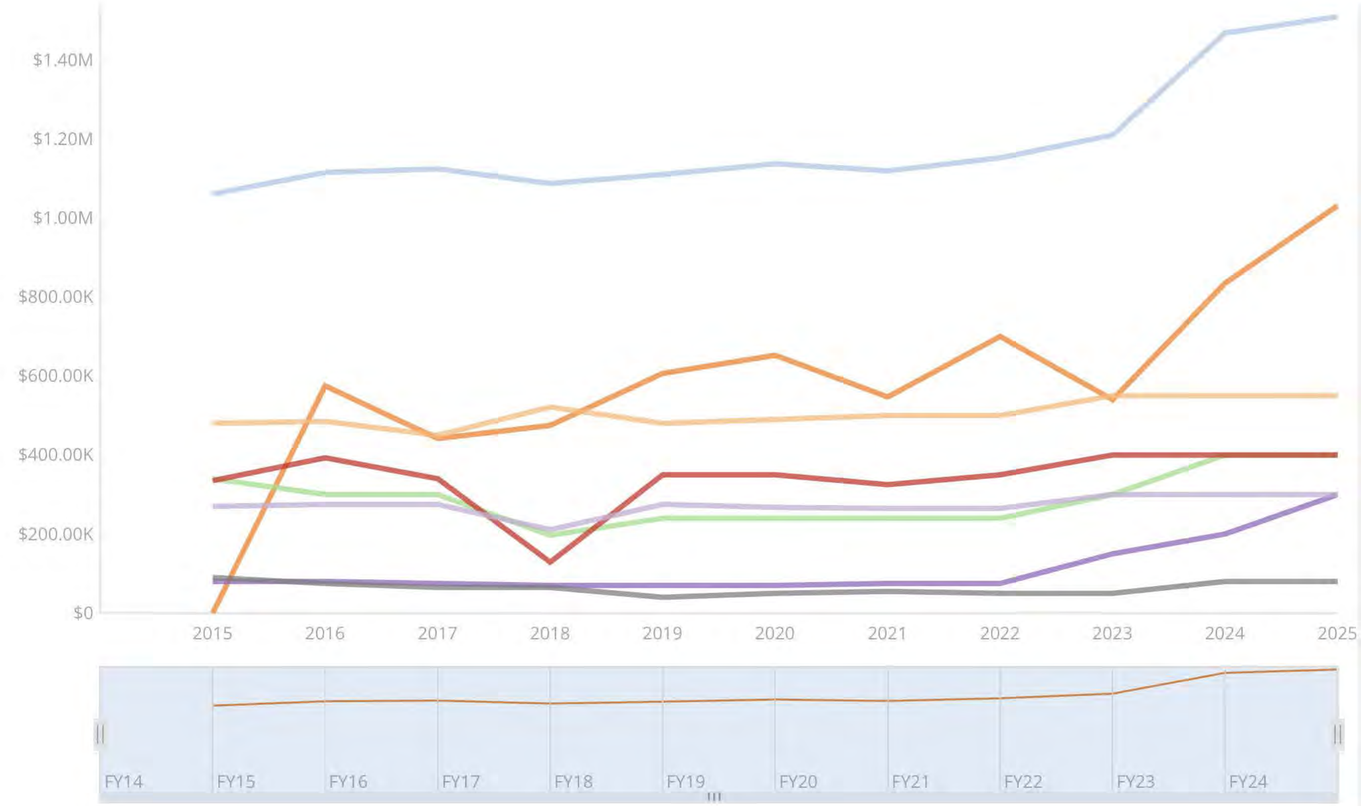
Road and Bridge broken down by Category

Within Transportation

Export Share

← Back

Show: Approved Amount



Total Show

- Transfer
- Salaries-Road & Bridge
- Purchase of Equipment
- Overlaying and Resealing
- Road Construction
- Gas
- Gravel and Crushing
- Group Health Insurance
- Culverts and Bands
- Maintenance and Repairs
- NDPERS
- Building Improvements
- Engineering
- FICA
- Overtime-Road & Bridge

Snapshot
Pie Chart
Over Time

Crystal Lake Watershed Initiative
Steering Committee - Meeting #3

To: Steering Committee
From: Michael H. Gunsch, PE, CFM, Senior Project Manager
Josh Loosmore, Peritiacon
Subject: Project Status Update and Presentation Information
Date: ***July 25, 2025 Meeting Summary***
Project: HEI No. 12808-0001-007

The following is a summary of the July 25, 2025 Steering Committee Meeting. These minutes are a tabulation versus a transcript of the discussions.

Those in attendance included Anthoney Roorda (Stutsman County WRD), Levi Taylor (Stutsman County Commission) Les Ressler (Reule Lake), Don Mittleider (Kidder County), Tim Brenner (Crystal Springs Bible Camp), Charlie Dronen, Kidder County Commission, Dan Peltier (BNSF – on Teams). Michael May (Interstate Engineering on Teams), Michael Gunsch (HEI), Josh Loosemore (Peritiacon).

Scope and Budget Amendment – SWC Cost Share and Local Funding

Adequate local funding was secured ($22,000) to match the authorized SWC cost share funding to complete the additional groundwater evaluation. The County Commission authorized the feasibility study to proceed with the additional scope of services if local funding was secured. Total amendment was in the amount of $40,000.

Feasibility Study Schedule – Summary

1. Web Grant Approved – DWR Agreement Addendum #1
2. Local Funding secured – for scope revision (checks pending)
3. Evaluation of the watershed and outlet alternatives has been completed
4. Hydrologic and expanded Groundwater Evaluation is underway
5. Joint County Commission and WRD meeting – July 30, 2025
6. Feasibility Study Report (Pending groundwater evaluation and HMGP inquiry)

Project Updates:

The following documents were presented and discussed at the meeting are attached.

1. **Crystal Lake – Second Steering Committee Meeting Summary**
    a. This document was reviewed and accepted without comment or objection

2. **Project Status Report and Invoice Description**

3. **Alternative Alignment Hydraulics (1)**
4. **Alignment – USFWS Regulatory (2)**
5. **CWSI Water Balance Equation (3)**
6. **Contributing Areas (4)**
7. **Lake Elevations and Controls (5)**
8. **Historic Lake Elevations (6)**
9. **Area Capacity Data – Removal Requirements (Water Balance) (7)**
10. **CWSI System Components and Opinion of Probable Costs (8)**
    a. Funding Options – HMGP, SWC
    b. Preliminary Engineering Report Cost
11. **Annual - O&M Expenses (9 and 9A) – initial years**
12. **Head loss and System Efficiency in pump system and benefits (10)**
13. **O&M Cost Projections for Alternatives – Supports the Preferred Alternative (11)**
14. **Downstream Impact Sheets (12)**
15. **Economics**
    a. **The total economic benefits were roughly determined for this feasibility study based on a 10-year planning horizon, and in general include the following, which are rough approximations and remain to be finalized.**
        i. BNSF – Grade Raise 3 more at $3.5 Million each = $10.5 million
        ii. Bible Camp Relocation = $11 Million
        iii. NDDOT – Single Grade Raise (3 feet) = $10 million (TBD)
        iv. 500-600 acres of Ag Land ($2,000/ac) = $1.2 million
            1. Land Value of inundated properties - no production recovery
        v. County Roadways ($1.5 million/mile) = $3 million
        vi. Interstate Commerce BNSF Lost Revenue = TBD

    Total Approximation $35.7 million + Lost Revenues
16. **Tributary Discharges – Impact Evaluation**
    a. See comments in Summary of Topics

17. **Joint Stutsman County Commission and Water Resource District Meeting**
    a. July 30, 2025 – 9 am

18. **Public Informational Meeting – Feasibility Study**

SUMMARY OF TOPICS

The preliminary findings supported the conclusion that groundwater is clearly influencing and affecting lake elevations. That portion of the feasibility study remains on going and was delayed by local funding and the conclusion of the SWC Cost Share approval process. A meeting held with the NDDWR on July 23, 2025 to discuss their AEM Groundwater Study, they are not anticipating any further evaluation of the collected data, except for how it is applicable to future water permit allocations. They are supportive of the project and are interested in reviewing the final feasibility study report.

The preferred alternative is clearly the western route along the north side of Interstate #94, with a proposed 20 cfs capacity, based on the hydrologic evaluation – groundwater evaluation continues.

The discharge of waters into the downstream tributary has been evaluated based on both 10 cfs and 15 cfs long term releases. The existing crossings upstream from the Long Lake Refuge discharge all currently comply with the ND Stream Crossing Standards, including with the addition of the project discharges. The only crossing not in compliance is the BNSF Railroad crossing, which can be upgraded by installing an additional 42" culvert.

To accommodate and mitigate for project discharges all crossings would be upgraded with the installation of an additional 24" culvert or equivalent capacity. The needs at each crossing will be evaluated during the preliminary design phase. These improvements will be installed as a project cost at no expense to Kidder County, NDDOT or Townships. The need for easements along this corridor for any channel improvements is a regulatory determination that will be made during the permitting process.

This summary is being provided to the following via email and posted on the County Web Site:

- Crystal Springs Steering Committee
- Stutsman County Commission
- Stutsman County Water Resource District
- Crystal Springs Interested Parties Email Group – Includes doner list

MEETING ACTION ITEMS…

Steering Committee – Third Meeting Summary

Request to the Stutsman County Commission and Water Resource District

- ✓ Funding options for the Preliminary Engineering Report
- ✓ Acceptance of the Feasibility Study Report on completion

NDDOT – provide comments on the draft report when provided.

BNSF – provide comments on the draft report when provided. Note interest in upgrading their stream crossing as part of the project expense or general compliance.

Stutsman County Highway Department – provide comments on the draft report when provided.

Others – Given the local funding provided there is a notable interest and support to proceed and implement a solution to this historic flooding situation.

These minutes were approved by consent by the Steering Committee at their _____ meeting. These minutes are included in the Third Meeting summary.

If there are questions, please contact Michael Gunsch at 701-527-2134 or mgunsch@houstoneng.com.

HoustonEngineering Inc.
3712 Lockport Street
Bismarck, ND 58503
Phone: 701-323-0200
Fax: 701-323-0300

Project Status and Invoice Description

HEI Project No.:	**12808-00001**
Client	**Stutsman County Commission/Water Resource District**
Project Name:	**Crystal Springs Watershed Initiative**

Billing Period: ***through May 31, 2025***

Professional engineering and consulting services related to the Crystal Springs Watershed Initiative and September 2024 agreement with the Stutsman County Commission/Stutsman County Water Resource District. The following is a summary of work completed on each task during this invoice period.

Phase 001 – Hydrologic Watershed Evaluation

- Continued evaluation and expansion of NDRAM 2D BLE model based on field observations to refine contributing watershed area. Additional field evaluations for drainage and culverts were completed as well related to the outfall channel etc.
- Created a landowner listing for the additional PRESEN's stations and coordinated with the NDDWR regarding installation and operation for 2025.
- Expanded contour coverage to 1754-1755 due to continued waters surface increases. This is necessary to evaluate the storage capacity and inflows during the latest runoff season.
- Evaluated Reule Lake cabin lots and elevations for influence of water surface reductions. Provided summary to the HOA for discussion. Contact with developer related this review and Presens Station.
- Review BNSF ROW within the lake system.

Phase 002 – Groundwater Influence Review

- A continued review of available groundwater wells and potential movement within the Central Dakota Aquifer and local groundwater influence.
- *Given the groundwater influence more evaluation is required, which was addressed in a scope and budget amendment, contract extension and determination for additional web grants request to the SWC.*
- NDDWR grant application submitted and in the review process, it was decided for approval on consent at the June 12th meeting. Time related to the expanded services on hold until the funding is approved by the SWC and Stutsman County Commission. It is anticipated the primary review under this task will be over budget given the findings and direction.

Phase 003 – Hydraulic Floodwater Removal Alternatives

- Preferred Alternative was selected for a detailed evaluation and determination regarding the downstream stream conveyance and culvert conditions. This evaluation is underway, with preliminary indications that improvements along this system associated with the project are anticipated.
- Letter response sent to Kidder County Commission to address the questions they raised with the Stutsman County Commission.
- An InfoWater hydraulic pipe and pump system model was created along the selected alignment, with the proposed system and pipe size to be determined. Once the volume and rate of annual lake system inflows are determined the pump and pipeline can be sized.
- Considerable work was completed to evaluate the downstream tributary and system conveyance. This as modeled to determine impacts using the 2D HEC-RAS NDRAM model. Culverts along this system were reviewed and documented for condition and consideration of use. There were multiple crossings that needed to be evaluated, and the final modeling remains to be completed at the time of this invoice.

Phase 004 – Regulatory Considerations

- Limited work on the regulatory issues occurred during this invoice period. Continued contacts with the agencies is ongoing, however most of this will need to be addressed during preliminary design. The specifics related to the influence and impacts to properties and USFW easements are outside the scope of this study. Therefore, they will be more fully documented during preliminary design.

Phase 005 – Water Quality Comparison – Influence Area

- No additional work was completed on this task during this period.

Phase 006 – Economic Analysis (Feasibility Level)

- Limited work continues related to the system installation costs or damage prevention.
- Several cost items were considered, including the BNSF grade raise and County #39 issues.

Phase 007 – Steering Committee and Feasibility Guidance

- Lake Reule HOA meeting update
- Discussion and sharing of groundwater issues
- Sharing of local rainfall event data
- Discussion of committee membership revisions
- Funding email and project status updates
- A third Steering Committee meeting is in the planning stages

Phase 008 – Future Funding Opportunities

- No additional work was completed on this task during this period.

Phase 009 - Feasibility Report

- Started preparing figures for use in report
- Initial drafting for sections and outline.

Comments and Issues:

- The surface water and groundwater assessment has resulted in an indication that groundwater is a greater influence than anticipated.
- *The new targeted completion date is the end of July 2025.* The DWR/SWC costs share approval to be approved June 12th, which will allow additional groundwater review. Until then we continue to evaluate all elements possible within the originally budget.
- Next Steering Committee meeting to be after the SWC funding approval and completion of the outfall evaluation for capacity and conveyance.
- Additional local funding opportunities are under review, with most funds raised that will offset the local share to complete the services under Addendum #1. Stutsman County Commission needs to approve SWC amendment then authorize HEI to proceed with the additional work and complete the draft report.

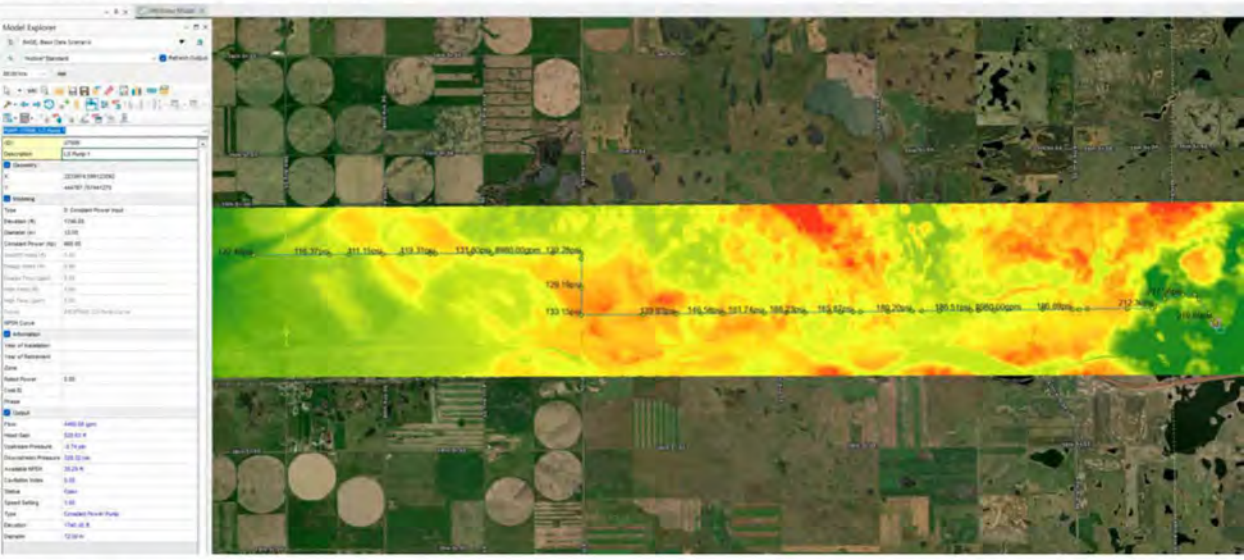
See accompanying invoice for personnel cost breakdown.

HEI Invoice	$ 46,140.75
Peritiacon Invoice	$ 4,410.00
This Invoice	***$ 50,550.75***
Total Budget	***$220,000.00***
Invoice #1	*$ 88,516.00*
Invoice #2	*$ 44,342.50*
This invoice #3	*$ 50,550.75*
Remaining Balance	***$ 38,590.75***

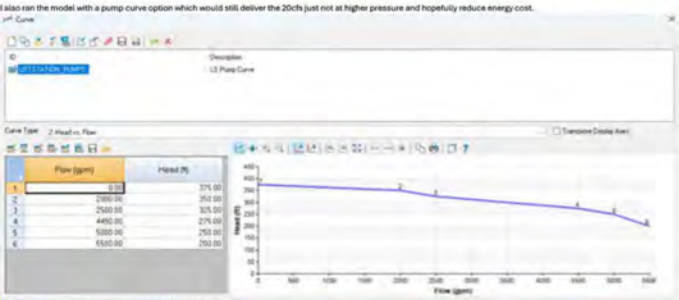
From: Tyler Paul
To: Travis Johnson
Cc: Michael Gunsch
Subject: RE: 12808-0001 Crystal Springs Pipeline Proposed Route
Date: Tuesday, July 8, 2025 5:03:24 PM
Attachments: image001.png
image003.png
image002.png
image004.png

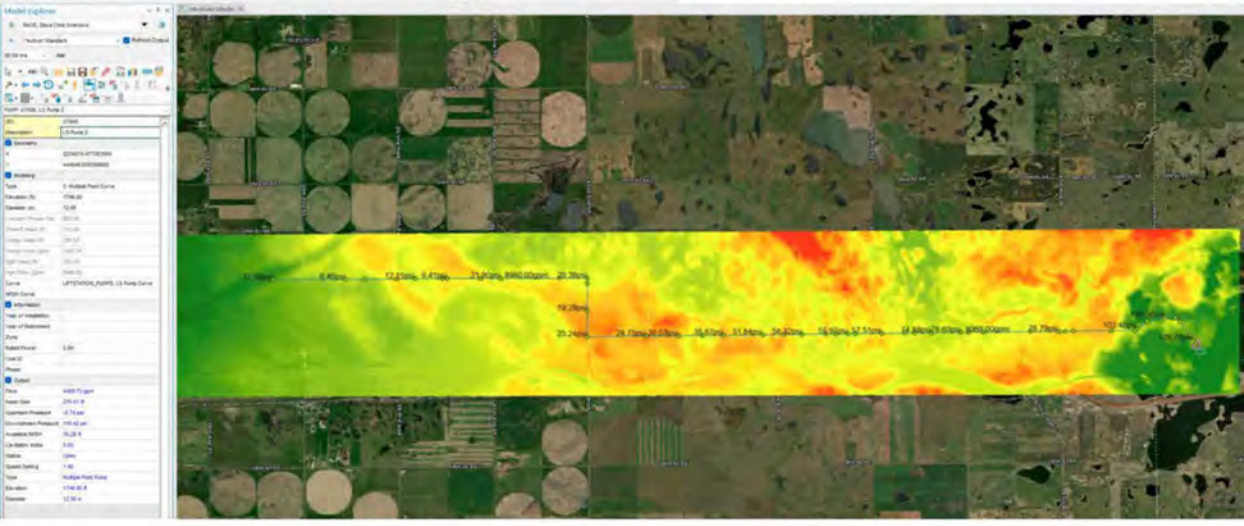
Hi Travis,

I ran it with two 600hp pumps (constant power input option) and a 24in pipeline and am getting the following psi results at the nodes along the pipeline.



I also ran the model with a pump curve option which would still deliver the 20cfs just not at higher pressure and hopefully reduce energy cost.





Sherwin also mentioned that maybe a 30in diameter pipe might allow us to get a more optimal pump size and energy cost as well.

Let me know what your thoughts are and if you need any other options ran on the pipeline/pumps.

Thanks!
Tyler

Tyler Paul
Senior Technician | Civil
Houston Engineering, Inc.
O 701.323.0200 | D 701.751.6288

From: Travis Johnson <travis.johnson@houstoneng.com>
Sent: Wednesday, July 2, 2025 3:22 PM
To: Tyler Paul <tpaul@houstoneng.com>
Cc: Michael Gunsch <mgunsch@houstoneng.com>
Subject: RE: 12808-0001 Crystal Springs Pipeline Proposed Route

I need to double check, but I think to push 10 cfs at 150 psi, we will need a 600 hp pump. Just pro-rating it compared to the pumps at Cottonwood, I came up with 555 horsepower. Will have to run the model and see what that shows for a discharge pressure to make that run and then I can look in the books and see what size of pump gives us those numbers to confirm what I am scratching out here.

Travis Johnson
Senior Civil Engineer
Houston Engineering, Inc.
O 701.323.0200 | D 701.751.6267 | C 701.226.0227

From: Tyler Paul <tpaul@houstoneng.com>
Sent: Wednesday, July 2, 2025 2:52 PM
To: Travis Johnson <travis.johnson@houstoneng.com>
Cc: Michael Gunsch <mgunsch@houstoneng.com>
Subject: 12808-0001 Crystal Springs Pipeline Proposed Route

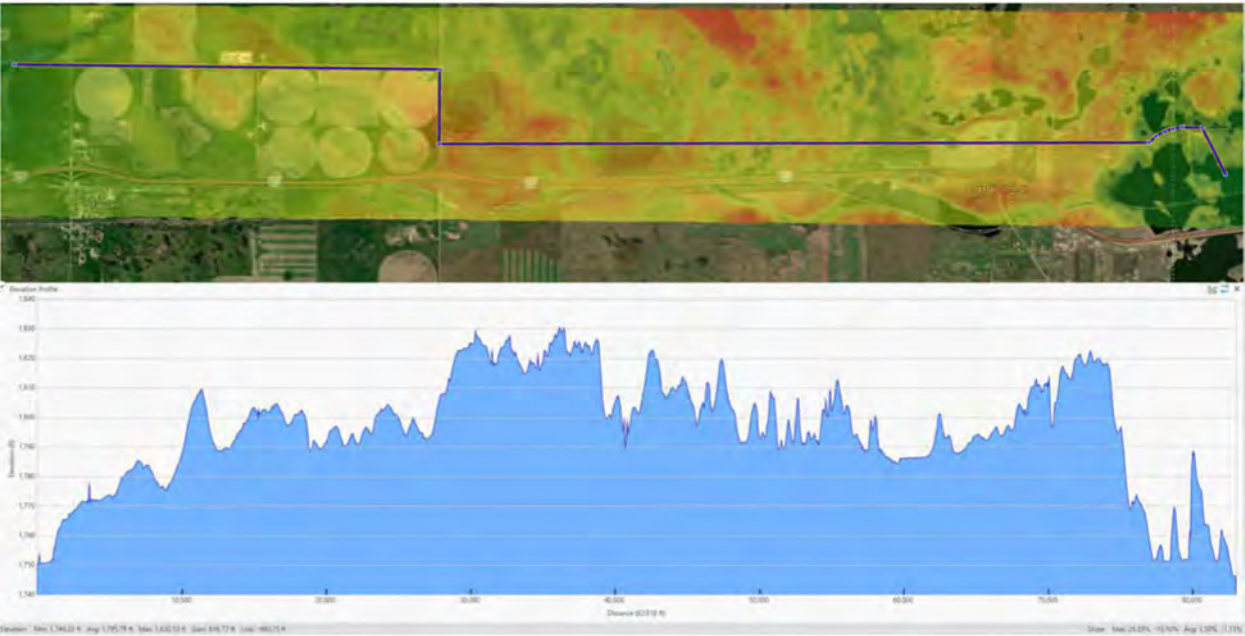
Hi Travis,

Below is a quick profile for the proposed pipeline route at Crystal Springs per our conversation this afternoon.

It looks like the route is currently 83,018 feet long.

If you have any other questions or need any other information, please let me know.

Thanks!
Tyler



Tyler Paul
Senior Technician | Civil
Houston Engineering, Inc.
O 701.323.0200 | D 701.751.6288

N

Kidder

Bird Lake

McPhail Slough

Sibley Lake

Stony Lake

Mud Lake

Tappen Slough

ffalo Lake

Big Muddy Lake

Sweetwater Lake

Chase Lake National Wildlife Refuge

Salt Alkaline Lake

Stink Lake

Tappen

Ladoga

Crystal Springs

Medina Rest Area

Dawson

Sibley

Slade National Wildlife Refuge

Lake Isabel

Chokecherry Lake

94

3

- West Preffered Route
- National Grasslands
- Waterfowl Production Areas
- National Wildlife Refuges
- PLOTS Lands
- Wildlife Management Areas
- North Dakota Conservation Easement
- NRCS Conservation Easement
- US Fish and Wildlife Service
- Surface_Trust_Land

0 1.25 2.5 5 Miles

FIGURE 6 - U.S. FISH AND WILDLIFE FACILITIES

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	JAP	MG	12808-0001	7/24/2025	

HOUSTON engineering, inc.

Crystal Springs Watershed Initiative
System Water Balance Evaluation

The hydrological balance of water in the Crystal Springs lake system is a function of the following factors:

Surface Water (SW) inflows generated by runoff from the watershed including combined surface flows within the tributaries and lake/slough systems. Runoff is affected by soils conditions, land use and precipitation. The total runoff value was approximated using the *USGS Stream Gate at Harvey, North Dakota (09020202)* just north of the study area. Total ac-ft runoff is projected then using a prorated or weighted function of runoff per square mile. This value was approximated for each year utilizing the gage records.

Precipitation (P) from rainfall on the open water. **Direct Rainfall (DR)** contributes to the elevation of each lake system. Simply stated a 2" rainfall generally adds 2" to the water surface elevation. The total ac-ft contribution on the lake is the direct precipitation multiplied by the lake area at the time of rainfall. This value was approximated using the rainfall gage for *Tappen, North Dakota* (_____), and the available lake area-capacity information.

Evaporation (E) is generalized as a loss based on the open water area using *the North Dakota Hydrology Manual (NDHM), Chapter 8 Figure 8-3*. There is no available evaporation station data for this area, there the NDHM approximation was utilized. Subsequently, the annual losses were determined, while monthly percentage evaporation data could be applied for subsequent evaluations if necessary. Total evaporative losses in ac-ft are based on the lake area for a given lake elevation.

Groundwater (GW) is a significant factor and has a measurable impact on lake levels, and the inflows are being evaluated. This influence is difficult to directly determine but can be approximated using the other factors, like soils and the AEM data recently acquired by the ND Department of Water Resources (*circa February 2025*). The GW inflows in ac-ft are undetermined; however, it could be approximated using a water balance equation.

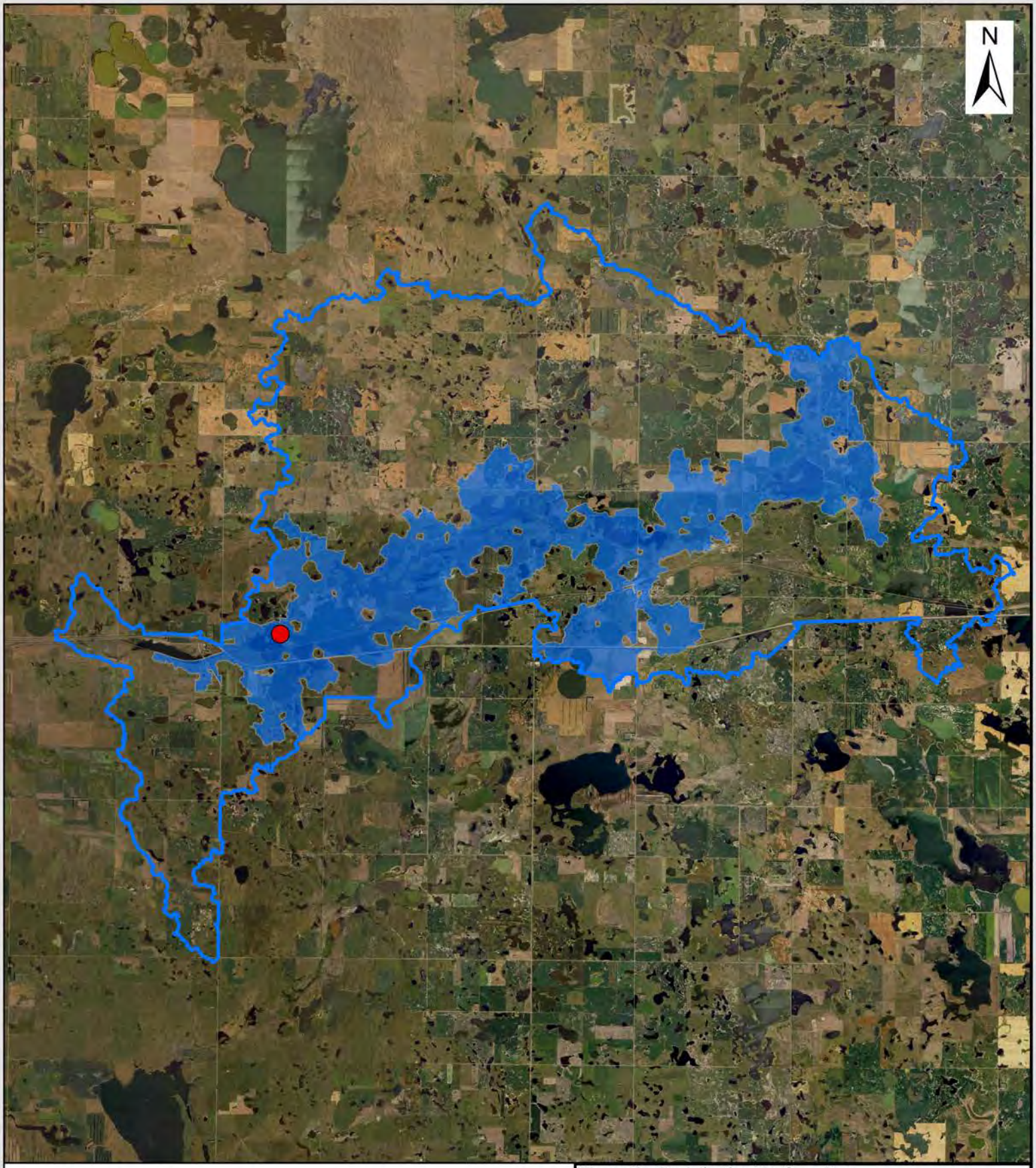
Annual Ac-Ft (AF) of change is determined utilizing the area-storage-capacity curves for each lake and combined lakes system and comparative values from year to year and lake level measurements.

Annual Water Balance Equation in any given year is determined by the following equation.

SW + DR - E + GW = Annual Acre-Feet (change in storage)

The only unknown in this equation is GW, which is projected over the 14+ year study period, based on the other variables. The others can be approximated as noted above.

The feasibility study is being completed to determine the amount of water to be removed to stabilize water levels in the system.



Watersheds

1 (101.3 Square Miles)

Contributing Surface Area

1 (25.8 Square Miles)

0 0.5 1 2 Miles

Figure 2: Contributing Surface Area (5.3 inch Rain Fall)

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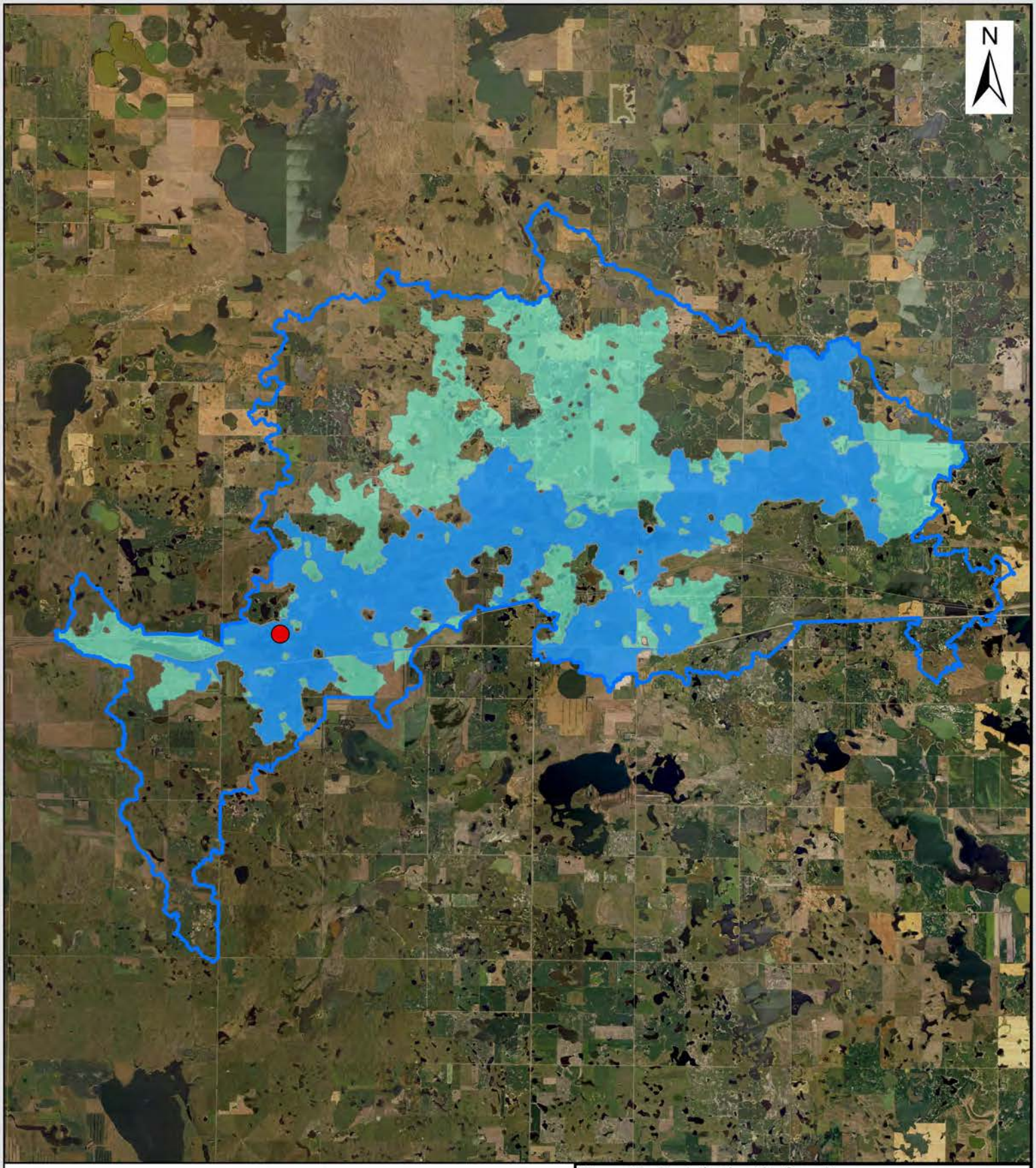
AS SHOWN	KZS	MG	12808-0001	2/14/2025	

HOUSTON engineering, inc.



Watersheds

1 (101.3 Square Miles)

Contributing Surface Area

1 (25.8 Square Miles)

Contributing Surface Area (Double Rain Fall)

1 (50 Square Miles)

0 0.5 1 2 Miles

Figure 3: Contributing Surface Area (11 inch Rain Fall)

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AS SHOWN	KZS	MG	12808-0001	2/14/2025	

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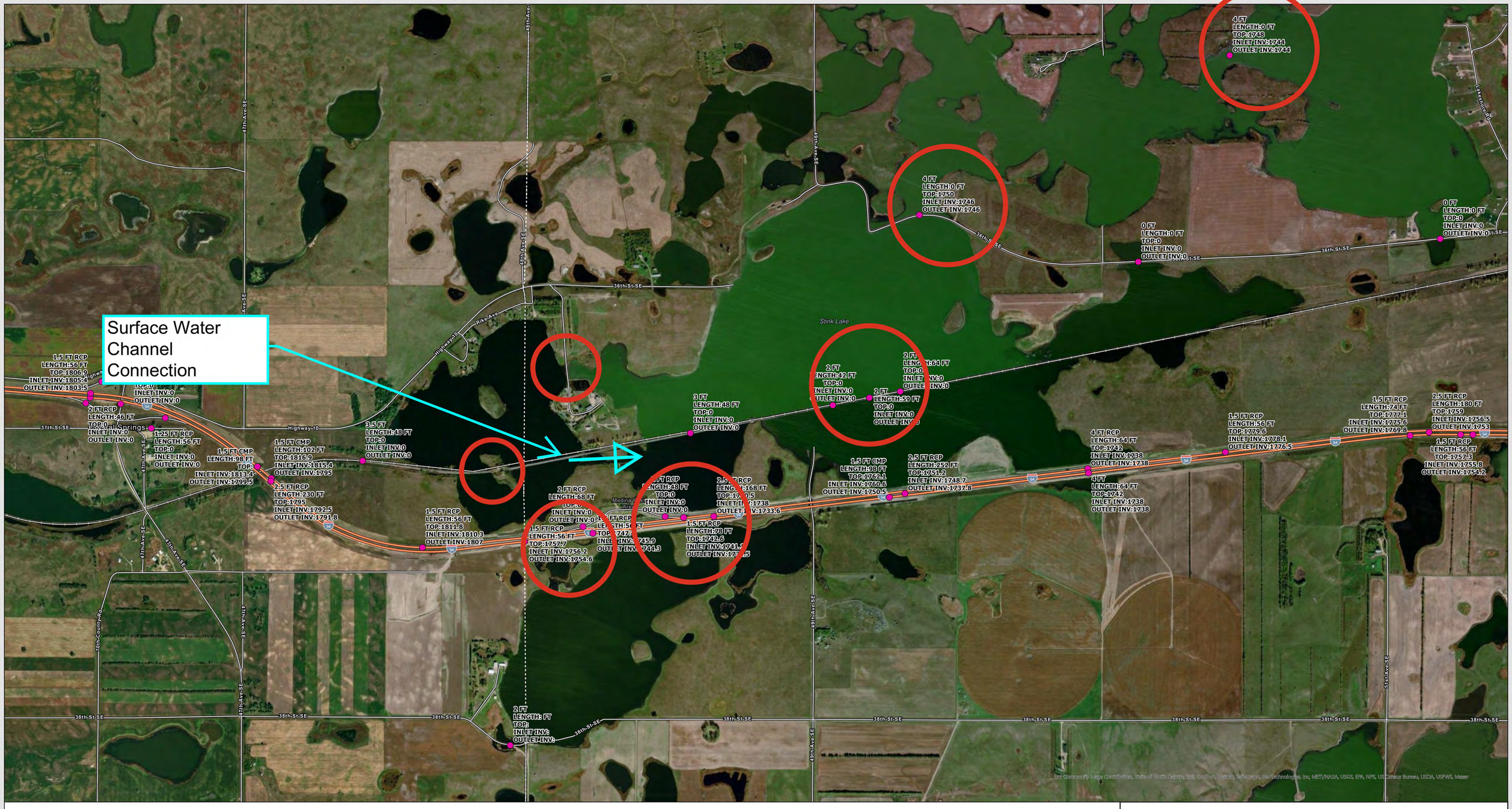

Legend

- Culverts

N

0 0.25 0.5 1

Miles

Crystal Springs & Stink Lake Culvert Map

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HOUSTON engineering, inc.

Crystal Springs Watershed Initiative
Aerial Photo/Lidar/Bathymetry Water Surface Elevations

Lake	*Year*	*Elevation*	*Source*	*Difference*	
Crystal Lake	2024	1752.27	Aerial	0.28	
	2023	1751.99	Aerial	0.48	
	2021	1751.51	Aerial	1.46	
	2015	1750.05	Aerial	1.49	
	2010	1748.56	Aerial	-3.43	Fall in elevation?
	2003	1751.99	Aerial	5.28	
	1980	1746.71	Aerial	0.35	
	1957	1746.37	Aerial	5.90	Rise Since 1957
	Average	**1749.93**			
South Stink Lake	2024	1752.15	Aerial	-0.31	
	2023	1752.46	Aerial	1.82	
	2021	1750.64	Aerial	2.08	
	2015	1748.56	Aerial	2.77	
	2010	1745.79	Aerial	-1.41	Fall in elevation?
	2003	1747.20	Aerial	13.22	
	1980	1733.98	Aerial	-0.81	
	1957	1734.79	Aerial	17.36	Rise Since 1957
	Average	**1745.70**			
Stink Lake	2024	1753.47	Aerial	0.54	
	2023	1752.92	Aerial	2.50	
	2021	1750.43	Aerial	2.84	
	2015	1747.59	Aerial	1.07	
	2010	1746.52	Aerial	3.62	
	2003	1742.90	Aerial	10.55	
	1980	1732.35	Aerial	0.47	
	1957	1731.88	Aerial	21.59	Rise Since 1957
	Average	**1744.76**			
Ruele Lake	2024	1753.27	Aerial	1.12	
	2023	1752.15	Aerial	1.68	
	2021	1750.46	Aerial	3.36	
	2015	1747.10	Aerial	4.12	
	2010	1742.98	Aerial	9.00	
	2003	1733.98	Aerial	0.00	
	1980	1733.98	Aerial	-0.81	
	1957	1734.79	Aerial	18.48	Rise Since 1957
	Average	**1743.59**			

14-Year Historic Record Evaluation - Crystal Springs Watershed Initiative

Year	*Elevation*	*Storage Volume - Area Capacity Curve*	
2024	1755	36,106	Acre-Feet
2010	1746	14,330	Acre-Feet
14	9	21,776	Acre-Feet
	Average	**1,555**	**Acre-Feet/Year**

Aerial Photo Storage Increase	*2010-2024*	
	42,335	Acre-Feet
Approximate ~ 0.5 ft	3,024	**Acre-Feet/Year**
100 Year Event Rainfall	***1,440***	***ac-ft***

		Per Year Removal (180)	
System Size (cfs)	*10*	3,564	**Acre-Feet**
	15	5,346	**Acre-Feet**
	20	7,128	**Acre-Feet**
		1.98	Ac/ft-Day- CFS
		180	Operational Days
Operational Removal		**3,024**	**Annual Ac-Ft (2021-2024)**
2025 Inflow		**7,900**	**Ac-ft** **(nearly 2 feet)**

Time to Remove Inflow - Area Capacity Value

Days	*Years*	*Target Elevation*	**1746**
1100	6.11		
733	4.07		
550	3.06		

Preliminary Removal Projections

O&M Plan	**Total Lake Storage**	**1755 - 1750**	**15,271**	**Acre-Feet**
	Average Annual Inflow - times 2 years		6,048	**Acre-Feet**
	Retain Waters In Ruele			
	Elevation 1753 - 1750	Reduction in Removal	7,800	**Acre-Feet**
			13,519	**Acre-Feet**

With Ruele Storage (including average inflows)			**Without Ruele Storage (including average inflows)**		
5 feet removed	3.79	Yrs at 10 cfs	5 feet removed	5.98	Yrs at 10 cfs
5 feet removed	2.53	Yrs at 15 cfs	5 feet removed	3.99	Yrs at 15 cfs
5 feet removed	**1.90**	**Yrs at 20 cfs**	**5 feet removed**	**2.99**	**Yrs at 20 cfs**

Period of Record Volume Approximations

Total Inflow USGS gage (SW)	41,455	ac-ft	25.8	Square Miles
Rainfall - Direct Precipitation (P-DR)	60,302	ac-ft	247.65	Total Inches (2010-2024)
Evaporation (E)	(110,790)	ac-ft	32.5	Inches/Surface Area
Total SW+DR-E	**(9,034)**	**ac-ft**		
Lake System Increase	**42,335**	**ac-ft**		
Groundwater (GW) Compnent	**51,369**	**ac-ft**		
	34%	of Total System Inflows		

Lake Surface Area (Acres)	
Elev 1744	2,324
Elev 1755	3,520
Average 2010-2014	***2,922***

Crystal Springs Lake Pump Removal System

Preferred Alternative

24-Jul-25

Construction Cost	**$16,262,000.00**		
Contingency	**$3,252,400.00**	**20%**	**Feasibility Level**
Opinion of Probable Construction Cost	**$19,514,400.00**		
Preliminary Engineering Report (w/operations plan)	$975,720.00	5%	
Final Design/CMS Services	$1,951,440.00	10%	
Legal and Administration (assessment district, easements, etc.	$1,170,864.00	6%	
Regulatory/Environmental	$975,720.00	5%	
Draft Preliminary OPC	***$24,588,144.00***	***26%***	

Potential Funding Sources - Consideration and Requests

	Full Project OPC			*Preliminary Engineering Report*	
HMGP	$18,441,108.00	Federal	75%	Up To	$731,790.00
	$2,458,814.40	State	10%	of Federal	$97,572.00
	$3,688,221.60	Local	15%	Local	$146,358.00
	$24,588,144.00			***Total***	***$975,720.00***

	Full Project OPC			*Preliminary Engineering Report*	
SWC Rural Flood Control	$11,064,664.80	State	45%		$439,074.00
	$13,523,479.20	Local	55%		$536,646.00
	$24,588,144.00			***Total***	***$975,720.00***

Design Considerations

1. **Utilization of a 30" PVC allows for lower headlosses in the system and smaller pump requirements**
2. **The 30" PVC pipe will lower internal pressures and associated operations and maintenance and maintenace costs**
3. **The 30" PVC allow for the ability to add pump capacity at some point if conditions require.**
4. **Annual Operations and Maintenance Costs for the 24" PVC System $ 266,540**

CSWI Initial 3 phase field pull from source to site:

4-5 miles installation via boring at an estimate of $350k-$400k. The cable cost ($250k) makes up the majority due to the required footage needed. This is according to Northern Plains Electric Cooperative point of contact.

Peritiacon LLC has an estimate of $85k-$100k per mile.

These estimates agree with one another and are constructed with conservative margins.

CSWI Pump House Annual O&M:

Operational – Electric loading on pump (Major Load), auxiliary systems (Minor Loads), operational startup/shutdown/monitoring/system checks/operational control (Operator).

Maintenance – Pump and Auxiliary system maintenance and repair. Maintenance frequency depends on component and tech spec requirements. Quarterly and annual schedules are the most common for lift station systems.

Assumptions: No consideration given to pump/load curves. 600hp is being used as a conservative measure. The 480v Motor Control Center (MCC) may use older DB style breaker schemes or newer Eaton style...shall be sized accordingly for redundancy and amp rated for starting current draws (5 times running current). In the PER, individual component sectional will more closely determine system efficiencies and cost reductions/savings opportunities. Fixed rate is assumed as NPEC has a fixed rural rate.

Operational	**Rate**	**Annual Cost @ 180 days operational**	
Pump Load @ 600hp @ 90% 20hrs/day	Fixed rural rate of $0.098/khw	$142,160.00	Assuming we can secure a fixed rate.
Minor Loads-MCC, lighting, HVAC...etc	8% of total pump load	$11,372.80	
Operator/Mech	55/hr with OT built in	$65,000.00	2 part time cross disciplined operators
Maintenance			
Routine – oil, filters, ventilation, minor leak repairs, valve M&R	$3,000.00/ operational month	$18,000.00	
Non-Routine – vendor service, equipment, unplanned downtime	$30,000.00 Annual	$30,000.00	
		Total O&M	per 1000 acre-feet of water removal @ 20cfs
		$266,532.80	$44,792.32

CSWI Initial 3 phase field pull from source to site:

4-5 miles installation via boring at an estimate of $350k-$400k. The cable cost ($250k) makes up the majority due to the required footage needed. This is according to Northern Plains Electric Cooperative point of contact. Peritiacon LLC has an estimate of $85k-$100k per mile.

These estimates agree with one another and are constructed with conservative margins.

CSWI Pump House Annual O&M:

Operational – Electric loading on pump (Major Load), auxiliary systems (Minor Loads), operational startup/shutdown/monitoring/system checks/operational control (Operator).

Maintenance – Pump and Auxiliary system maintenance and repair. Maintenance frequency depends on component and tech spec requirements. Quarterly and annual schedules are the most common for lift station systems.

Assumptions: No consideration given to pump/load curves. 500hp is being used as a conservative measure. The 480v Motor Control Center (MCC) may use older DB style breaker schemes or newer Eaton style…shall be sized accordingly for redundancy and amp rated for starting current draws (5 times running current). In the PER, individual component sectional will more closely determine system efficiencies and cost reductions/savings opportunities. Fixed rate is assumed as NPEC has a fixed rural rate.

Operational	**Rate**	**Annual Cost @ 180 days operational**	
Pump Load @ 500hp @ 90% 20hrs/day	Fixed rural rate of $0.098/kwh	$118,435.96 (Divide by 2 for single pump operation + 10-20% efficiency gains for single train operations)	Assuming we can secure a fixed rate.
Minor Loads-MCC, lighting, HVAC…etc	8% of total pump load	$9,474.80	No change for single pump OPS
Operator/Mech	$55/hr with OT built in	$65,000.00	2 part time cross-disciplined operators
Maintenance			
Routine – oil, filters, ventilation, minor leak repairs, valve M&R	$3,000.00/ operational month	$18,000.00	
Non-Routine – vendor service, equipment, unplanned downtime	$30,000.00 Annual	$30,000.00	
		Total O&M	per 1000 acre-feet of water removal @ 20cfs
		$240,910.76	$40414.12

Pump Work Note: 33psi is added to each Frictional Head Loss value. This accounts for the Static Head Loss for a suction bell house casing set 20ft below the water surface and a max elevation deviation of 76' (1810'-1734')

11.5 miles 58000ft @ 20cfs

Pipe Dia	Frictional Head Loss (psi)	Velocity (ft/s)
	PVC	
24"	99.52	6.39
30"	33.6	4.09

15.75 miles 83000ft @ 20cfs

Pipe Dia	Frictional Head Loss (psi)	Velocity (ft/s)
	PVC	
24"	142.22	6.39
30"	48.02	4.09

11.5 miles 58000ft @ 10cfs

Pipe Dia	Frictional Head Loss (psi)	Velocity (ft/s)
	PVC	
24"	27.53	3.19
30"	9.3	2.04

15.75 miles 83000ft @ 10cfs

Pipe Dia	Frictional Head Loss (psi)	Velocity (ft/s)
	PVC	
24"	39.4	3.19
30"	13.3	2.04

Cost Estimates Based on Known Assumptions

Known:

1. Duplex System of 10 cfs (20cfs total)
2. 600hp electric required (3 phase)
3. Distance of route options – friction losses
4. Head height (elevation change) of the route options
5. System design will remain the same so system minor losses (valves, joints, bends… are assumed constant
6. Piping material to be used is HDPE
7. Estimates are done with 2ft pipe diameter
8. Fixed electric rate of $0.098/kwh

Unknown:

TBD in PER

1. Actual power required in kW (electric) and bhp (hydro hp) required
2. Pump efficiency, required NPSH, pump curves…etc
    a. Pump selection will be benchmarked based on *knowns* and selected for application specific needs as seen fit during the PER

Approach:

What takes WORK? 1)Friction losses due to pipe length and diameter as expressed as Headloss (H_l). 2) Headloss due to height, the water needs to be pumped.

HW Equation in *imperial* units for frictional H_l:

$$H_l = \left(4.52 \times L_{pipe} \times Q^{1.852}\right) \div \left(C^{1.852} \times D^{4.87}\right)$$

$$H_l = \left(4.52 \times L_{pipe} \times \left(\frac{Q}{C}\right)^{1.852}\right) \div \left(D^{4.87}\right)$$

Where:

H_l = Head loss (ft)

L = Pipe length (ft)

Q = Volumetric flow rate (ft^3/sec)

C = Pipe roughness

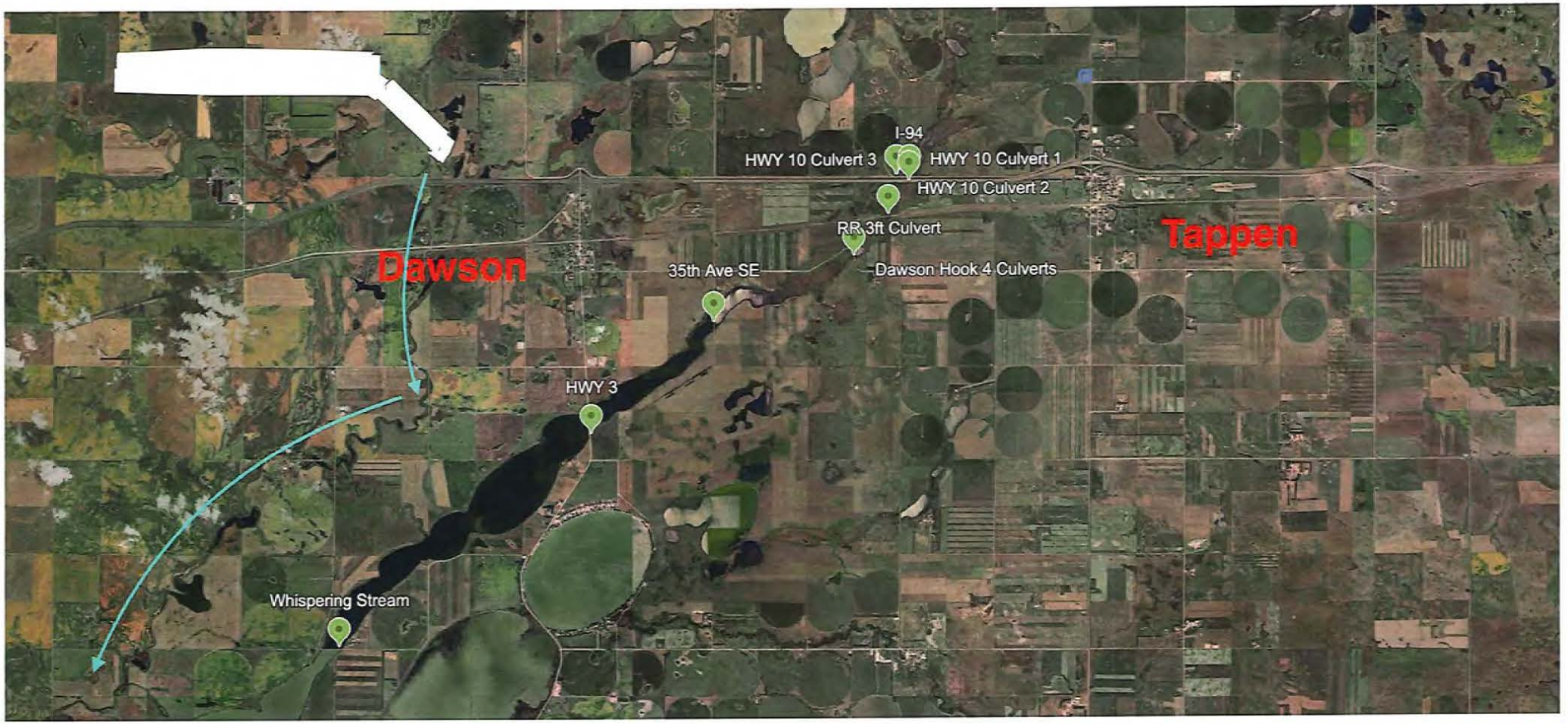
D = Pipe diameter (ft)

Height of water is divided by 33ft to convert to PSI as 1 ATM ~ 33ft water height. This total then needs to be added to the static head height loss.

Headloss at 20cfs for 2ft diameter HDPE pipe run

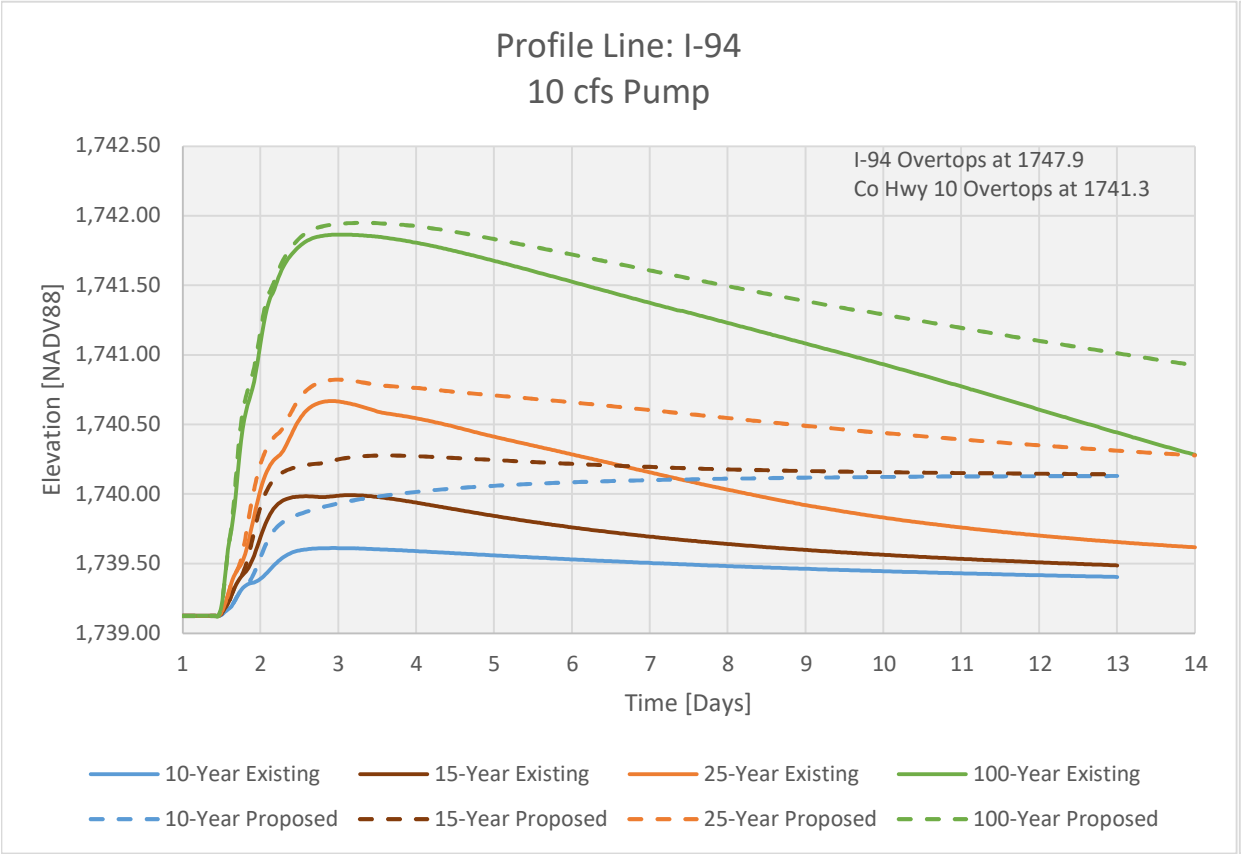
Route	Max Elevation (ft)	Piping Length (ft) Shown in miles	Frictional Headloss (H_l) (psi)	Static Headloss (psi)	Total Headloss (psi)	Cost Factor (CF) (O&M cost for preferred route times CF)
Upper Pipestem	1930	32.6	276.6	78.4	355	2.96
Lower Pipestem	1946	37.8	326.8	82	408.8	3.40
South	2110	17.5	151.3	157.2	308.5	2.57
West RR	1836	13.5	116.4	36.2	152.6	1.27
West North	1810	11.5	95.1	25	120.1	1

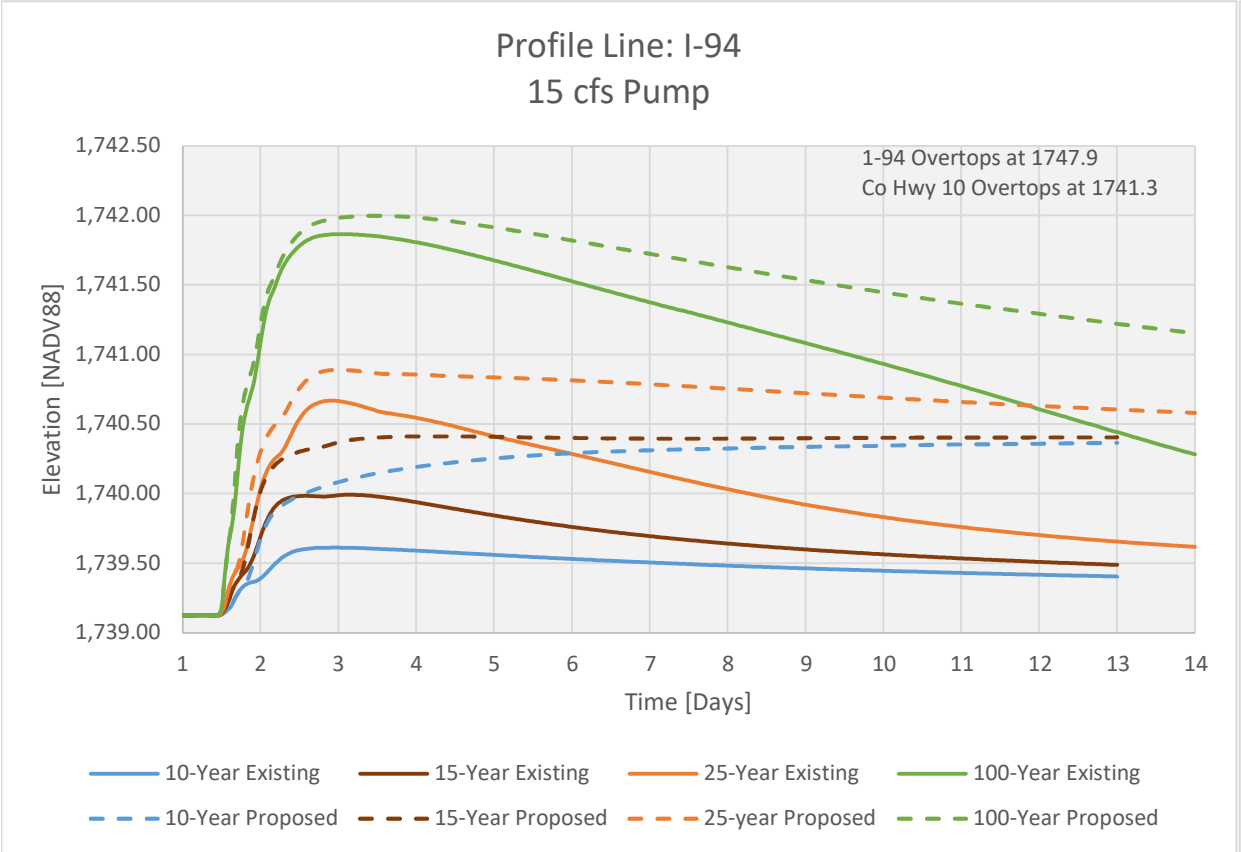
Note: This does not consider system losses or minor losses.

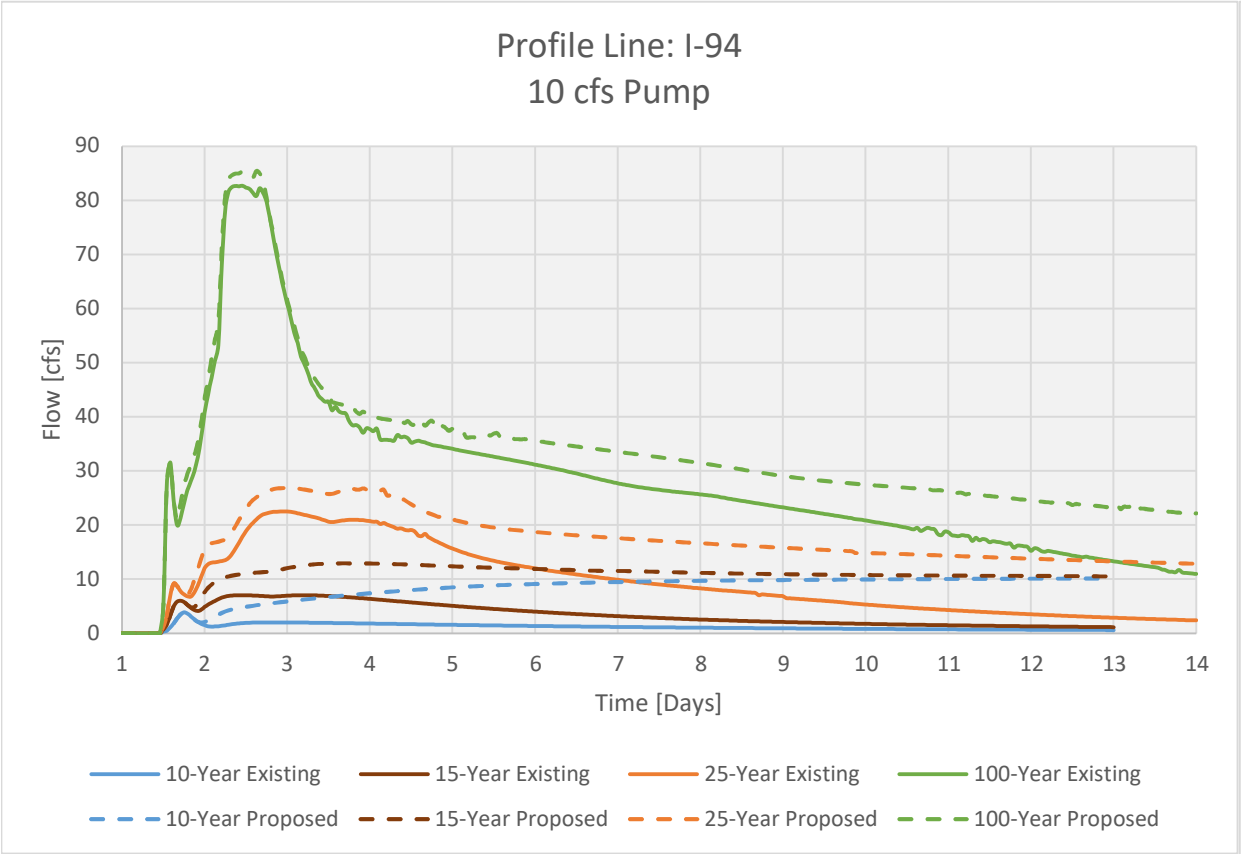

I-94
HWY 10 Culvert 3
HWY 10 Culvert 1
HWY 10 Culvert 2
RR 3ft Culvert
Dawson Hook 4 Culverts
35th Ave SE
HWY 3
Whispering Stream
Dawson
Tappen

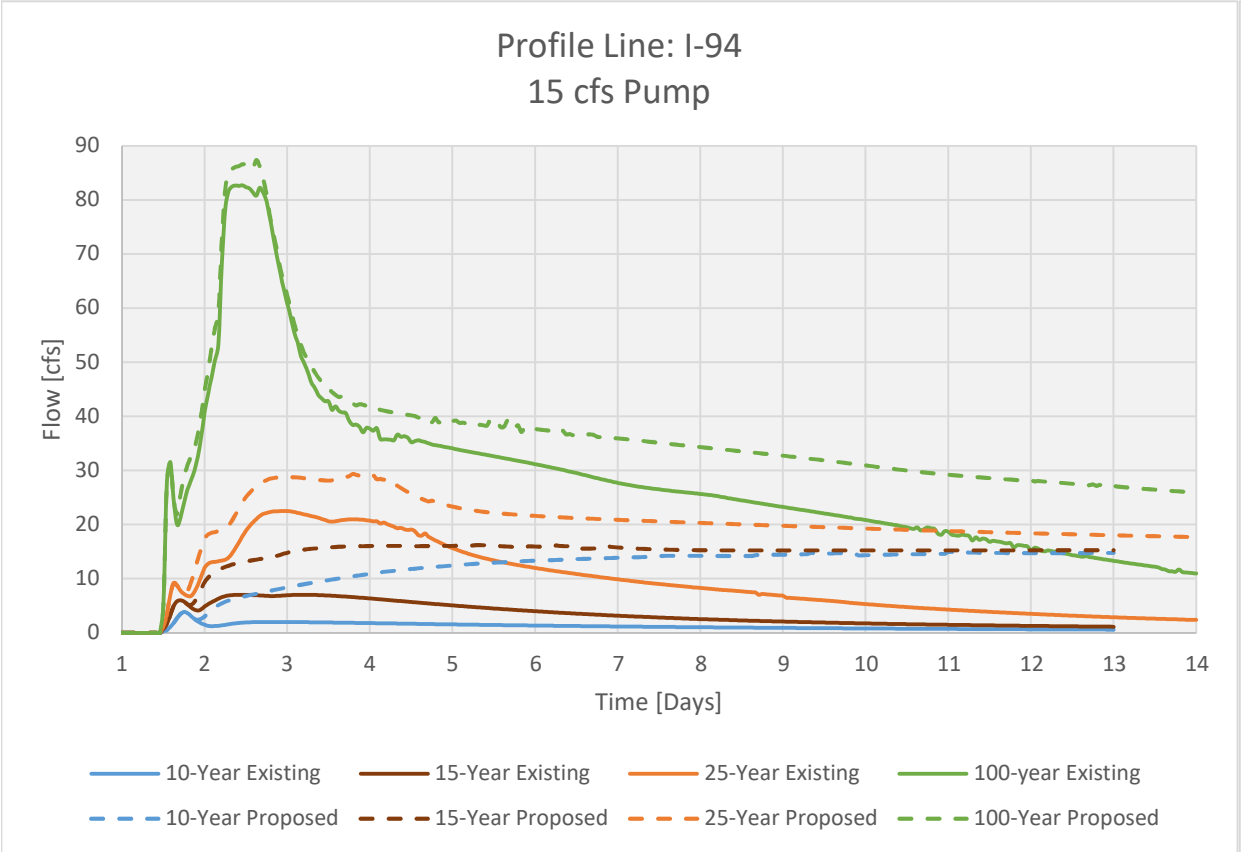
Crossing Name	Culvert Size [inch]	Culvert type	Invert of Culvert* [NADV88]	Design Event Return Frequency	Allowable Headwater Elevation	Water Surface Elevation for the Design Event [NADV88]			Pass/Fail
						Existing Conditions	Proposed 10 cfs Pump	Proposed 15 cfs Pump	
Highway 10	3-36	RCP	1737.00	25 Year	1742.00	1740.67	1740.82	1740.89	P - P - P
I-94	3-36	RCP	1737.00	50 Year	1742.00	1741.07	1741.19	1741.27	P - P - P
Railroad	36	RCP	1735.00	50 - 100 Year	1738.00 - 1739.50	1740.93 - 1741.71	1741.06 - 1741.79	1741.14 - 1741.84	F - F - F
Dawson Hook	2-30, 2-24	CMP	1731.50	15 Year	1736.00	1733.65	1733.86	1734.02	P - P - P
35th Ave	36	CMP	1723.23	10 Year	1728.23	1726.74	1727.50	1727.86	P - P - P
Highway 3	2-18	vert Unco	1724.5	25 Year	1728.00	1727.12	1727.35	1727.43	P - P - P
Whispering Stream	2-24	CMP	1723.60	10 Year	1727.60	1726.12	1726.12	1726.12	P - P - P

*Values are based on survey data, while HEC-RAS modeling of culvert inverts are based on the lowest LiDAR value near the culvert


Profile Line: I-94
10 cfs Pump
I-94 Overtops at 1747.9
Co Hwy 10 Overtops at 1741.3
Elevation [NADV88]
1,742.50
1,742.00
1,741.50
1,741.00
1,740.50
1,740.00
1,739.50
1,739.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: I-94
15 cfs Pump
1-94 Overtops at 1747.9
Co Hwy 10 Overtops at 1741.3
Elevation [NADV88]
1,742.50
1,742.00
1,741.50
1,741.00
1,740.50
1,740.00
1,739.50
1,739.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-year Proposed
100-Year Proposed


Profile Line: I-94
10 cfs Pump
Flow [cfs]
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: I-94
15 cfs Pump
Flow [cfs]
Time [Days]
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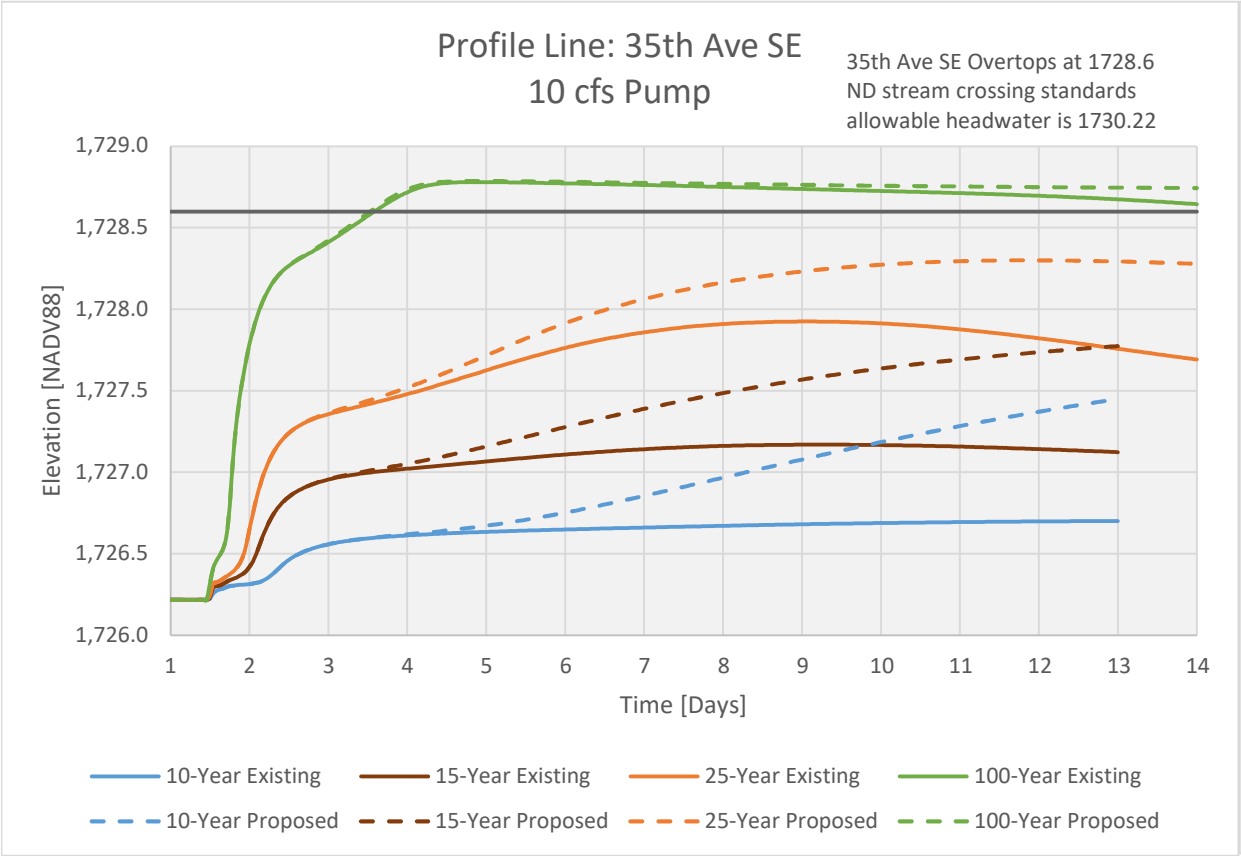
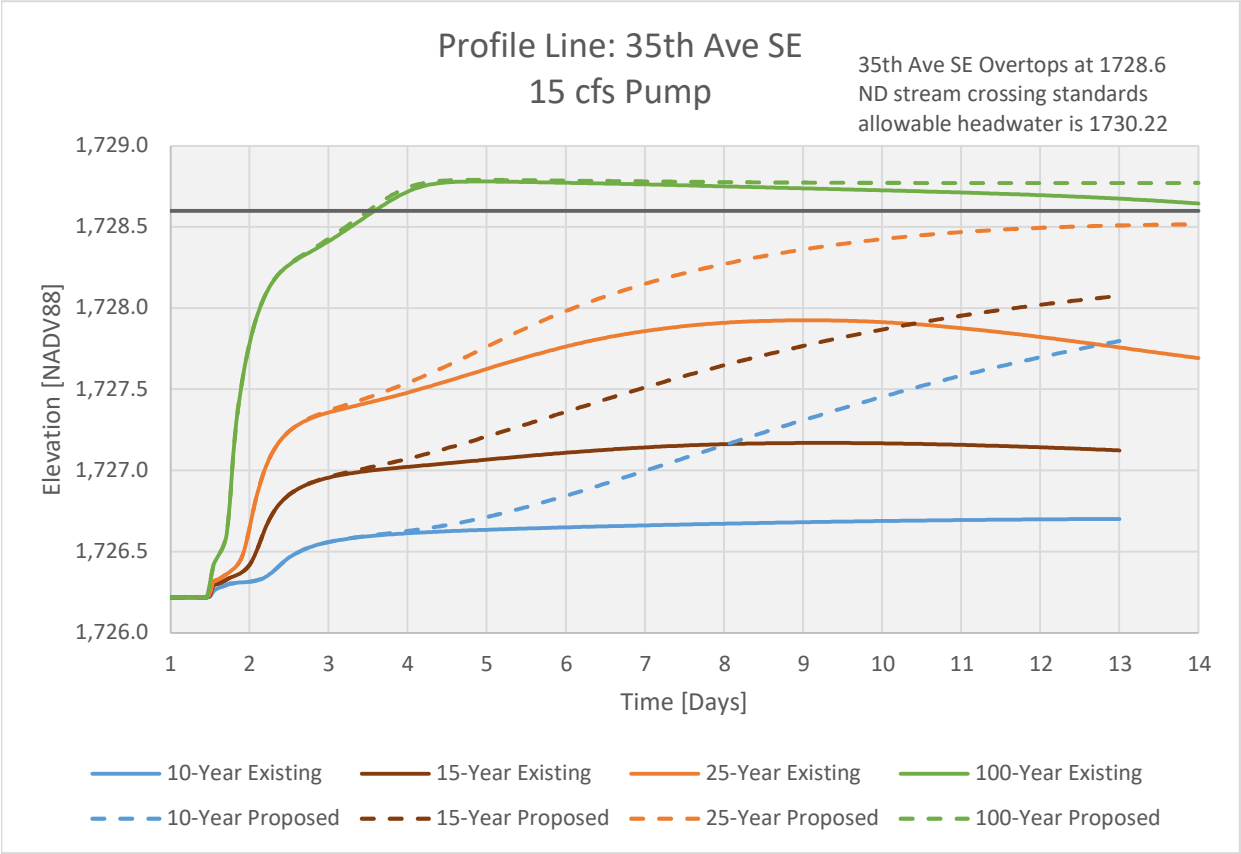
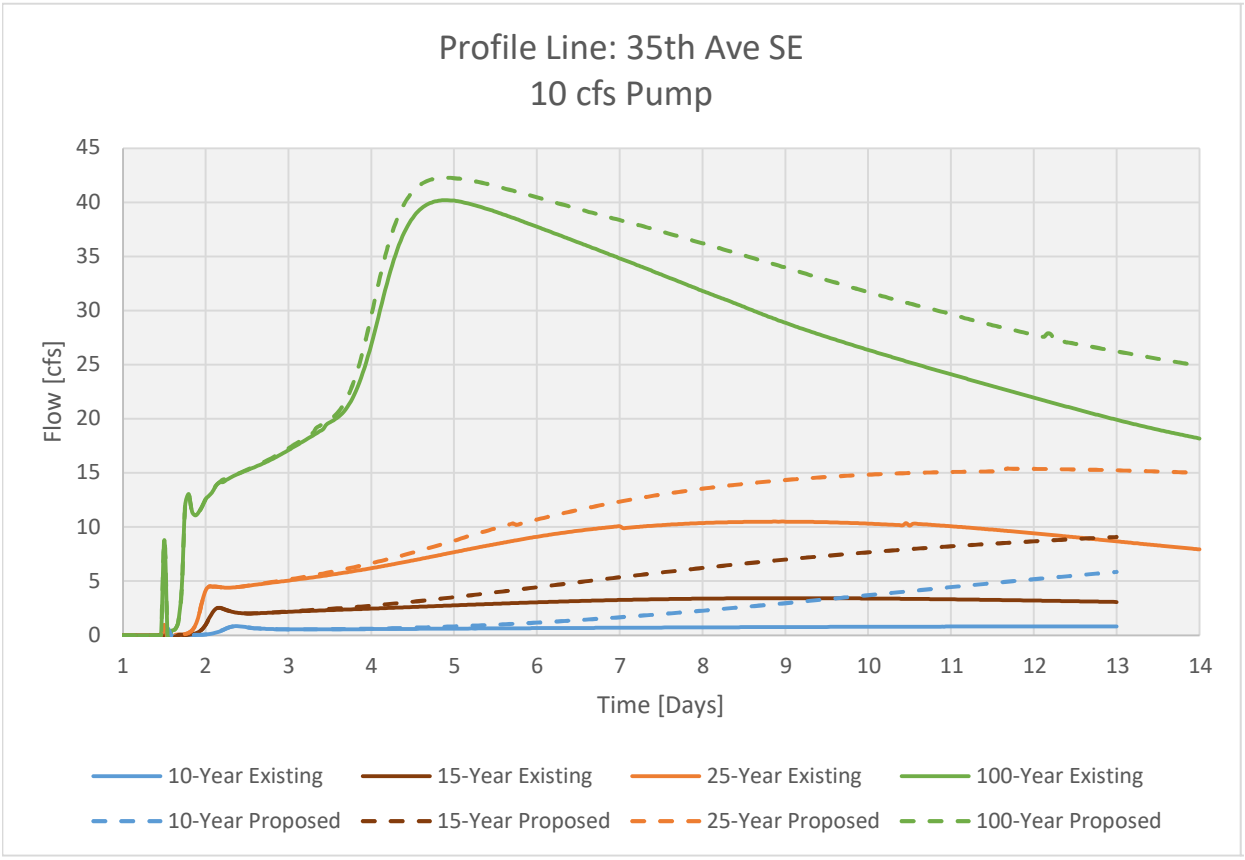
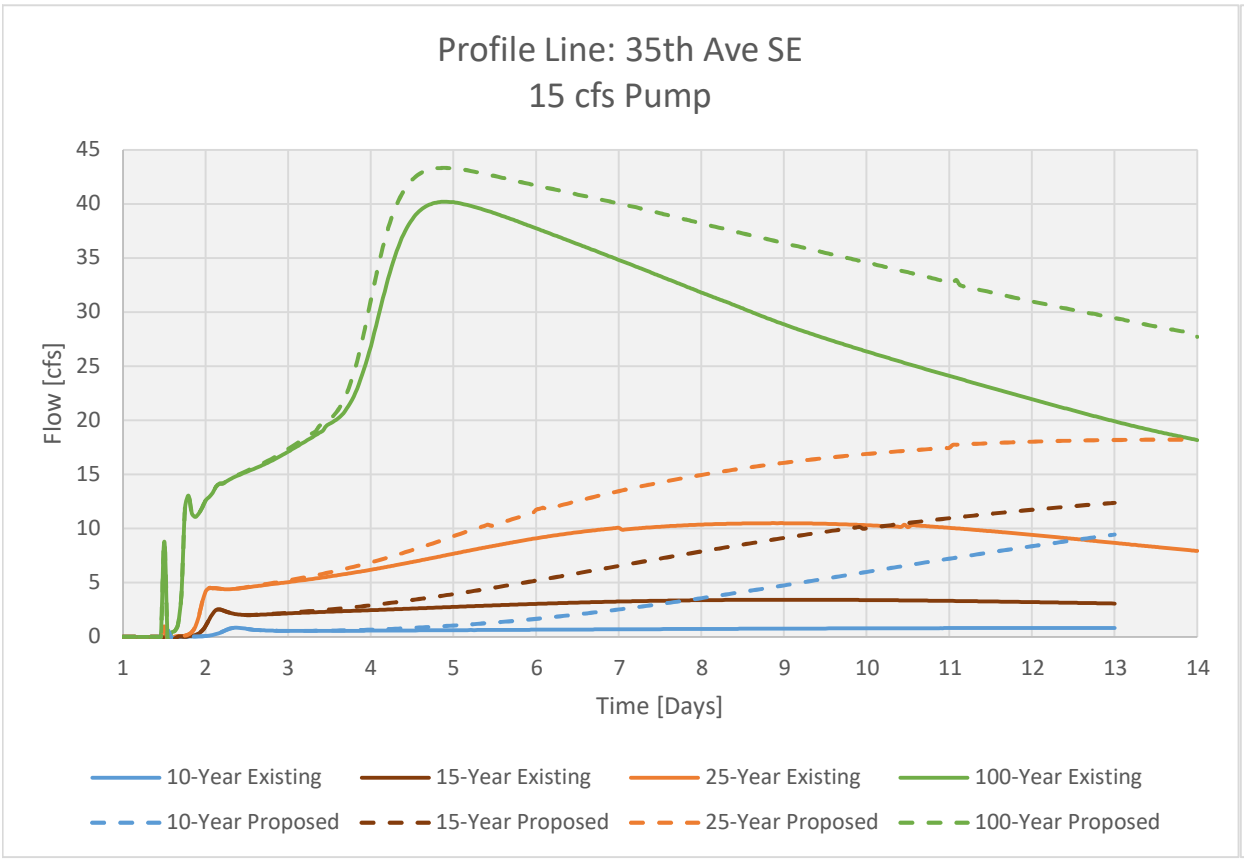
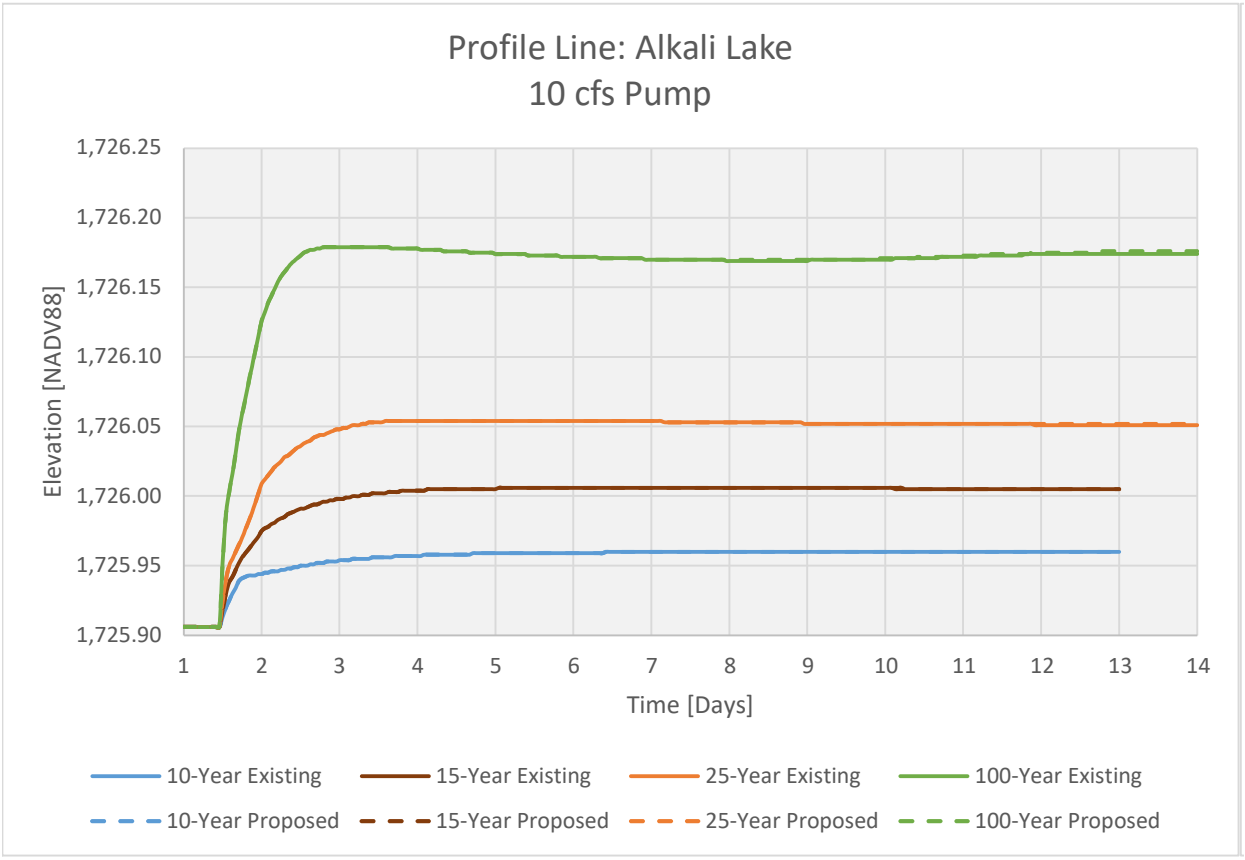
15-Year Existing
25-Year Existing
100-year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

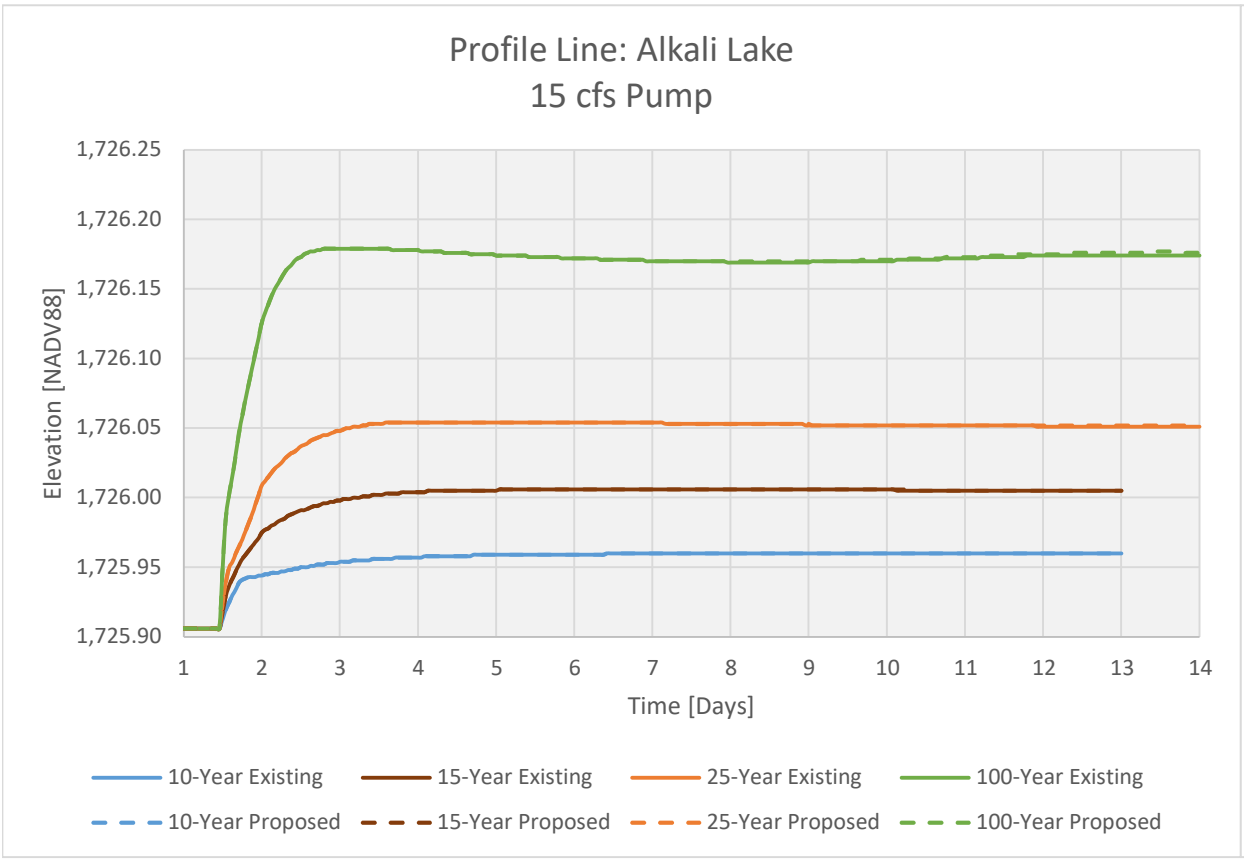

Profile Line: 35th Ave SE
10 cfs Pump
35th Ave SE Overtops at 1728.6
ND stream crossing standards
allowable headwater is 1730.22
Elevation [NADV88]
1,729.0
1,728.5
1,728.0
1,727.5
1,727.0
1,726.5
1,726.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

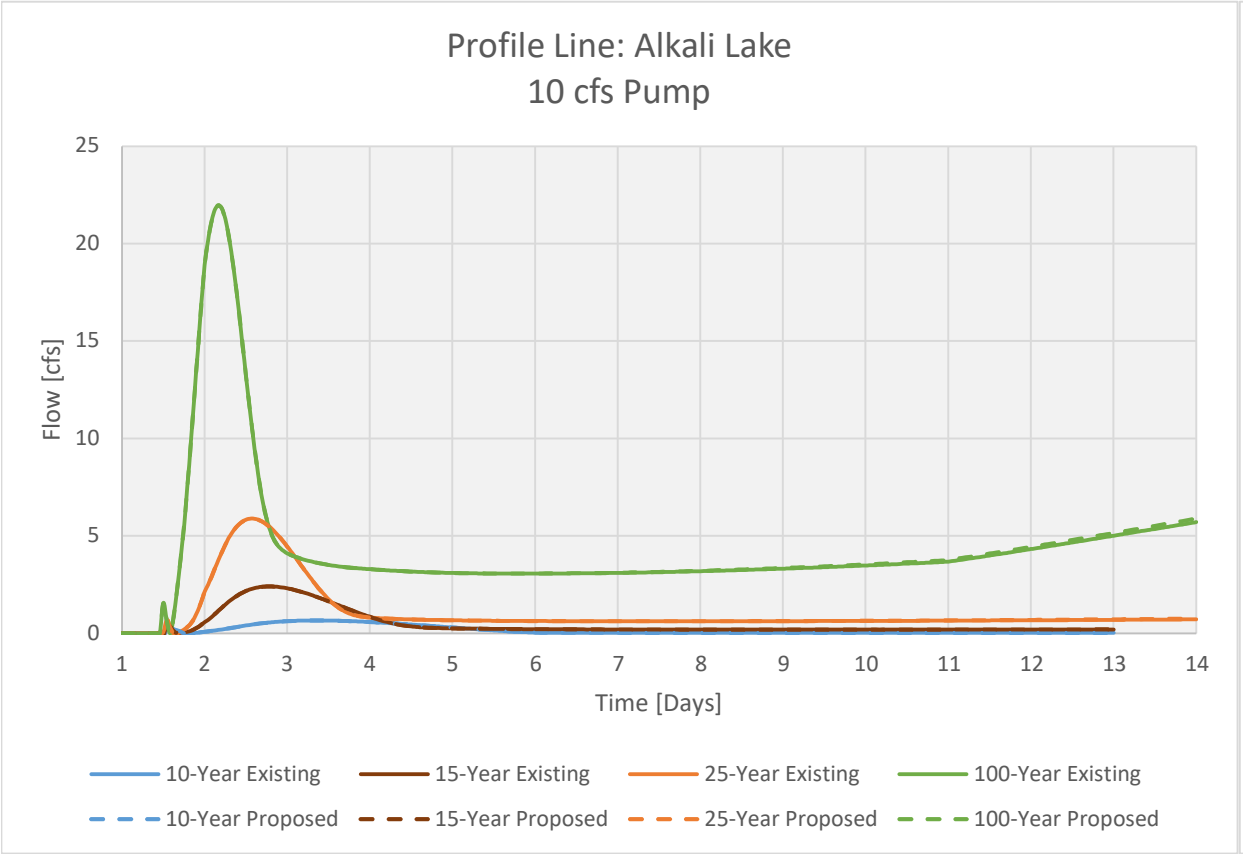

Profile Line: 35th Ave SE
15 cfs Pump
35th Ave SE Overtops at 1728.6
ND stream crossing standards
allowable headwater is 1730.22
Elevation [NADV88]
1,729.0
1,728.5
1,728.0
1,727.5
1,727.0
1,726.5
1,726.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

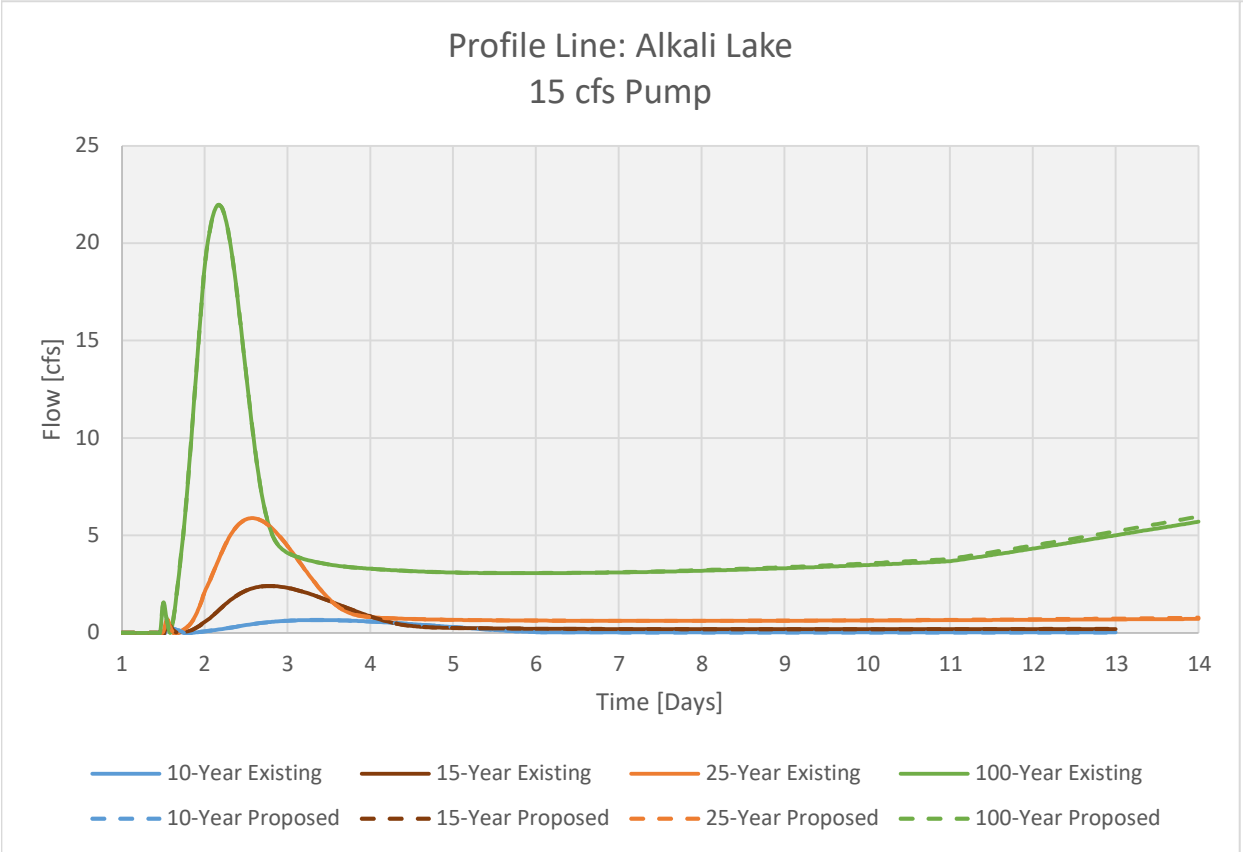

Profile Line: 35th Ave SE
10 cfs Pump
Flow [cfs]
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

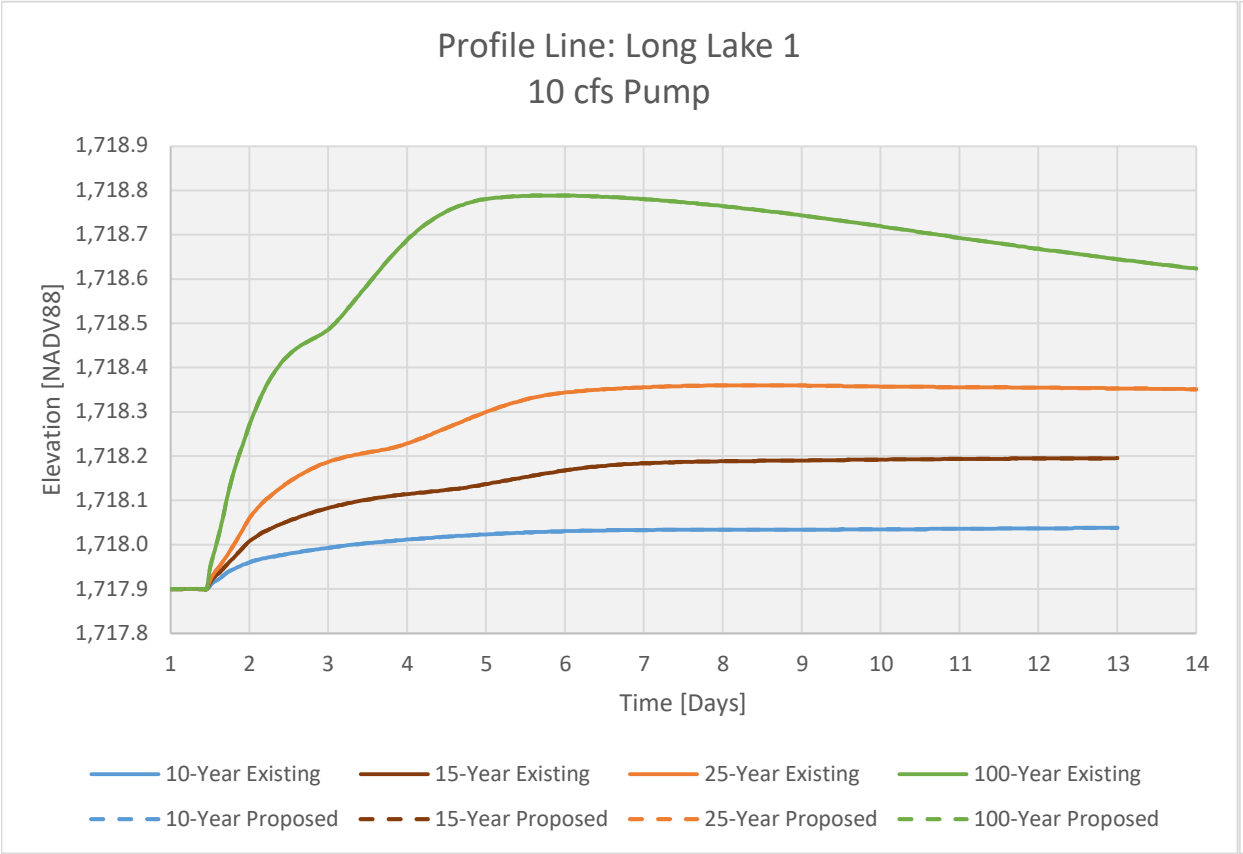

Profile Line: 35th Ave SE
15 cfs Pump
Flow [cfs]
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

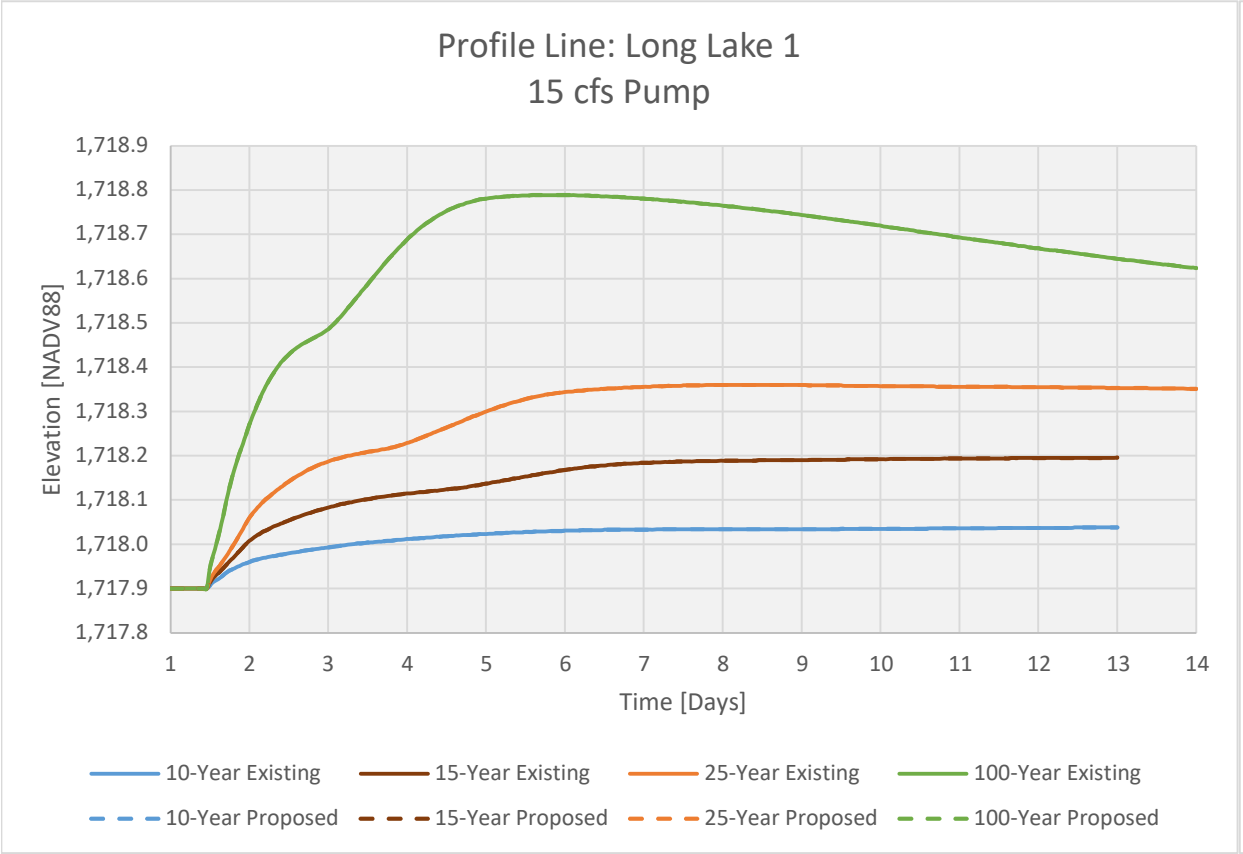

Profile Line: Alkali Lake
10 cfs Pump
Elevation [NADV88]
1,726.25
1,726.20
1,726.15
1,726.10
1,726.05
1,726.00
1,725.95
1,725.90
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

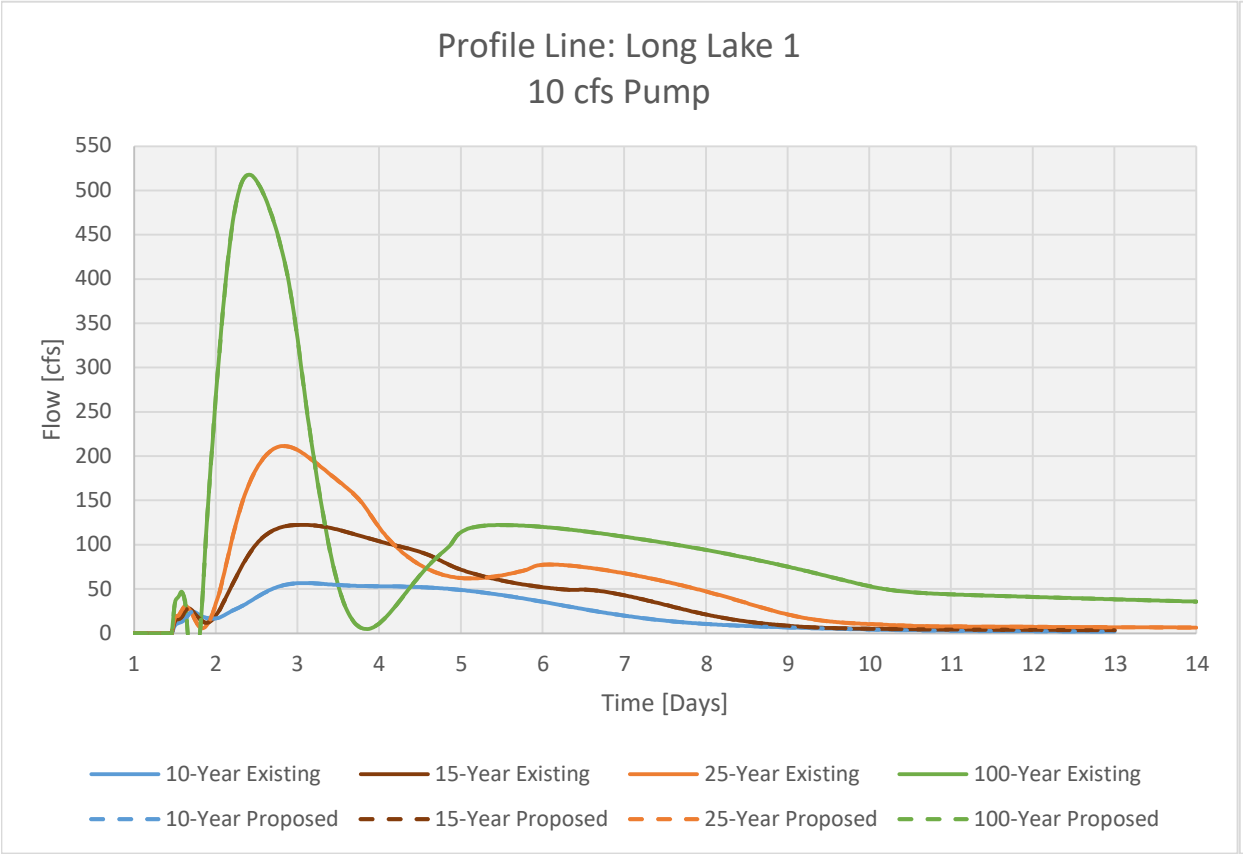

Profile Line: Alkali Lake
15 cfs Pump
Elevation [NADV88]
1,726.25
1,726.20
1,726.15
1,726.10
1,726.05
1,726.00
1,725.95
1,725.90
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed

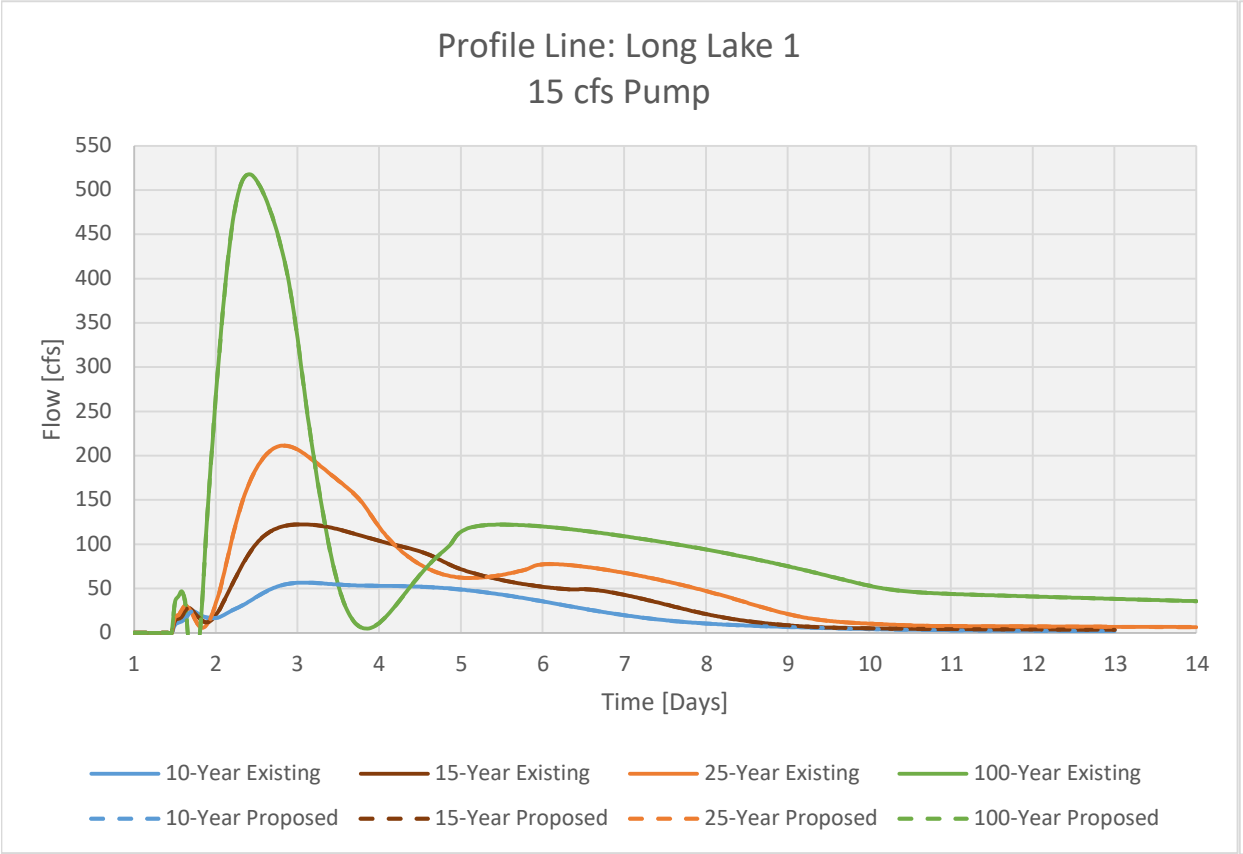

Profile Line: Alkali Lake
10 cfs Pump
Flow [cfs]
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: Alkali Lake
15 cfs Pump
Flow [cfs]
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: Long Lake 1
10 cfs Pump
Elevation [NADV88]
1,718.9
1,718.8
1,718.7
1,718.6
1,718.5
1,718.4
1,718.3
1,718.2
1,718.1
1,718.0
1,717.9
1,717.8
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: Long Lake 1
15 cfs Pump
Elevation [NADV88]
1,718.9
1,718.8
1,718.7
1,718.6
1,718.5
1,718.4
1,718.3
1,718.2
1,718.1
1,718.0
1,717.9
1,717.8
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: Long Lake 1
10 cfs Pump
Flow [cfs]
550
500
450
400
350
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: Long Lake 1
15 cfs Pump
Flow [cfs]
550
500
450
400
350
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
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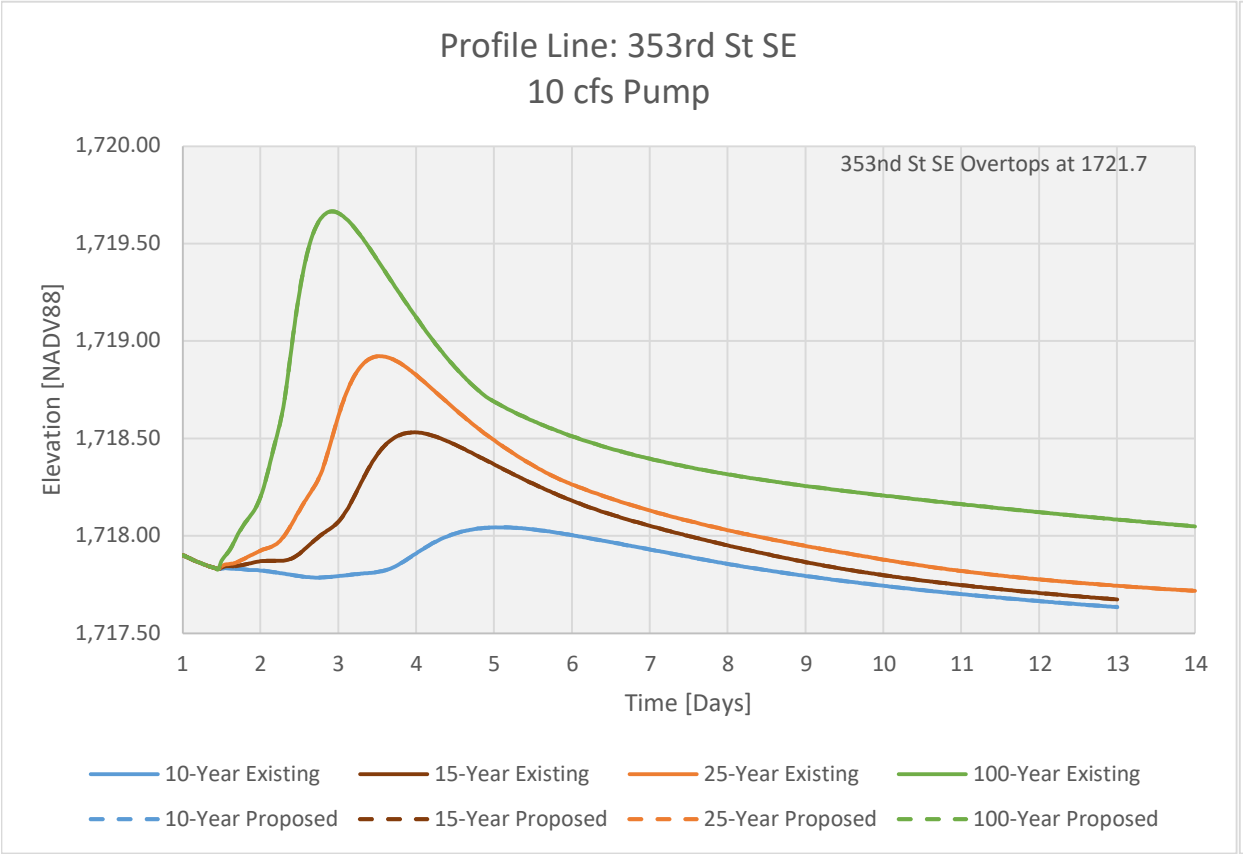
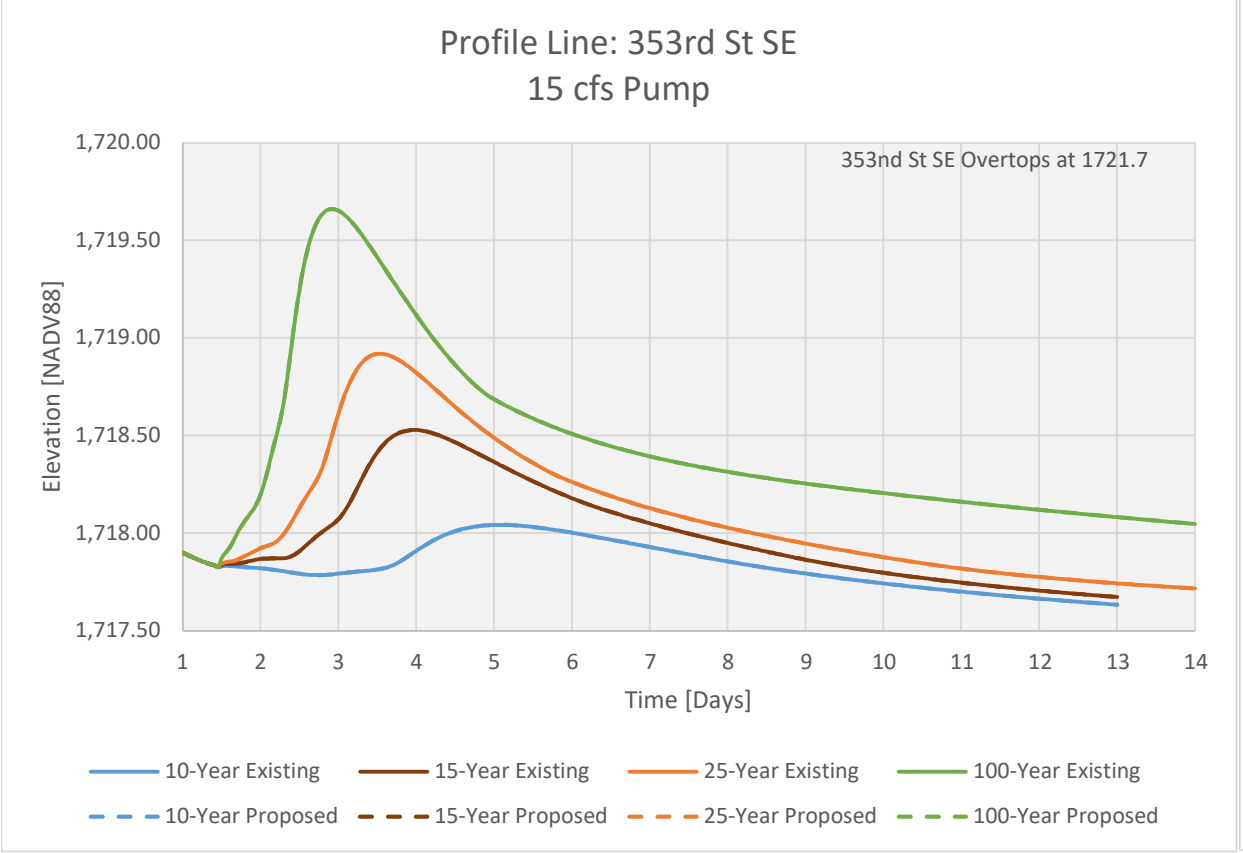
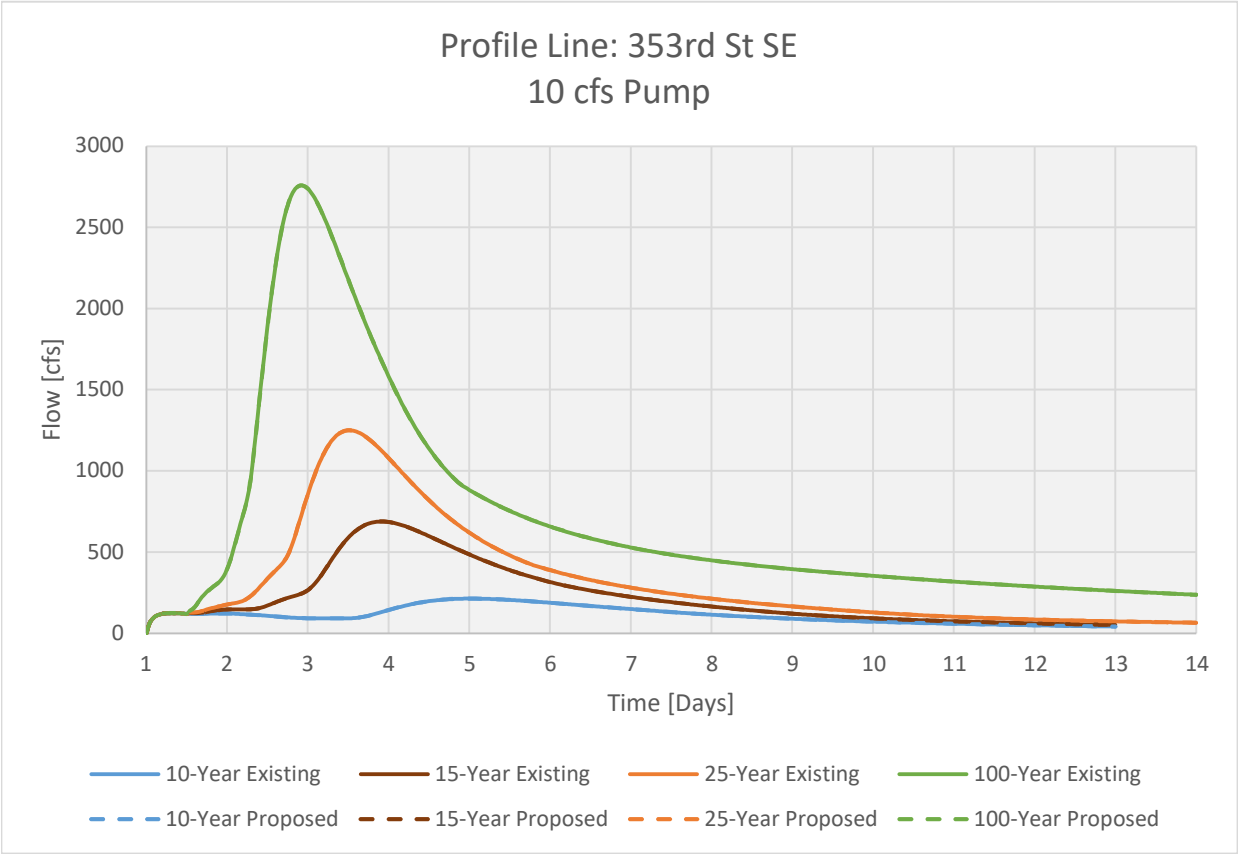
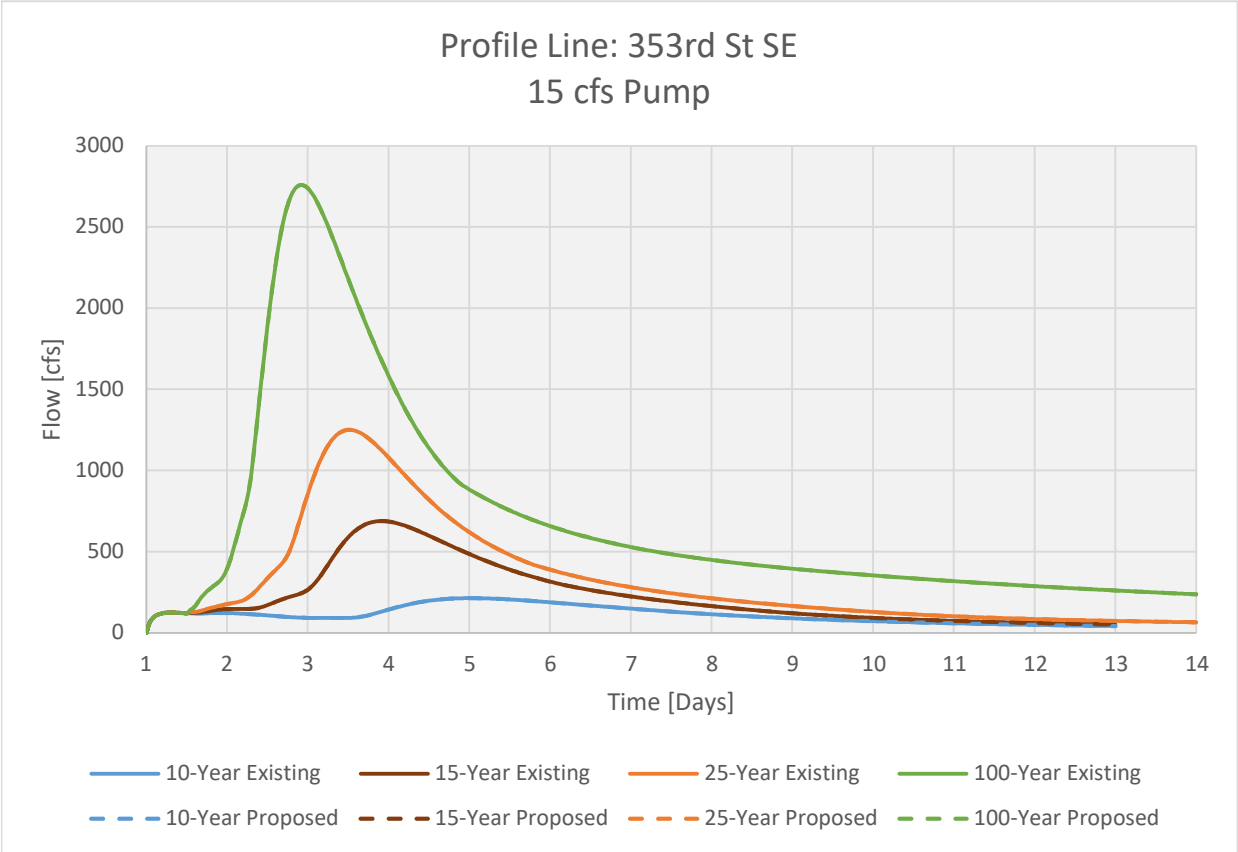
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: 353rd St SE
10 cfs Pump
353nd St SE Overtops at 1721.7
Elevation [NADV88]
1,720.00
1,719.50
1,719.00
1,718.50
1,718.00
1,717.50
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: 353rd St SE
15 cfs Pump
353nd St SE Overtops at 1721.7
Elevation [NADV88]
1,720.00
1,719.50
1,719.00
1,718.50
1,718.00
1,717.50
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: 353rd St SE
10 cfs Pump
Flow [cfs]
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
15-Year Proposed
25-Year Proposed
100-Year Proposed


Profile Line: 353rd St SE
15 cfs Pump
Flow [cfs]
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time [Days]
10-Year Existing
15-Year Existing
25-Year Existing
100-Year Existing
10-Year Proposed
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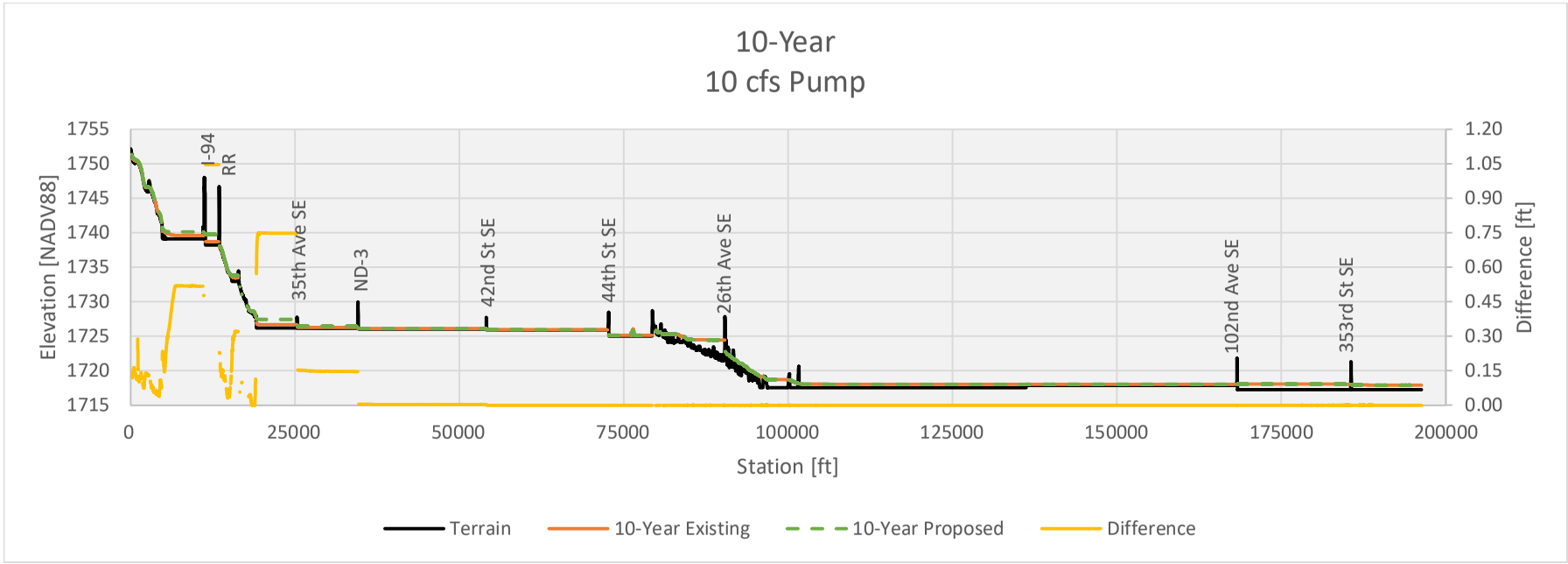
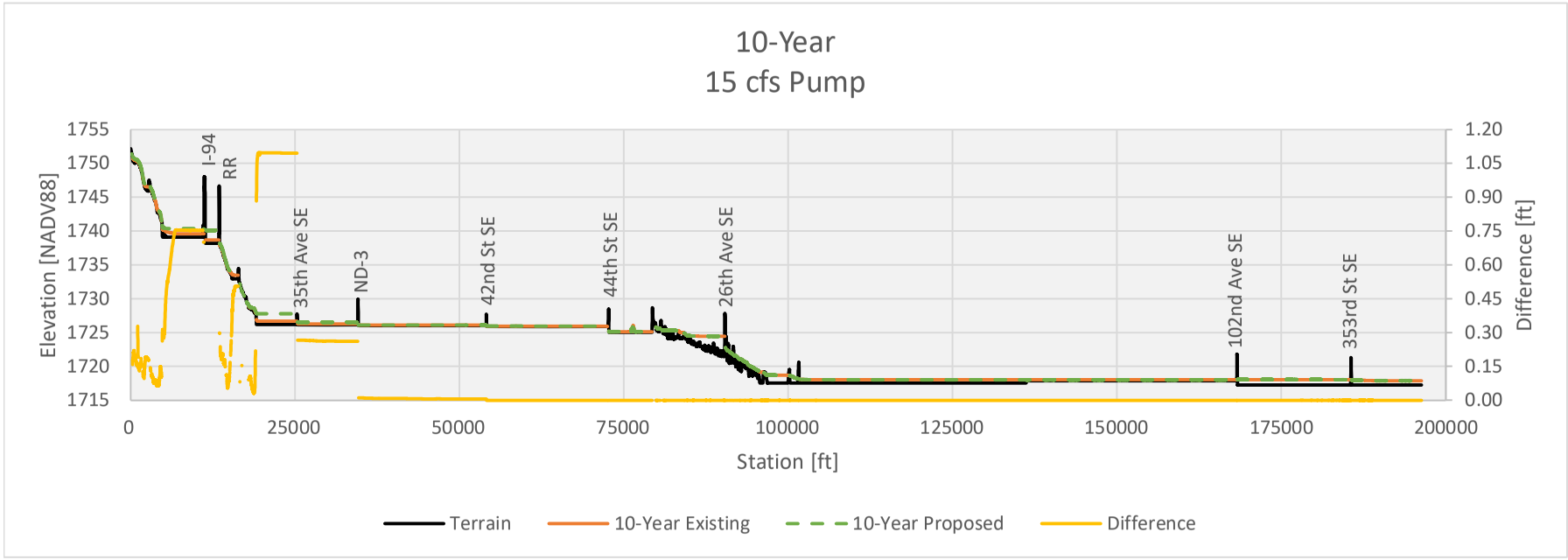
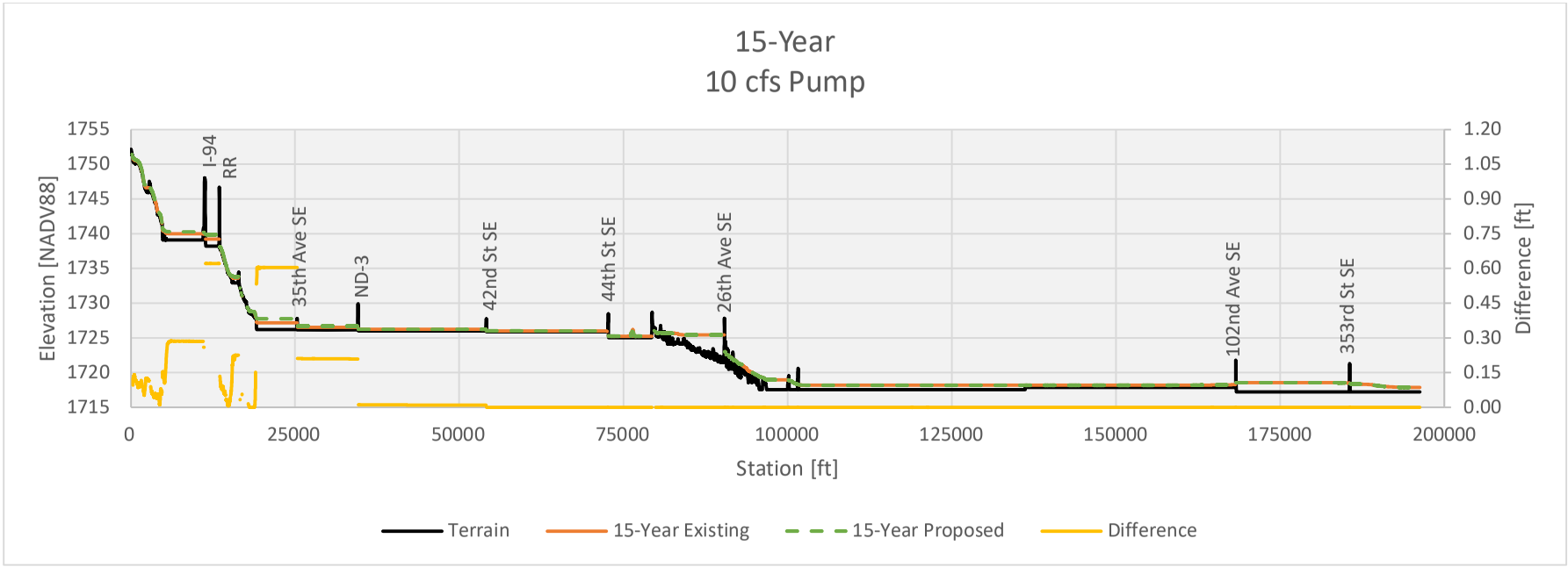
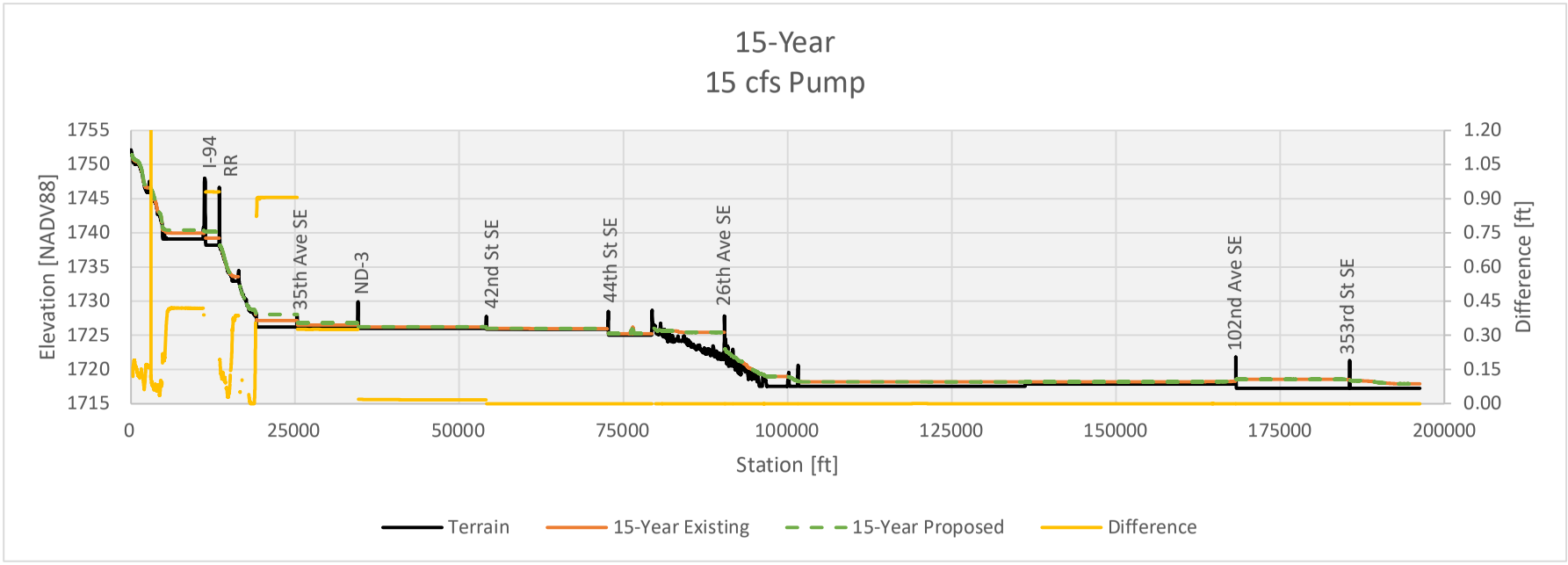
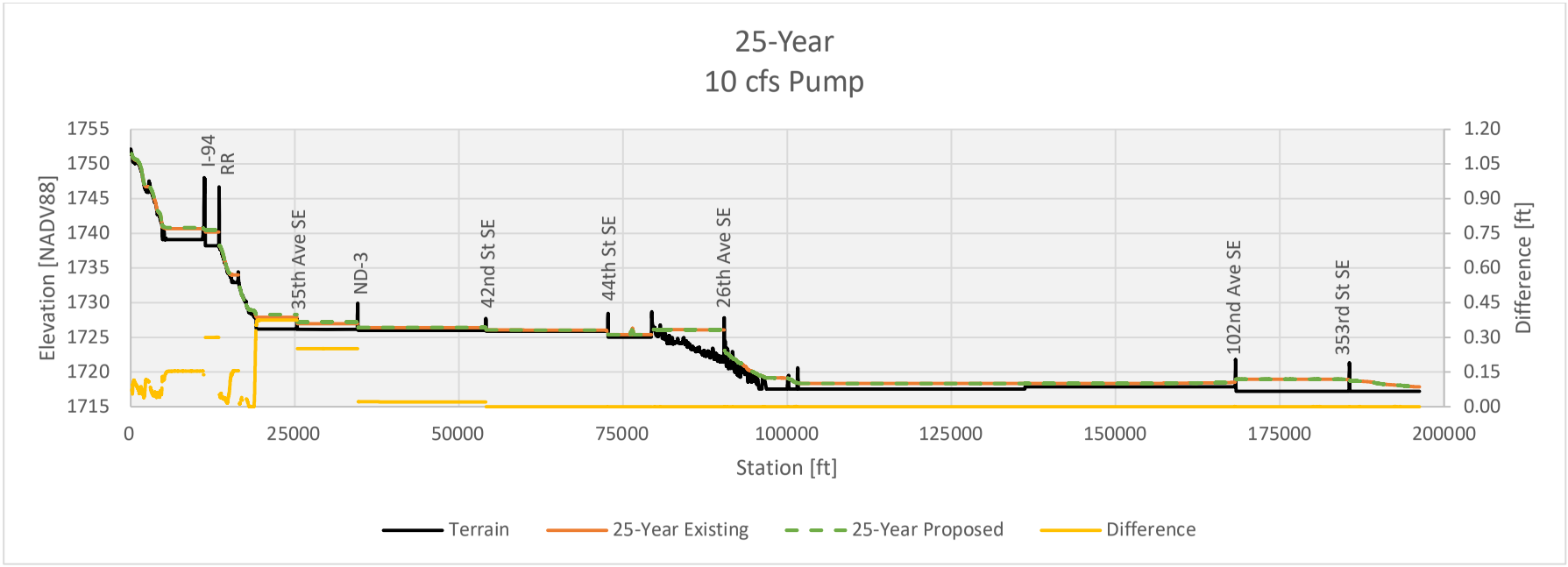
100-Year Proposed

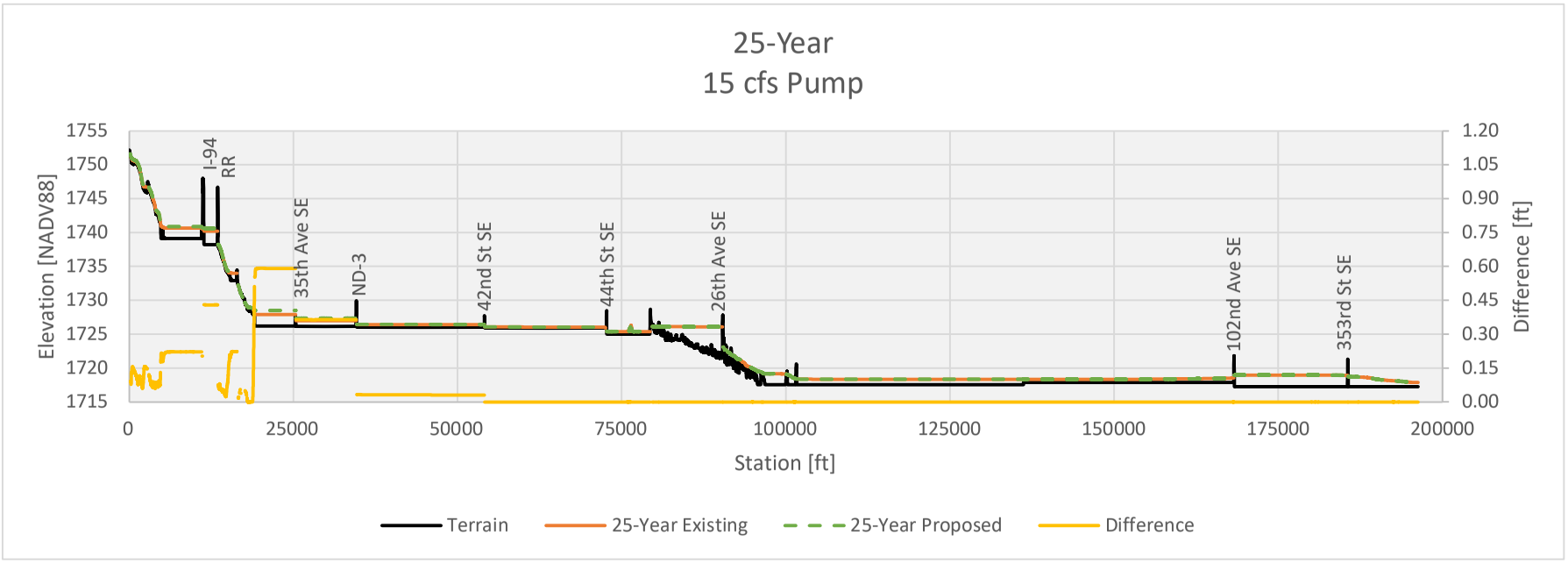

10-Year
10 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
10-Year Existing
10-Year Proposed
Difference

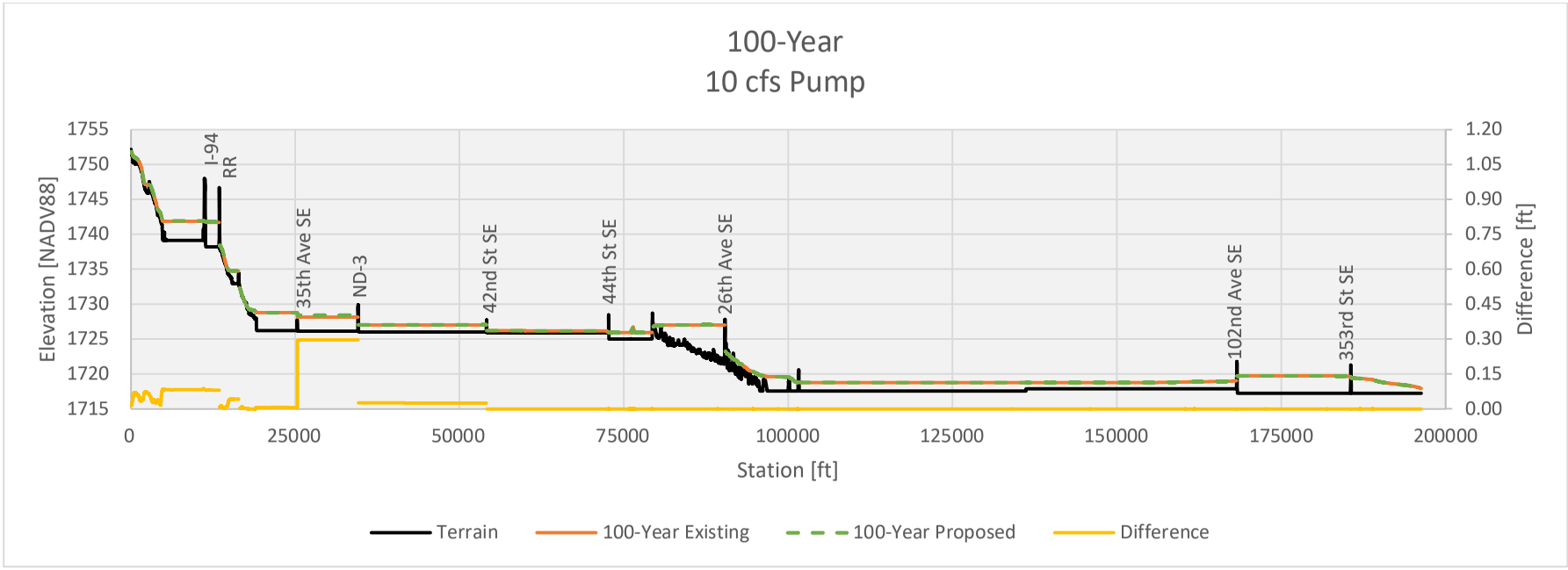

10-Year
15 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
10-Year Existing
10-Year Proposed
Difference

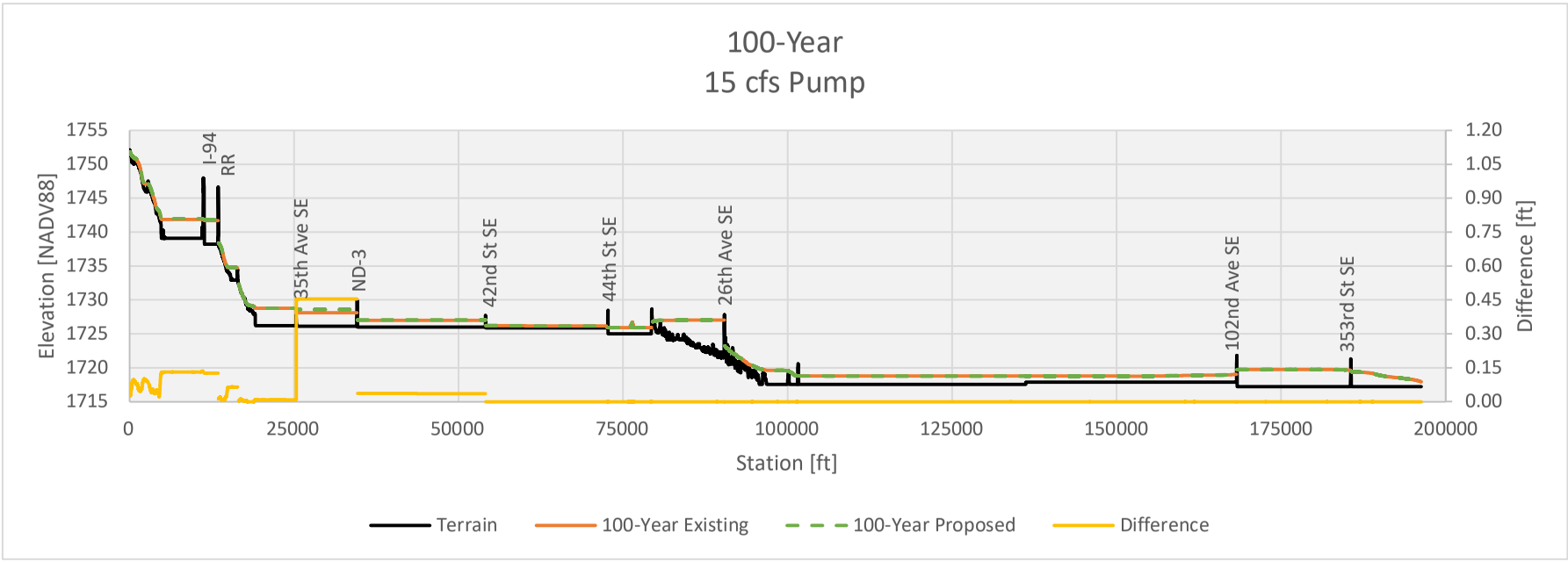

15-Year
10 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
15-Year Existing
15-Year Proposed
Difference


15-Year
15 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
15-Year Existing
15-Year Proposed
Difference


25-Year
10 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94 RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
25-Year Existing
25-Year Proposed
Difference


25-Year
15 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94 RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
25-Year Existing
25-Year Proposed
Difference


100-Year
10 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
100-Year Existing
100-Year Proposed
Difference


100-Year
15 cfs Pump
Elevation [NADV88]
Difference [ft]
Station [ft]
I-94
RR
35th Ave SE
ND-3
42nd St SE
44th St SE
26th Ave SE
102nd Ave SE
353rd St SE
Terrain
100-Year Existing
100-Year Proposed
Difference

Crystal Lake Watershed Initiative
Steering Committee – Informational Update

To:	Steering Committee Stutsman County Commission and WRD Kidder County Commission and WRD Stakeholder email list - as of the date of this update, Stutsman County Web Site
From:	Michael H. Gunsch, PE, CFM, Senior Project Manager Josh Loosmore, Peritiacon
Subject:	Project Status Update and Presentation Information
Date:	December 22, 2025 – Public Information Meeting Summary and Responses
Project:	HEI No. 12808-0001-007

The following is an abbreviated summary of the September 12, 2025, Public Informational meeting held at the Steele Community Building. This summary was prepared as a tabulation versus a transcript of the meeting and related discussions; the meeting was recorded and provided for distribution. The attendance sheets for this public informational meeting, both for those in person and those online are attached.

This summary's format focuses on key elements/questions/responses, rather than attempting to document specific commentary. The first two statements at the meeting are noted below, the second is the basis for what is presented here, that being options for solutions. Understand in this context it's not productive to list every issue that involves consequences, concerns, perspectives and perceptions related to an individual landowner's property, but to focus on potential generalized solutions, to the extent practical.

> "***What are we here to solve?" – Harold Hamm (Continental Petroleum)***
> ***"Focus on the solution not the problem"*** **– Jim Rohn (Motivational Speaker and Author)**

Overall, during the meeting many concerns and issues were presented ranging from local to regional, with each to be considered proactively versus negatively. One essentially was - don't send us any of your water as we have enough already and are unable to accommodate "any more", meaning project waters. Others were questions related to impacts due to the new or project water, costs, operations, and maintenance. In retrospect many landowners appeared to have greater concern about any water, without knowing what that really meant in terms of stream flows or volume. The ability to convey these waters in the existing natural tributary located in Kidder County was previously evaluated and discussed. One attendee noted the 9,000 gallons per minute flow would only fill a 24" culvert about half full. This is not entirely accurate, more on that later, as it relates to channel improvements along the tributary and culvert upgrades at each roadway (stream) crossing. These improvements have been identified as a project cost and not an expense for either Kidder County or the landowners along this system.

To move the project development forward to the Preliminary Engineering Report (PER) the Houston Engineering team has completed services outside the original and amended Feasibility Study scope. These resulted from landowner insight, commentary and a need to respond to public inquiries. While these are generally addressed in the PER, it seemed prudent to touch on some items at this stage in the Feasibility Study. We appreciate that insight and have requested additional funding under **Addendum #2** to address and/or initially document these items and responses.

Kidder County Concerns and Responses

BUDGET ADDENDUM #2 AND ADDENDUM #3 - SCOPE AND BUDGET FOR THE PRELIMINARY ENGINEERING REPORT

Addendum #2 (attached)- About half the out-of-scope services have been completed or near completed, so these costs are ineligible for cost share (ND Department of Water Resources), as are additional services without cost share preapproval. **Addendum #2** includes an initial response to the concerns and questions raised within the limitations of the time allowed to reasonably complete the Feasibility Study and move forward. Given the timeline for an additional cost share request and the amount of that request, it is recommended not to pursue that route and instead push the larger or focused portion of this work into the Preliminary Engineering Report.

The scope and budget process for the Preliminary Engineering Report (**Addendum #3**) is also not an eligible cost. In the interest of maximizing cost share it is recommended that the services necessary to complete and formalize evaluating irrigation removal/use alternative, updated provisions related to capacity improvements to the discharge tributary, and investigating the Long Lake Refuge water management and control issues would be included in the Preliminary Engineering Report. The projected cost to complete the Scope and Budget for the PER remains to be determined as there are various components that remain under consideration.

While the LLNWR outfall structure is in Burleigh County there are no improvements or system upgrades included or subject to evaluation downstream from the LLNWR as part of the Feasibility Study. This area is a larger natural tributary on Long Lake Creek, and unless and until there is regulatory requirement no additional evaluation will be conducted in Burleigh County. The area of Long Lake Creek, McKenzie Slough and Apple Creek were mentioned as having issues needing to be addressed. The answer to this is “no” they are independent elements with capacity to convey project flows. Therefore, tying project planning and development to requiring improvements in this reach is premature and counterproductive.

Considering these factors **Addendum #2,** in the amount of $21,300, has been submitted to complete the Feasibility Study, based on the out-of-scope services to date, including the Kidder County Public Informational meeting summary, along with the issues noted. The following are the expanded components that will require additional services. These will be completed as supplemental appendices to the Feasibility Study, as part of the Preliminary Engineering Report.

Irrigation Potential and Benefits (Irrigation Appendix)

Landowners have suggested a project alternative to remove excess surface water or including groundwater removal through its use for irrigation. The purpose would not only be for floodwater removal, but to provide economic development opportunities. This alternative was not included in the original Feasibility Study Scope as it was not material at the time as the groundwater review was limited, though the evaluation of groundwater's influence has since been expanded. This appendix will provide a more in-depth review of the ability to remove water from the lake system and/or groundwaters to consider those potential economic opportunities. Removal of these waters after discharge into the receiving tributary is potentially viable as an irrigation source. Removal or distribution of water directly from the pipeline is not an option for individual users but may be a consideration for an established irrigation district. It is our understanding that the Central Dakota Irrigation District is active and may encompass all lands in Kidder County. It is recommended they be contacted to discuss how this project or related investigations could be used to benefit that district.

The utilization of project water from its pipeline for irrigation was discussed, but no formal determinations were made. This approach is problematic based on the principal funding source being for flood control. The ability to use such water for alternative purposes will require regulatory review and permitting, as well as consideration related to project funding and repayment by the participating beneficiaries. Assigning benefits not tied to floodwater removal could create issues related to construction timeline as well as acceptability to the project owners/operators and funding agencies. Groundwater recharge was suggested in some locations, however that was not deemed viable given the excessively high groundwaters within the regional area. The availability of irrigation water in some areas appears to be potentially related to well capacity and their location.

Solution – to further evaluate the viability and consequences of an irrigation alternative, is this a feasible solution and how might it or some variation be implemented? The initial assessment was that it is not a viable solution, for reasons noted above, however a further review would be completed for the Preliminary Engineering Report, as part of the final alternative selection.

Kidder Couty Tributary (Tributary Appendix)

There was considerable discussion regarding the potential and perceived impacts to the tributary channel into which the pumped waters would be discharged. The landowner(s) position was there was no way they could or would accept any additional water. It appears the greatest unknown is a perception related to the actual amount of water they will receive (0 to 20 cfs, 0 to 9,000 gpm) and how these discharges are accommodated. One solution, and the focus of the Feasibility Study is to create a system that can accommodate the discharges without adverse impacts and/or to mitigate the impacts. It was noted that during high flows in the tributary during flood flows the pumps could be shut down, thus avoiding impacts all together. However, if the tributaries' capacity was adequately increased halting pumping may not be required. In addition, a system that had to go through shut down periods would be a less reliable irrigation supply during that period.

There were questions related to the pump shut down procedures and if the landowners would be in control of that system? The answer was no, in that the system operating authority would be in control, and any releases regulated by the approved drainage and water quality permits and their conditions.

Initially the Feasibility Study objective was limited to channel maintenance necessary on the stream (e.g. vegetation removal, control and spraying), along with an additional culvert at each crossing to accommodate the limited project discharges. This recognized that the additional flows can be conveyed in the existing system with limited system improvements. Several attendees acknowledge that the amount of new water could be conveyed in a 24" culvert, which initial appears viable from a stream crossing and impact assessment on backwaters and flow depth.

Solution – The proposed approach to be evaluated in the Preliminary Engineering Report is excavation of a two-foot-deep conveyance channel, with a 12-foot bottom width and 6:1 side slope. This would be supplemented by installing a 36" x 24" arch culvert at each crossing. The project releases would be accommodated within this improved channel and the culverts limit backwaters to a two-foot depth that would not have water flowing in the existing culverts. Though long-term channel conditions could create this situation as the project ages. The channel would be revegetated, and if dry, suitable for mowing. Though given high groundwaters in this area there is no assurance for to occur at least in the near term. An added value with an excavated channel is the lowering or removal of groundwater at the surface immediately adjacent to the channel. The scope of services, in the Preliminary Engineering Report, will include individual landowner meetings, to discuss specific problems being experienced on their properties and potential solutions that have merit. Also important to understand is that the channel and culvert maintenance would be a project cost with any work and future maintenance being completed with easements obtained from the landowners.

Long Lake National Wildlife Refuge (LLNWR Appendix)

There were numerous concerns expressed regarding the localized effects of flooding around the Long Lake National Wildlife Refuge. However, the specifics and location of these impacts remain to be determined. This appendix would focus on defining the elements and impacts at issue associated with the refuge, which include and are not limited to the following items noted below. However, the evaluation would focus on refuge compliance rather than any defined solution. While observations and recommendations can be provided through this review, this is a federal refuge, with state permitting, and a federal nexus, leaving refuge compliance to the State of North Dakota or potentially the Burleigh County Water Resource District relative to any illegal obstruction to the flow of water. To be clear these issues are related to existing conditions and not project related. It is understood that these issues need to be evaluated and addressed by the proper authorities and impacted parties as the Preliminary Engineering Report is being completed.

A detailed refuge evaluation is outside the project scope, as the issues are related to a federal refuge located in Kidder County and Burleigh County, and the pre-existing conditions. Therefore, any inclusion in the Crystal Lake Watershed Initiative project needs to be discussed after the refuge provides the requested information. Apparent elements at issue with the refuge are as follows:

- ✓ Stored waters in the refuge appear to be flooding land that is either not on refuge property or within its easements. The initial assessment is based on GIS mapping provided by the US Fish and Wildlife Service. These waters include the potential to increase groundwater saturation on lands adjacent to the refuge. This might also be a situation like the Crystal Springs Lake area where groundwater inflows to the lake are a significant contributing factor, which remains to be determined.

- ✓ Management of the internal refuge gate system appears to influence upstream water levels to the north and thus impacting tributaries to the refuge, located on private lands. There is a question as to whether the refuge and gate system is being managed according to a defined plan or if there have been alterations due to current high water conditions.

- ✓ The wooden stop log gate system that separates the northern and southern refuge areas was replaced in 2015 with aluminum logs to allow for improved ability to adjust their setting. After several visits to the site in late 2024 and in 2025, it was evident that there were no changes made to the stop logs during this period. During several visits it was noted that significant flows were occurring to the north through the gates versus being discharged through the outfall structure.

- ✓ The outfall structure's elevation appears to have been modified via the placement of rocks on top of the concrete weir system. These rocks do not appear to be associated with the original construction and appears to add 12"-18" to the refuge water surface elevation. Information on this structure (i.e., construction plans) has been requested from the refuge manager; however, these remain to be provided.

Information obtained from the NDDOT Bismarck Regulatory District was reviewed related to Highway #83 crossing downstream from the refuge. While the downstream channel and concrete box structure structures appear to contain some sediments, they are not obstructing flows. The concrete box culverts at Highway #83 were installed around the mid-1960s' and there have been no modifications or changes that affect the refuge or its outlet capacity.

Another observation of the channel, Long Lake Creek, is that there is a notable drop in the downstream channel elevation below the refuge. Therefore, this channel does not require any modifications to accommodate project releases, though normal maintenance is not unreasonable. The maximum project release after a full season of inflow is 20 cfs, which based on the length of the outfall structure, the additional water depth would be approximately 1.5" to discharge this flow.

FEASIBILITY STUDY SCHEDULE – SUMMARY

There are many considerations related to the next steps and timing for the Feasibility Study. The following are set at the time of this memorandum, and subject to revision as the project development continues:

1. **Addendum #2 – Approval ($22,300) – December/January**
2. **Feasibility Study Report - Completion January 2026**
    a. Receipt by the Stutsman County Commission and Water Resource District
    b. Distribute to involved and interested parties
    c. Request final cost share from the NDDWR
    d. Long Lake Refuge Data review (TBD)
3. Consideration of **Addendum #3** (Budget TBD)
    a. Authorize development of the Preliminary Engineering Report – Scope and Budget
4. Authorize **Addendum #3** Services (TBD Tentative February – April 2026)
5. Complete **Addendum #3** Services
    a. **Review of the Scope of Services (Phases and Development Components)**
    b. Funding requests to participation entities (BNSF, NDDOT, Camp, County, Others)
    c. DWR Web Grant and DES funding applications - Preliminary Engineering Report
6. **Preliminary Engineering Report** (18 – 24 months) – Budget TBD via **Addendum #3**
    a. Alternative Analysis
    b. Preferred Alternative Selection
    c. Preliminary Design and Opinion of Probable Costs
    d. Funding and Project Implemenation Recommendations

There are considerable complexities to be evaluated and considered in the Scope and Budget for the Preliminary Engineering Report. These will take considerable time to step through to determine the best route to evaluate the final preferred alternative and the ability to fund, implement and operate the project.

If there are questions, please contact:

Michael Gunsch, Senior Project Manager
Houston Engineering, Inc.
701-527-2134 or mgunsch@houstoneng.com.

Crystal Springs Watershed Initiative

Public Informational Meeting - October 17, 2024, Steele Community Center

Attendance Sign In Sheet

Name	Address	City/State	Zip
Levi Taylor		Ypsilanti, ND	58497
Chad Wolsky		Dawson, ND	58401
Mike Hansen		Monpelior, ND	58472
Dan. P. Mittleider		Tappen, ND	58487
Thomas Binder		Steele, ND	58482
Russ Well		Jamestown, ND	58401
Bryan Behm		Medina, ND	58467
Darrell Guthmiller			
Pat Erdelt		Steele, ND	58482
Karen Dockter		Medina, ND	
John Schock		Jamestown, ND	
Greg Spenningsby		Jamestown, ND	58401
Dennis Clark		Woodworth, ND	58496
Dennis Morlock		Pettibone, ND	58475
David & Barb Heaton		Steele, ND	58482
Rick Dewitz		Tappen, ND	58487
Gary Auhely		Steele, ND	58482
Mike & Michelle Keily		Tappen, ND	58487
Brett Stroh		Tappen, ND	58487
Jesse Christenson		Jamestown, ND	58401
Leroy ?		Jamestown, ND	
Donavon Hoffer		Tappen, ND	
David Lang		Dawson	
Mark Staloch		Medina, ND	
Patrick Carroll		Moffit, ND	58560
Steve Koester		Steele, ND	58482
John Patzner		Bismarck, ND	58504
Steven & Stacy Eberl		Dawson, ND	58428
Chance Schaffner		Dawson, ND	58428
Tim & Deb Staloch		Medina, ND	58437
Bill Adams		Steele, ND	58482
Joel Lees		Buchanan, ND	58420
Loren Dewitz		Bismarck, ND	58503
Neil & Becky Fanta		Dawson, ND	58428
Mark Stphens		Bismarck, ND	58504
Craig Kemmet		Tappen, ND	58427
Jane Thomas		Tappen, ND	58487

1. Summary

Meeting title	**Crystal Springs Informational Meeting - October 17th**
Attended participants	**12**
Start time	10/17/25, 4:53:44 PM
End time	10/17/25, 8:04:07 PM
Meeting duration	3h 10m 23s
Average attendance time	1h 29m 1s

2. Participants

Name	First Join	Last Leave	In-Meeting Duration
Michael Gunsch	10/17/25, 5:00:21 PM	10/17/25, 8:04:07 PM	1h 12m 6s
Sherwin Wanner	10/17/25, 4:53:54 PM	10/17/25, 7:25:31 PM	1h 55m 47s
Mike May (External)	10/17/25, 4:59:45 PM	10/17/25, 7:20:00 PM	2h 20m 14s
Dean Sommerfeld	10/17/25, 5:00:12 PM	10/17/25, 6:05:08 PM	1h 4m 55s
Stein, Grace (External)	10/17/25, 5:00:36 PM	10/17/25, 6:17:50 PM	1h 17m 14s
Nat Strutz	10/17/25, 5:06:19 PM	10/17/25, 6:38:22 PM	1h 32m 2s
Thad Kuntz (External)	10/17/25, 5:06:31 PM	10/17/25, 7:20:07 PM	2h 13m 36s
Nancy (Unverified)	10/17/25, 5:10:58 PM	10/17/25, 5:42:02 PM	31m 4s
Josh Loosmore (External)	10/17/25, 5:11:13 PM	10/17/25, 7:19:56 PM	2h 8m 42s
Shawn Mistelski	10/17/25, 5:33:04 PM	10/17/25, 7:09:54 PM	2m 21s
Nancy Braun (Unverified)	10/17/25, 5:43:46 PM	10/17/25, 7:24:51 PM	1h 41m 4s
Travis Johnson	10/17/25, 6:14:59 PM	10/17/25, 8:04:07 PM	1h 49m 7s

3. In-Meeting Activities

Name	Join Time	Leave Time	Duration
Michael Gunsch	10/17/25, 5:00:21 PM	10/17/25, 6:11:57 PM	1h 11m 36s
Michael Gunsch	10/17/25, 8:03:37 PM	10/17/25, 8:04:07 PM	30s
Sherwin Wanner	10/17/25, 4:53:54 PM	10/17/25, 6:48:22 PM	1h 54m 27s
Sherwin Wanner	10/17/25, 7:24:11 PM	10/17/25, 7:25:31 PM	1m 20s
Mike May (External)	10/17/25, 4:59:45 PM	10/17/25, 7:20:00 PM	2h 20m 14s
Dean Sommerfeld	10/17/25, 5:00:12 PM	10/17/25, 6:05:08 PM	1h 4m 55s
Stein, Grace (External)	10/17/25, 5:00:36 PM	10/17/25, 6:17:50 PM	1h 17m 14s
Nat Strutz	10/17/25, 5:06:19 PM	10/17/25, 6:38:22 PM	1h 32m 2s
Thad Kuntz (External)	10/17/25, 5:06:31 PM	10/17/25, 7:20:07 PM	2h 13m 36s
Nancy (Unverified)	10/17/25, 5:10:58 PM	10/17/25, 5:42:02 PM	31m 4s
Josh Loosmore (External)	10/17/25, 5:11:13 PM	10/17/25, 7:19:56 PM	2h 8m 42s
Shawn Mistelski	10/17/25, 5:33:04 PM	10/17/25, 5:33:19 PM	15s
Shawn Mistelski	10/17/25, 6:21:00 PM	10/17/25, 6:21:38 PM	37s
Shawn Mistelski	10/17/25, 7:08:25 PM	10/17/25, 7:09:54 PM	1m 29s
Nancy Braun (Unverified)	10/17/25, 5:43:46 PM	10/17/25, 7:24:51 PM	1h 41m 4s
Travis Johnson	10/17/25, 6:14:59 PM	10/17/25, 8:04:07 PM	1h 49m 7s

This is **Appendix 1, Scope of Services and Engineers Standard Hourly Rates**, - ***ADDENDUM #2*** referred to in and part of the Short Form of Agreement between Owner and Engineer for Professional Services dated **August 20, 2024**

APPENDIX A – SCOPE OF SERVICES – *ADDENDUM #2*
CRYSTAL SPRINGS WATERSHED INITIATIVE - FEASIBILITY STUDY

Total Budget Amendment	**$22,300**	**Revised Total Contract**	**$284,300**
Prime	**Houston Engineering, Inc**		
Subcontractor	**Peritiacon LLC**		
Subcontractor (added)	**Adaptive Resources, Inc**		

Phase 002 - Groundwater Influence Review **$40,400 + $2,500 = $42,900**

The additional funds will be utilized to expand on the discussion of groundwater and potential irrigation opportunities within the regional area, to be included in the Feasibility Study. This will not include an in-depth review of irrigation as a project alternative, as that option will be considered in the Preliminary Engineering Report.

Phase 009 - Feasibility Report **$21,300 + $2,000 = 23,300**

The report will be expanded to include the various items in Addendum #2**.** The increased report costs are incorporated in the other addendum revisions and new phases.

Phase 010 – Kidder County Concerns and Public Information Meeting (New Phase) **$10,500**

This phase involves addressing various items raised during discussions with Kidder County (County Commission, Water Resource District and Landowner) and their concerns related to downstream impacts. Many of these relate to issues not normally considered during a feasibility study level revision, including project funding details and system management. The report will now include information related to those issues, but not full details that are to be developed and evaluated in the Preliminary Engineering Report. A limited amount of time was spent on discussions with Burleigh County representatives to increase project awareness. One deliverable in this phase is the Steering Committee Informational update that documents the Kidder County meeting and project status.

Phase 011 - Long Lake Wildlife Refuge (New Phase) **$7,300**

These services are limited to communications, contacts and requests to the USFWS, regarding their Long Lake Refuge Facilities. This includes securing information on design, permits and management to determine, to the degree practical, related to compliance with their permits and identification of risks to adjoining properties. This will not include detailed evaluations or extended communications related to potential solutions to identified concerns. Additional services related to this issue are to be incorporated into the Preliminary Engineering Report.

STUDY SCHEDULE

The Feasibility Study completion schedule is amended to end of January 2026. These additional services are subject to funding from the Owner and do not include additional grant funding either locally or through the NDSWC. This is due to the fact some services were provided prior to requesting additional cost share assistance and requesting the remaining amount would increase costs and extend the report completion deadline. This deadline includes acceptance of the Stutsman County Commission and the Stutsman County Water Resource District.

Appendix V

Various Documents

- ✓ Passenger Rail Line Proposal – ND Legislative Action
- ✓ Passenger Rail Study (insert link)
- ✓ Jamestown Sun Article – Crystal Springs
- ✓ Lake Side Development Information

HOUSTON engineering, inc.

https://bismarcktribune.com/news/state-regional/government-politics/article_2400cacb-6783-47a9-a30a-9dfe665b61ec.html

ALERT TOP STORY

North Dakota Legislature allocates $150K for passenger rail service project

MASAKI OVA The Jamestown Sun

May 21, 2025

This graphic shows the potential route of restoration of passenger rail service from Chicago to Seattle. Cities on the map are not intended to identify station locations and are used as points of reference. Station locations will be determined in the service development phase of the Corridor Identification and Development Program.

CONTRIBUTED, BIG SKY PASSENGER RAIL AUTHORITY

MASAKI OVA The Jamestown Sun

The North Dakota Legislature during its recently concluded session allocated $150,000 for the creation of a service development plan to restore passenger rail service from Chicago to Seattle on a route likely passing through southern North Dakota and Bismarck.

Dave Strohmaier, chair of the Big Sky Passenger Rail Authority, said the $150,000 will be part of a new $11 million grant agreement with the U.S. Department of Transportation's Federal Railroad Administration. As part of the agreement, $1.1 million is needed to match the federal dollars.

Strohmaier said on May 14 that North Dakota is the only state that has allocated funding for the $11 million grant agreement. He said a few states' legislatures are still in session and working on their budgets.

"The Rail Authority is kicking off a capital campaign to close the gap on the balance of the dollars we need to move forward," he said.

People are also reading...

1. **Negligent homicide trial in Bismarck ends in mistrial**
2. **North Dakota lawmaker Cynthia Schreiber-Beck dies at 70**
3. **Bismarck woman pleads not guilty to attempting to bribe a police officer**
4. **Mandan woman reports to jail after pleading guilty to stealing from employer**

He added about another $1 million is needed for the match of the federal dollars. He said the route for passenger rail service would go through eight states.

The Federal Railroad Administration awarded a $500,000 grant from its Corridor Identification and Development Program to the Big Sky Passenger Rail Authority to restore passenger rail service on the former North Coast Hiawatha Chicago to Seattle

route, known as the Big Sky North Coast Corridor. Passenger rail projects in Amtrak's North Coast Hiawatha are overseen by the Big Sky Passenger Rail Authority.
The Big Sky North Coast Corridor would go through eight states from Chicago to Seattle, including southern Montana and North Dakota. The route would go through Fargo, Jamestown, Bismarck, Dickinson and Medora.

The concept of high-performance rail includes both freight and passenger operations, The Jamestown Sun reported in March. The Big Sky Passenger Rail Authority is developing a route that would include two trains in each direction daily, ensuring that every community with a stop has at least one daylight train.

Rep. Terry Wanzek, R-Jamestown.
PROVIDED

Sen. Terry Wanzek, R-Jamestown, said allocating the $150,000 to the Big Sky Passenger Rail Authority gives the state the ability to participate in the planning of the passenger rail route.

"If we didn't participate, a plan could be developed and we might not have a say in whether they stop in Jamestown, Medora, Bismarck and Fargo or anywhere else," he said.

Rep. Craig Headland, R-Montpelier, said the passenger rail route going through North Dakota will help with tourism.

"I think it would enhance what we are trying to create here in North Dakota," he said.

Headland said the passenger rail route could help get out-of-state visitors to stop in Jamestown, Bismarck or Medora.

"I think it would be used," he said. "I just think it would be a big boost."

Jamestown City Councilman David Steele said he hasn't heard any negative comments about the passenger rail route going through Jamestown.

“Everybody has been positive wishing it was done tomorrow or yesterday,” he said.

Steele said the passenger trains would be great for tourism for all communities along the route.

Rep. Craig Headland, R-Montpelier.
PROVIDED

“We just need to make the connections with the public and what the advantages would be to having passenger rail,” he said.

Strohmaier said the Big Sky Passenger Rail Authority is in the process of completing the first step of the Corridor Identification and Development Program.

“We're coming up with a scope schedule and budget for creation of a service development plan for the route,” he said.

The service development plan results in a corridor project inventory that identifies the capital projects necessary to achieve the proposed service, according to the Federal Railroad Administration’s document on providing a scope of work framework for creating a service development plan.

Strohmaier said the goal is to have the passenger rail service starting in the early to mid-2030s. He said it will take about two to three years to finish the service development plan.

“That gets us up to the point of step three, which is the final step in this program, and that's when we begin preliminary engineering and environmental analysis,” he said. “That's going to be another probably couple-year-long exercise to do all of that

engineering and so that that gets you five or six years into this."
Strohmaier said the Big Sky Passenger Rail Authority also will need to think about the fabrication of the trains.

"We're going to have to start relatively soon thinking about how to get an order lined up so that when we finish all of the planning, all the infrastructure investment, we'll actually have the trains ready," he said.

After the planning work is done, he said, the groundwork can begin.

"That could be double tracking," Strohmaier said. "It could be the reestablishment of stations themselves, which can run the gamut from pretty simple to much more elaborate based on what a community wants."

The Federal Railroad Administration will make the final decision on the locations when approving the service development plan for the route.

For more information about the Corridor Identification and Development Program and the Big Sky Rail Authority, go to **www.bigskyrail.org**.

INTRODUCTION

Corridor ID Program

In 2018, commissioners in counties across southern Montana began discussions to reintroduce passenger rail service. At that time, there was not a government agency or public institution in Montana to oversee such an endeavor. In 2020, interested counties created the Big Sky Passenger Rail Authority, the purpose of which is to preserve and improve abandoned rail service for agriculture, industrial, and passenger traffic. BSPRA's vision is to transform the economy and quality of life across the American West by expanding passenger rail within Montana and encouraging companion efforts in other states through an interstate rail consultation process.

In 2023, BSPRA was awarded a $500,000 FRA Corridor ID Program grant. The Corridor ID Program consists of three steps that direct federal financial support and technical assistance toward the development of proposals for new or improved passenger rail services throughout the United States.

BIG SKY PASSENGER RAIL AUTHORITY

Fast Facts

BIG SKY NORTH COAST CORRIDOR

A Federal Investment in Rural Economic Development

The Big Sky Passenger Rail Authority (BSPRA) is spearheading a multi-state initiative to restore long-distance passenger rail service across across southern Montana and North Dakota and the northern tier of the United States. This route will reconnect numerous rural and Tribal communities with the national rail network, bringing broad economic, environmental, and quality-of-life benefits. As a federally designated long-distance route, the Corridor qualifies for full federal funding for both operations and capital costs

STEP I | 2024 - 2025

- Develop a Scope of Work (SOW) for approval by the Federal Railroad Administration (FRA) of a service development plan (SDP), which encompasses ridership forecasting, route alternatives analysis, and cost assessment
- Foster support through stakeholder engagement and creation of an Intergovernmental Council (IGC) framework
- Secure a 10% non-federal match for Step II

STEP II | 2025 - 2028

- Complete the full SDP, including:
  - Infrastructure and station analysis
  - Ridership and economic forecasting
  - Route refinement and evaluation of alternatives
- Continue stakeholder engagement, finalize IGC, and prepare for Step III.
- Secure a 20% non-federal match for Step III

STEP III | 2028 - TBD

- Engineering, environmental review, and construction planning
- Planning for implementation and construction

TARGETED SERVICE LAUNCH

EARLY TO MID-2030s

Frequently Asked Questions

HOW MUCH WILL IT COST?

Total costs depend on rail infrastructure needs and operational assumptions developed in the Service Development Plan. Route-specific costs will be identified in Step II, including station upgrades, track needs, trainsets, and service operation.

WHO'S PAYING?

Because this is a long-distance route (over 750 miles), both capital and operational costs will be federally funded. States and local governments are not responsible for these expenses. Steps II and III require a 10% and 20% non-federal match, respectively, for planning activities only.

WILL AMTRAK OPERATE THE ROUTE?

Operator selection will occur in Step II per FRA guidance. Amtrak is one possible operator, but others may be considered.

WHEN WILL PASSENGER RAIL RESUME?

We are targeting a service launch in the early to mid-2030s, contingent upon planning, federal approvals, and funding.

WILL STATES OR TRIBES HAVE TO PAY FOR OPERATIONS?

No. Like all long-distance routes, this service will be operated with federal support.
States and Tribes will participate in planning, not in funding operations.

IS THE ROUTE ALREADY SET?

No. Step II includes route alternatives analysis and public input.
The former North Coast Hiawatha alignment is a starting point for evaluation.

HOW WILL THIS AFFECT FREIGHT RAIL?

Planned investments will enhance capacity and safety for both passenger and freight service.
Coordination with host railroads and freight operators is integral throughout.

WHAT'S THE ECONOMIC IMPACT?

Step II will refine current modeling, indicating an annual benefit of $270 million corridor-wide, driven by increased tourism, business activity, and improved access to services.

IS THERE ENOUGH PUBLIC SUPPORT?

Yes. Over 25 counties, 7 Tribes, and numerous economic development groups and municipalities have endorsed the project. In 2025, Montana's HB 848 earned bipartisan support and generated hundreds of pro-rail public comments.

WHY NOW?

This project addresses long-standing gaps in rural mobility and access.
It supports economic revitalization while leveraging a rare federal opportunity to fund new service.

BIG SKY
PASSENGER
RAIL AUTHORITY

For More Details and Updates About the Project

Visit **bigskyrailmt.gov**
Contact **hello@bigskyrailmt.gov**

Contributions coming in for study to move water from Stutsman County

John M. Steiner / The Jamestown Sun file photo
A boathouse at Crystal Springs Lake is partially submerged from the risingwater. Stutsman County Commissioner Jerry Bergquist says contributionsare coming in for the $122,100 local share for a feasibility study on how tomove water from basins in western Stutsman County and Crystal SpringsLake.

BY MASAKI OVA - THE JAMESTOWN SUN

JAMESTOWN — Stutsman County Commissioner Jerry Bergquist said $70,000 has been contributed for the $122,100 local share for a feasibility study on how to move water from basins in western Stutsman County and Crystal Springs Lake.

The feasibility study will show the benefits of removing excess waters, how much of the 250-square-mile watershed is contributing to flooding,

regulatory issues, alternative options to remove water and the cost to remove the excess water.

The study will also help determine what the cost is to move water in different directions. The county is looking to move water to the west to the Missouri River, north to Wells County where Pipestem Creek and the James River originate, or east from Crystal Lakes toward Pipestem Creek and James River.

The cost of the feasibility study is $222,000. The local cost share is about $122,000 if the State Water Commission approves an approximately $100,000 cost-share grant.

Bergquist told the Stutsman County Commission on Tuesday, Oct. 15, the contributions include $20,000 each from the Steele AMVETS and Crystal Springs Bible Camp and $5,000 from the All Vets Club in Jamestown. He added that the contribution from Steele AMVETS is from gaming funds.

He said a $20,000 contribution from BNSF Railway Co. is pending approval of an agreement with Stutsman County. BNSF also has a $20,000 in-kind contribution, which is Houston Engineering's estimate on what the value of BNSF's data is that Houston will use for the feasibility study.

Bergquist said the $70,000 amount also includes a $5,000 contribution from another organization that has yet to be approved. He said three other organizations could contribute funds for the feasibility study as well.

He said the county commission should not go ahead with the feasibility study until the county is notified that it is being awarded the nearly $100,000 cost-share grant.

Commission discusses library agreement

Bergquist said Mayor Dwaine Heinrich missed an opportunity last year when the county commission asked him to sit down to revise or at least review the memorandum of agreement between Stutsman County and the city of Jamestown to provide joint library services.

He said Heinrich wanted to have a group of people to get together who were not associated with the Jamestown City Council or the county commission to review the memorandum of agreement and come up with ideas to make it better. He said the committee was not assembled.

"Now instead of doing what is in the agreement, it says, 'This agreement may be modified at any time by written mutual agreement of the governing authorities of the city and county,'" he said. "Instead of doing that, we are

now dissolving the agreement. In the agreement itself, we are dissolving this relationship. There is no putting this together. We are taking it apart. If that's what the city wants to do, then that's what's going to happen."

Earlier this month, the Jamestown City Council approved providing a two-year notice to the Stutsman County Commission that the city of Jamestown will withdraw from the memorandum of agreement to provide joint library services.

The city would officially withdraw from the memorandum of agreement on Feb. 28, 2027. The city of Jamestown and Stutsman County would still have two years to discuss the memorandum of agreement and procedures.

The city of Jamestown and Stutsman County have provided joint library services under the agreement after voters approved a measure in 2008 to combine them.

Mark Klose, commission chairman, said the new Stutsman County Commission will need to make a decision on whether or not it wants to continue library services.

Klose and Commissioner Joan Morris are not seeking reelection.

Morris said it's her responsibility as a county commissioner to look at how taxpayer funds are spent.

She said Stutsman County pays $175,000 per year for joint library services. She said a contribution of 4 mills would mean the county would provide $375,000 per year, a $200,000 increase, for joint library services.

"I've gone through and I've done analysis after analysis trying to find why the library is spending so much money," she said.

Heinrich said the big flaw in the memorandum of agreement is that it does not include language specifying the city's and county's financial contributions to the James River Valley Library System, The Jamestown Sun reported. He said the City Council passed a resolution to enter into a memorandum of agreement with Stutsman County to establish the joint library board after voters approved the measure in 2008 to combine the city and county libraries. The resolution stipulated that funding would remain the same, which was 15 city mills and 4 county mills. The city and county mills are not of equal value.

Morris said she also looked at alternatives for providing library services to county residents. She said she talked with the University of Jamestown about

a potential partnership and the cost to the county would have been about $125,000 per year.

“So to be in this group with the Alfred Dickey Library, it would cost an additional $250,000 to partner with them than with another vendor and I don’t understand why and I can’t get an answer,” she said. “I don’t think it’s a good taxpayer spend.”

She also questioned why the city is overfunding the James River Valley Library System. She said the library system’s funding is compared to statewide and national averages

VSO seeing out-of-state vets

The Stutsman County Veterans Service Office is helping out-of-state veterans, according to David Bratton, county veterans service officer.

Bratton said the veterans he helped have referred other veterans to the Stutsman County Veterans Service Office. He said some of the veterans have gotten burned in the past with other veterans service offices.

Bratton said being a full-time veterans service officer and being proficient with his work are a couple of reasons why other veterans want to work with him. He said seeing out-of-state veterans does not jeopardize him helping county veterans.

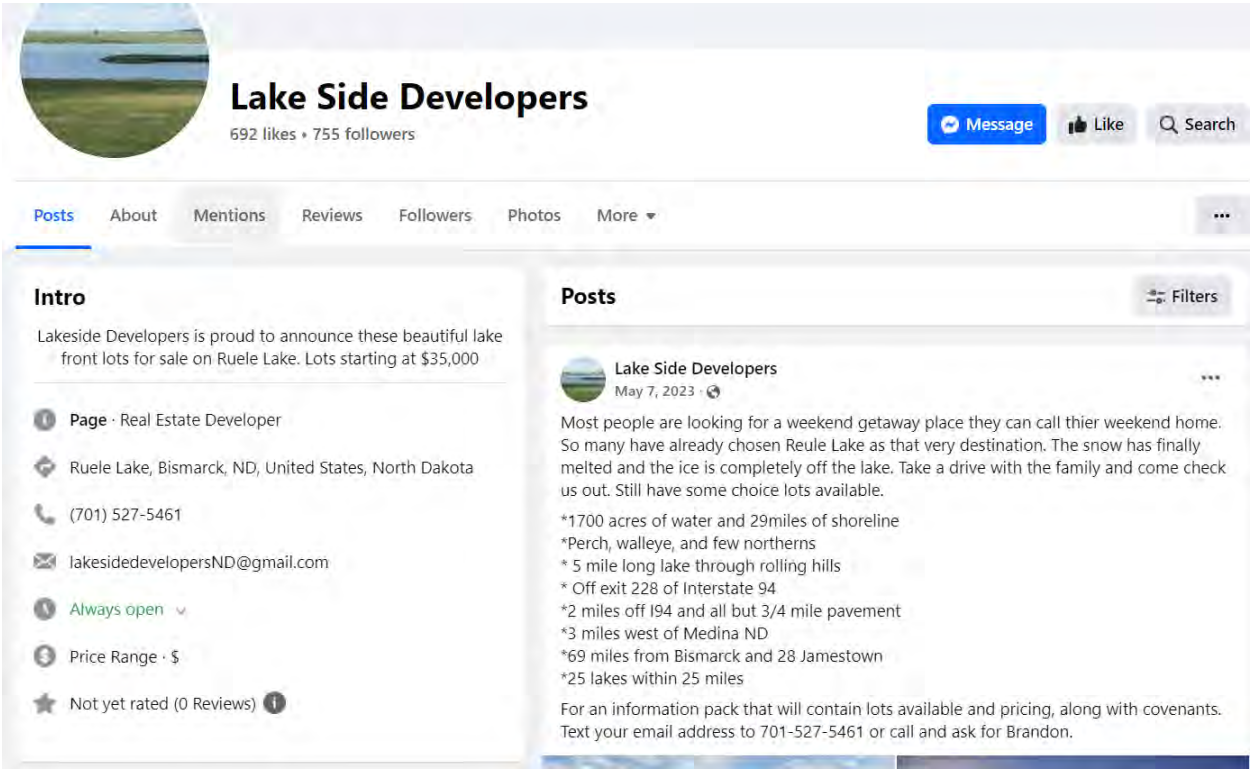
He also said the county Veterans Service Office is by appointment only. He said his office is the busiest it has ever been and he needs time to process claims for veterans.

“We are doing good work over there,” he said. “I’m proud of what we are doing.”

mova@jamestownsun.com | (701) 952-8454

Lake Side Developers

Ruele Lake – Stutsman County



Appendix RL

Reule Lake

- ✓ Ruele Lake Shoreline Topography
- ✓ North Dakota – NE Game and Fish Report
- ✓ NDGF Stoking Report
- ✓ NDDEQ Water Quality Report

HOUSTON engineering, inc.

Legend

Reule Lake Cabin Shoreline Elevations
- 1744 - Reule Dam Natural Overflow
- 1746 - County Road #39
- 1752 - Existing Water Level
- Additional Lakebed Contours
- Reule Lake Cabin Sections
- Parcels

N

0 250 500 1,000
Feet

Reule Lake Cabins Shoreline Map

Scale:	Drawn by:	Checked by:	Project No.:	Date:	Sheet:
AS SHOWN	TP	MG	12808-0001	4/7/2025	1

HOUSTON engineering, inc.

1ft
contours

ND Game & Fish Department Fish Stocking Report

December 2024

Reule Lake -- Stutsman County

2024	Walleye	166,250	Fingerling
2023	Walleye	137,450	Fingerling
2023	Walleye	1,800,000	Fry
2022	Walleye	149,350	Fingerling
2021	Walleye	146,600	Fingerling
2021	Walleye	300,000	Fry
2020	Walleye	150,000	Fingerling
2019	Walleye	150,000	Fingerling
2018	Walleye	75,500	Fingerling
2017	Walleye	273,300	Fingerling
2016	Walleye	49,600	Fingerling
2015	Walleye	111,500	Fingerling
2014	Walleye	46,400	Fingerling
2014	Walleye	200,000	Fry

- Fry are newly hatched fish -- Fingerlings are young fish from 1" to 3" in length -- Advanced Fingerlings are young fish from 4 - 10" in length -- Catchables are young Trout from 8 - 10" in length -- Smolts are young Salmon from 4" - 6" in length

North Dakota Game and Fish Lake Overview

Lake Detail

Lake Overview:

Reule Lake In Stutsman County **1,753.2 msl**

Directions:
5 miles west of Medina

Walleye abundant. Moderate number of perch. Low density pike population.

Sport Fish:
Northern Pike, Walleye, Yellow Perch

Reports: ▼

Stocking Report - Opens a New Tab

Survey Report - Opens a New Tab

Length Table - Opens a New Tab

Length Chart - Opens a New tab

Ramps:

Main Ramp: Gravel Boat Ramp: **Usable**

NORTH Dakota | Environmental Quality

Be Legendary.™

Contact: Watershed Management Program

Phone: 701-328-5210

December 2019

Crystal Springs Lake

(46.878191 N, -99.447809 W)

Kidder and Stutsman Counties

- Crystal Springs Lake is a small natural lake in central North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/crystalsprings2005.pdf).
- There is one public, paved boat ramp on Crystal Springs Lake on the west side of the lake.
- The Crystal Springs Lake watershed is about 700 acres of mostly grassland/pasture, open water and agriculture. The most common crops grown are spring wheat, other hay/non-alfalfa and peas (Table 1).
- Crystal Springs Lake is a Class III fishery, which are "capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota."
- Crystal Springs Lake is managed for walleye, with fingerlings of each stocked annually. Walleye, bullhead species, yellow perch, northern pike, golden shiner and white sucker were captured during the last sample by the ND Game and Fish.
- Crystal Springs Lake was previously assessed in 2008.

Figure 1. *Location of Crystal Springs Lake within the state*

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2018). Value listed of crop type represents percentage of total production*

Land Cover Type	% in Watershed	% within 500 meters
Grassland/Pasture	36.4%	46.9%
Open Water	29.0%	17.7%
Agriculture	18.6%	14.3%
Spring Wheat	*42.2%*	*16.1%*
Other Hay/Non-Alfalfa	*24.2%*	*39.5%*
Peas	*12.9%*	*6.6%*
Developed	12.5%	15.2%
Wetlands	3.0%	5.3%
Forest	0.6%	0.6%
Shrubland	< 0.1%	< 0.1%

Temperature and Dissolved Oxygen

- Crystal Springs Lake rarely stratifies in the summer due to a being a shallow, wind-swept lake.
- There was no thermal stratification recorded in 2019. There was no temperature change during any profile recorded in 2019.
- Dissolved oxygen concentrations were relatively high throughout the water column during all samples.

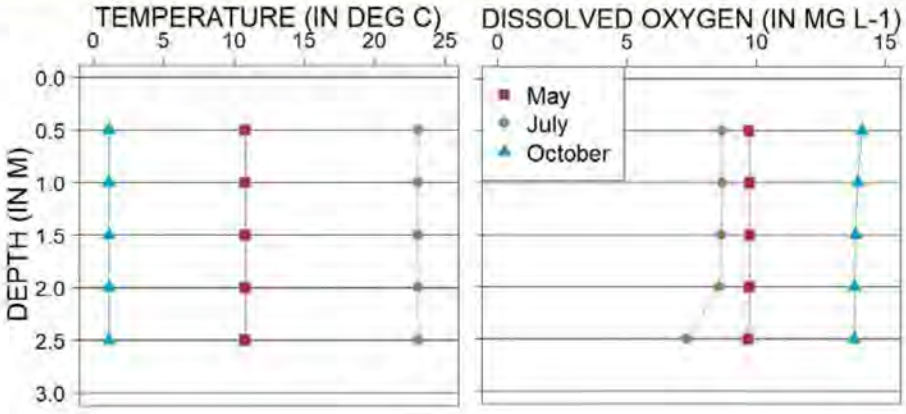


Figure 2. *2019 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

Trophic State Indices

- Trophic state is a measure used by scientists to assess the condition (where lower scores indicate better water quality) of a lake using three common measures: total phosphorus (TP), Secchi disk transparency and chlorophyll-a concentration.
- Crystal Springs Lake is a mesotrophic lake (Figure 3) that has low to moderate nutrient concentrations and moderate algal growth.
- Current trophic state has improved slightly compared to historical data.
- Crystal Springs Lake has not had any confirmed ***harmful*** algal (cyanobacteria) blooms.

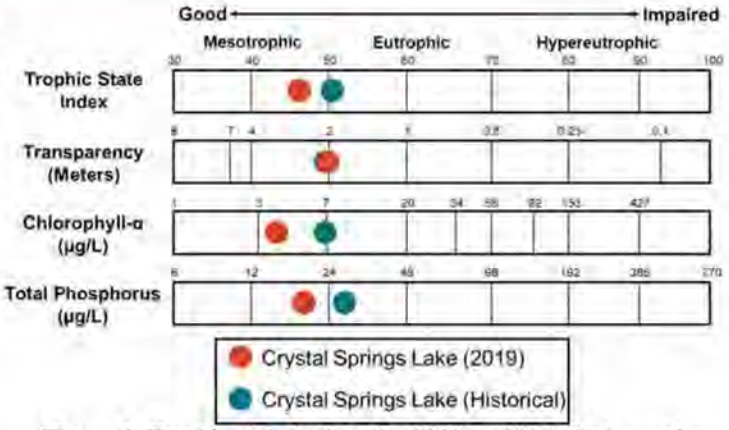


Figure 3. *Trophic state indices for 2019 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) in 2019 was less than the historical median for the lake and much less than the median for the Collapsed Glacial Outwash Level IV Ecoregion (hereafter, Ecoregion) where Crystal Springs Lake is located (Figure 4).
- Median concentration of dissolved TN was slightly less than TN.
- Median TP concentration in 2019 was less than the median for the lake and less than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was similar to TP.
- Neither ammonia nor nitrate-plus-nitrite were detected at Crystal Springs Lake in 2019.

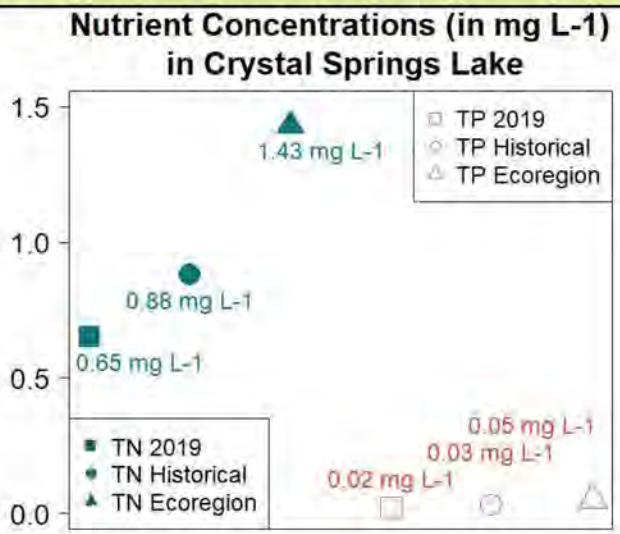


Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2019 and historical samples and from all Ecoregion natural lakes.*

Measure	2019 Median	Historical Median	Ecoregion Median
Alkalinity	200 mg L^{-1}	198 mg L^{-1}	464 mg L^{-1}
Bicarbonate (HCO^-_3)	240 mg L^{-1}	198 mg L^{-1}	463 mg L^{-1}
Calcium (Ca^{2+})	27.4 mg L^{-1}	23.4 mg L^{-1}	26.1 mg L^{-1}
Carbonate (CO^{2-}_3)	4 mg L^{-1}	21.5 mg L^{-1}	56 mg L^{-1}
Conductivity	620 µS cm^{-1}	728 µS cm^{-1}	1,760 µS cm^{-1}
Dissolved Solids	364 mg L^{-1}	442 mg L^{-1}	1,240 mg L^{-1}
Magnesium (Mg^{2+})	40.7 mg L^{-1}	50.8 mg L^{-1}	86.7 mg L^{-1}
Sodium (Na^+)	37.7 mg L^{-1}	52.3 mg L^{-1}	164 mg L^{-1}
Sulfate (SO^{2-}_4)	121 mg L^{-1}	170 mg L^{-1}	547 mg L^{-1}

- Bicarbonate is the dominant anion in Crystal Springs Lake, while magnesium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are less than the historical median for the lake and less than the median for the Ecoregion.

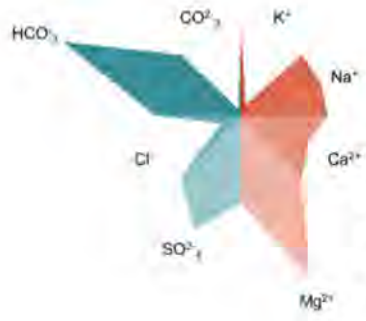


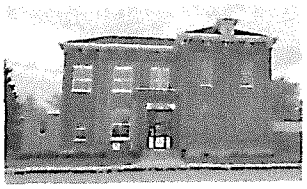
Figure 5. *Maucha diagram showing ionic balance based on 2019 data*

Appendix L

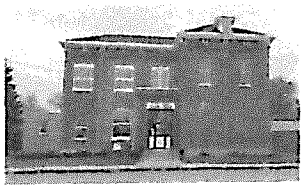
Correspondence

- ✓ Kidder County Commission Letter – March 31, 2025
- ✓ Kidder County Commission Letter – August 3, 2025
- ✓ Stutsman County Response Letter to Kidder County Commission – September 16, 2025

Rec'd 3-31-2025



Kidder County



PO Box 167
Steele, ND 58482-0167
Phone: 701-475-4547 Fax: 701-475-2202

Commissioners:
Darrell Guthmiller Chairman, Timothy C. Dronen, Nicholas Friez
Jean Schoenhard, Auditor

Stutsman County Commission
Jerry Bergquist, Chairman
511 2nd Ave SE
Jamestown, ND 58402-1476

~~Stutsman County Water Resource Board~~
Joel Lees, Chairman
Po Box 68
Jamestown, ND 58402-0068

Dear Mr. Bergquist and Mr. Lees

This letter is in regards to the Crystal Springs Watershed Project. Kidder County has concerns with the plan and the path of water drainage thru Kidder County. The current path of the water thru our county would be a hardship on our property owners with low land flooding.

The culverts we have will not be able to handle the amount of water that will be released. These culverts would have to be replaced with box culverts. Also, the cost of reconstructing the roads to include the box culverts would be an expense to the taxpayers of Kidder County along with the cost of box culverts.

With the ramifications of the water being pushed into our county we feel Kidder County needs to be included into the study at no cost to the county, because of the cost and hardships that will be placed on our tax payers due to the cost of box culverts, roads and overland flooding.

Kidder County does not have any tributary streams or rivers that would connect Crystal Springs with Long Lake.

All of these concerns and cost to our County should be included in the feasibility study. Kidder County would like to extend an invitation to discuss our concerns with Stutsman County and Huston Engineering.

Sincerely,

Darrell Guthmiller

Darrell Guthmiller
Kidder County Commission Chairman

DG/js

KIDDER COUNTY

P.O. BOX 167
STEELE, NORTH DAKOTA 58482
Phone: (701) 475-4547

KIDDER COUNTY WATER DISTRICT BOARD
Pat Leier, Dennis Morlock, Donovan Hoffer
COUNTY COMMISSIONERS:
Darrell Guthmiller, Timothy C. Dronen, Nicholas Friez

Huston Engineering
Michael Gunsch, Engineer
3712 Lockport St #A
Bismarck, ND 58503

Stutsman County Commission
Levi Taylor, Chairman
511 2nd Ave SE
Jamestown, ND 58401

August 3, 2025

To Whom This Concerns,

Kidder County Water Board and the Kidder County Commission would like to inform Huston Engineering and the Stutsman County Commission that Kidder County is not in favor of the Crystal Springs Watershed Project and will not support the project.

The Boards are in consensus that Kidder County does not want water to be piped or drained into Kidder County from Crystal Springs because of the water issues it will create for the Kidder County residents.

Sincerely,

Kidder County District Water Board

Pat Leier, Chairman — Dennis Morlock — Donovan Hoffer

Kidder County Commissioners

Darrell Guthmiller, Chairman — Timothy C. Dronen — Nicholas Friez

js/PL,DG

STUTSMAN COUNTY

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auditor@stutsmancounty.gov
www.stutsmancounty.gov

September 16, 2025

Darell Guthmiller, Chairman
Kidder County Commission

Pat Lier, Chairman
Kidder County Water Resource District

Re: Crystal Springs Watershed Initiative and Feasibility Study

We are in receipt of your letter dated August 3, 2025, regarding opposition to the above project and are providing our response. At the project's inception, Stutsman County committed to involving Kidder County in the project feasibility study discussions and continued that process through the Steering Committee. With this letter we restate our commitment to open continued communication and discussion regarding future project development opportunities.

Our assurance included considering the potential risks and impacts, as well as costs, to Kidder County, which continues to be the case. Your letter states your opposition is *"... because of the water issues created for Kidder County residents"*. Your letter does not define these issues; however, several items were identified and discussed during the scoping process and work on the feasibility study. The final report when completed will document these findings and conclusions regarding the impact evaluation. One primary concern was the ability to accommodate project discharges in the downstream conveyance system in Kidder County, which is a natural watercourse, that flows into and through Lake Etta, then into Long Lake Refuge and Long Lake Creek in Burleigh County.

First, the proposed pump system and 83,000-foot water transmission line will be a buried pipeline system. Construction will result in temporary surface impacts and possibly during future maintenance. This installation will require landowner easements, which are to be acquired via appraisal and negotiated compensation.

Second, easements would also need to be secured along the downstream tributary from the discharge point south to Lake Etta (Hwy #3). Again, these are to be acquired via appraisal and negotiated compensation. The feasibility study indicates there will be limited impacts along this watercourse, along with implementing the following anticipated mitigation measures.

STUTSMAN COUNTY

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www.stutsmancounty.gov

- ✓ The existing watercourse will be cleaned, as necessary to restore its natural functionality, and improved to accommodate the projected project releases. This will provide for existing flows and project waters to be accommodated within the channel without adverse impact. Subsequently, even when project waters are being discharged the existing saturated conditions may be reduced, including the potential removal of groundwater inflows along the system.
- ✓ The existing stream (roadway) crossings currently comply with the ND Stream Crossings Standards, even with the addition of project discharges. The exception is the BNSF rail crossing, which would be improved to achieve their standards by installing an additional culvert. All other stream (roadway) crossings would be improved to provide additional culvert capacity to accommodate the associated project discharges to mitigate stage increases and flood impacts. This will be in the form of additional culverts and/or replacements at each crossing.
- ✓ The acquired easements would allow this watercourse, now an improved channel, to then be operated and maintained during the service life of the project, at the project's expense.
- ✓ **All the above are intended to mitigate, and will provide benefits above existing conditions, at no cost to the property owners or Kidder County residents**. The construction, operation and maintenance would be allowed via the easement provisions, without cost to the landowners or Kidder County.
- ✓ The only properties impacted by project construction and releases are located along the primary conveyance route.

During the Preliminary Engineering Report development, our engineer will be instructed to include in the initial design a more detailed evaluation of the mitigation features along this watercourse as one of the first tasks. This will require 30% design drawings to assist in creating the necessary easements and facilitate landowner negotiations relative to the mitigation measures. The final details and costs for these improvements are currently unknown, though we recognize there are existing issues along the channel that require attention, with or without the project.

We are willing to consult with your Engineer to further evaluate the mitigation needs within the watercourse to accommodate existing runoff and project releases. This could include discussions regarding Kidder County's desire to convey other waters that are not part of the Crystal Springs project.

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In conclusion, without the proposed project improvements drainage conditions within the Kidder County watercourse would remain unchanged and system limitations (i.e., water issues) would not be addressed to the detriment of the Kidder County landowners and the Crystal Spring's project beneficiaries. We recommend continuing the dialogue and discussion of benefits to both Kidder County and Stutsman County during the Preliminary Engineering phase of project development. If you have questions regarding the project, you may contact Michael Gunsch, Project Manager with Houston Engineering at 701-527-2134 or at mgunsch@houstoneng.com

Respectfully,

Levi Taylor
Commission Chairman

C: Stutsman County Commissioners - email
Stutsman County Water Resource District Managers - email
Michael H. Gunsch, Houston Engineering, Inc. – email

Appendix LLR

Long Lake Refuge Summary

- ✓ Letter to Burlegih County Water Resource District – May 6, 2026
- ✓ Long Lake Refuge Data Summary – April 30, 2026

HOUSTON engineering, inc.

STUTSMAN COUNTY

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511 2nd Ave SE Suite 102
Jamestown, ND 58401
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auditor@stutsmancounty.gov
www.stutsmancounty.gov

May 6, 2026

Submitted via Email

James Landenberger, Chairman
Burleigh County Water Resource District
PO Box 1255
Bismarck, ND 58502-1255

Re: Long Lake Refuge Informational Summary

Dear Chairman Landenberger:

On behalf of Stutsman County and the Crystal Springs Watershed Initiative (CSWI) we greatly appreciate the Burleigh County Water Resource District's taking a supporting role in seeking to resolve long-standing flood-related issues associated with the Long Lake Refuge. During our CSWI public meetings regarding potential discharges into Kidder County the landowners were adamant that until the refuge issues were resolved they were not interested in accepting discharges into their county. We took their concerns under advisement and worked to secure background information from the FWS. Then we had Houston Engineering prepare the enclosed informational summary memorandum regarding those issues for your discussion and use.

All the background data provided by the FWS is available through Houston Engineering. We understand that related historic construction and water permit information has been requested from the North Dakota Department of Water Resources.

A collaborative approach and communications with the FWS are critical towards seeking a mutually viable resolution. Again, we appreciate the work you are undertaking to assist the Kidder and Burleigh County landowners. We believe that resolving the refuge and landowner issues provides the ability to build a greater understanding and will improve the opportunity for a potential pathway for the CSWI discharges.

Respectfully,

Levi Taylor
Commission Chairman

Enclosure

cc: Stutsman County Commissioners and WRD Managers – Email
Kidder County Commissioners and WRD Managers – Email
Crystal Springs Watershed Initiative Steering Committee – Email

Long Lake Refuge Data Review
Informational Summary

To: Levi Taylor, Chairman Stutsman County Commission
From: Michael H. Gunsch, PE, CFM
Houston Engineering, Inc.
Date: April 30, 2026
Project: HEI 12808-0001-011

After reviewing information provided, per our request, by the United States Fish and Wildlife Services (*Long Lake National Wildlife Refuge – LLR*), as part of the Crystal Lake Watershed Initiative Feasibility Study for the Stutsman County Commission, we have reached the following findings, conclusions and recommendations.

Findings:

1. The Federal Government developed the Long Lake Refuge (LLR) under the applicable authorities at the time of its creation. The work started in 1936 and extended through 1942, then through easements and construction activities to present day, with a new spillway (i.e., outlet structure) installed in 102nd Avenue in 2000 and a replacement stop-log structure to the east on 102nd Avenue in 2015.
2. The reconstruction of the spillway involved filing with the ND State Engineer to secure a "perfected" water permit and allocation based on the original construction, and current land uses. The original water permit was based on the elevation of the constructed masonry spillway 1713.4 ('29 datum).
3. In 2000 the USFWS filed to secure a new water permit application and received a subsequent "perfected" permit from the ND State Engineer. This occurred after a review of the submitted data and corrections identified and documented by the State Engineer's staff. The newly configured existing outlet structure has an overflow at elevation 1716 ('29 datum). The permit was authorized by the ND State Engineer in a letter to USFWS dated March 2003 (***Attachment F***).
4. In reviewing the construction drawings, however, there is a discrepancy between the permit and other sources, which indicate the control elevation is at 1716.2. This exceeds the authorized permit, see clips from the plan sets at the end of this memorandum.
5. There have been any number of dike/dam improvements that have occurred over the years, and while no permits were provided by the FWS, we did not request them. The FWS noted in their letter that the federals government believes none are required to construct projects on federal lands and that providing them to state or local agencies is a curtesy and not required. (***Exhibit #1***). We understand the North Dakota Department of Water Resources has several recorded permits on file for the LLR features. These documents have been requested from the NDDWR, to assist in further investigating landowner concerns.

6. The original 112-foot-long spillway was located south of 102nd Avenue. This structure was replaced with seven (7) - 3' X 8' box culverts under the roadway, for a total of 56 feet in length, or half the original. The new spillway was also raised to elevation 1716.0 (29 datum), or 2.6 feet higher. It is our understanding that the added depth was desired to improve water quality and improve vegetation within the LLR.

7. Per an engineering report the conversion to '88 datum is ~1.3 feet making the control elevation at 1717.3 ('88). This elevation was then used for our GIS and LiDAR topographic mapping of the lake control and reservoir aerial coverage. It was noted during the aerial photo evaluation that water levels were at or exceeded 1718 ('88). It appears there are a number of properties where the stored waters extended outside the easement boundaries provided by the FWS.

8. Only a few easement documents were provided, some originals others newer. Some allow flooding on all lands within a specific description, while others are based on the projected or new outfall elevation of 1716 ('29 datum). Without mapping individual easements or verifying them through public records we relied on the GIS mapping prepared by the FWS, see attached ***Figure 7***. Many of these are original easements dated 1942. It is unknown if the entire refuge and its flooded or impact area is adequately covered by easements based on available information and mapping. This is a significant concern given the increased elevation and upstream impacts around the refuge based on landowner comments and concerns.

9. Management – during high flows from Long Lake Creek waters entering the LLR from south of Moffit push north into Lake Etta area and upstream into off refuge areas. This conflicts with the natural inflows entering from the north, resulting in backwater flooding in those areas. A detailed water management plan was not provided, though these are typically created for such refugees. Flows north from the refuge were observed during several site visits. These occurred at relatively shallow overflows at the outfall structure and were not controlled or managed with the available stoplog structures.

10. One reason for these flows to the north is the inability of the outfall spillway to accommodate inflows and allow overflows downstream. Such conditions exacerbate upstream flooding within the refuge, by not only increasing floodwater, but extending flood durations, as these waters are stored at higher elevations, then gradually released downstream into Long Lake Creek and through McKenzie Slough.

11. It was noted in 2015 that an internal control structure on 102nd Avenue was replaced and upgraded to assist in managing refuge waters. This metal stoplog structure replaced an older wooden stop log system and had no effect or change on water levels, however management of these gates could increase the flood potential in Burleigh County as well as upstream into Kidder County. To our knowledge there is no formal management plan for the operation of this structure related to water levels within the refuge.

Conclusion and Observations:

Based on the informational summary above and the drawings provided there are several critical issues of concern documented as follows:

1. The outfall structure's (spillway) ability to remove excess waters or floodwaters from the refuge was affected by a reduction in the spillway length from 112 feet to 56 feet effectively half. This does not include entrance losses, as well as headwater impacts when inflows exceed the 3-foot-high box culvert depth. The result is an increase in upstream flood levels and a longer duration of higher waters held on easement and non-easement lands. **A determination regarding the increased water level depth and flood duration is outside the scope of this review**. However, to better understand and manage the refuge a full hydrological and hydraulic assessment of the watershed, outfall capacity is highly recommended, along with developing a management plan for water control within the refuge. We are not aware that one was completed with the original design but understand if there is no formal management plan for a passive spillway structure, however the upstream stoplog gate systems are intended for internal water level control.
2. As a point of reference, there was a downstream box culvert 24' long x 16' wide under the roadway (102nd Avenue), with the top of road deck at 1718.8, and abutments at 1719.84 as illustrated in the original construction drawings. This structure restricted discharges from the original outfall structure, therefore, the capacity decrease noted may be less unless roadway overtopping occurred. The current design (circa 2000) has a control elevation of 1716 at the invert of the box culverts. The FWS did not provide any engineering documentation regarding the sizing of this structure.
3. The construction drawings for "Dike A" place the overflow spillway elevation at 1716.2 or 0.2 feet higher than authorized under their "perfected" water permit. As a point of reference adding 0.2 feet of water based on a stated surface area of >13,500 acres, would increase total storage by 2,700 ac-ft. A preliminary GIS review found the acre to be closer to 17,000 acres, at around 1718 ('88). Therefore, there is a question whether 0.2 feet is closer to 3,400 ac-ft. This issue needs to be evaluated to clarify the status of the outfall elevation and actual stored waters as it relates to the "perfected" water permit.

4. Water levels have been causing increased flooding due to higher water surface elevations and extended flood duration due to the inability to remove inflows. Another adverse impact is potentially increased groundwaters on adjacent properties. The Kidder County landowners during the Crystal Springs Watershed Initiative public information meeting expressed serious concerns with existing water levels, however, they were unaware of the cause or how to address. Subsequently, a full investigation to evaluate these issues is appropriate and warranted.

5. The refuge manager commented they are having issues with the inability to remove excess water from the lake. The reason is directly associated with the passive overflow, size of the structure and the lack of low-level removal system for either water quality or elevation control.

Recommendations:

The following recommendations related to the refuge system and its management should be shared with the Burleigh County Water Resource District, as the refuge control structures are located within Burleigh County. Copies of the transmittal should be shared with the Stutsman and Kidder County Commission's, and their respective water resource districts, as well as the North Dakota Department of Water Resources. It is our understanding that the Burleigh County Water Resource District will be contacting representatives from the LLR to discuss the items noted in this summary.

1. The refuge should immediately begin a process to investigate the management of waters within the refuge as it relates to the excessive floodwaters and impacts. The focus would be to restore the value of the refuge as it relates to the original intent for its creation, which appears to have been lost with the historic system modifications and to offset impacts created by the refuge on non-easement lands.

2. The refuge should fully evaluate and categorize their existing easements to determine if all the properties impacted by floodwaters are adequately covered. This to address direct inundation by stored and floodwaters.

3. The bathymetry of the refuge basin needs to be determined as that is necessary to adequately manage waters and wildlife utilizing the refuge.

4. Water levels related their "perfected" water permit and authorized structure need to be evaluated and confirmed. This includes the potential discrepancy between the spillway elevations.

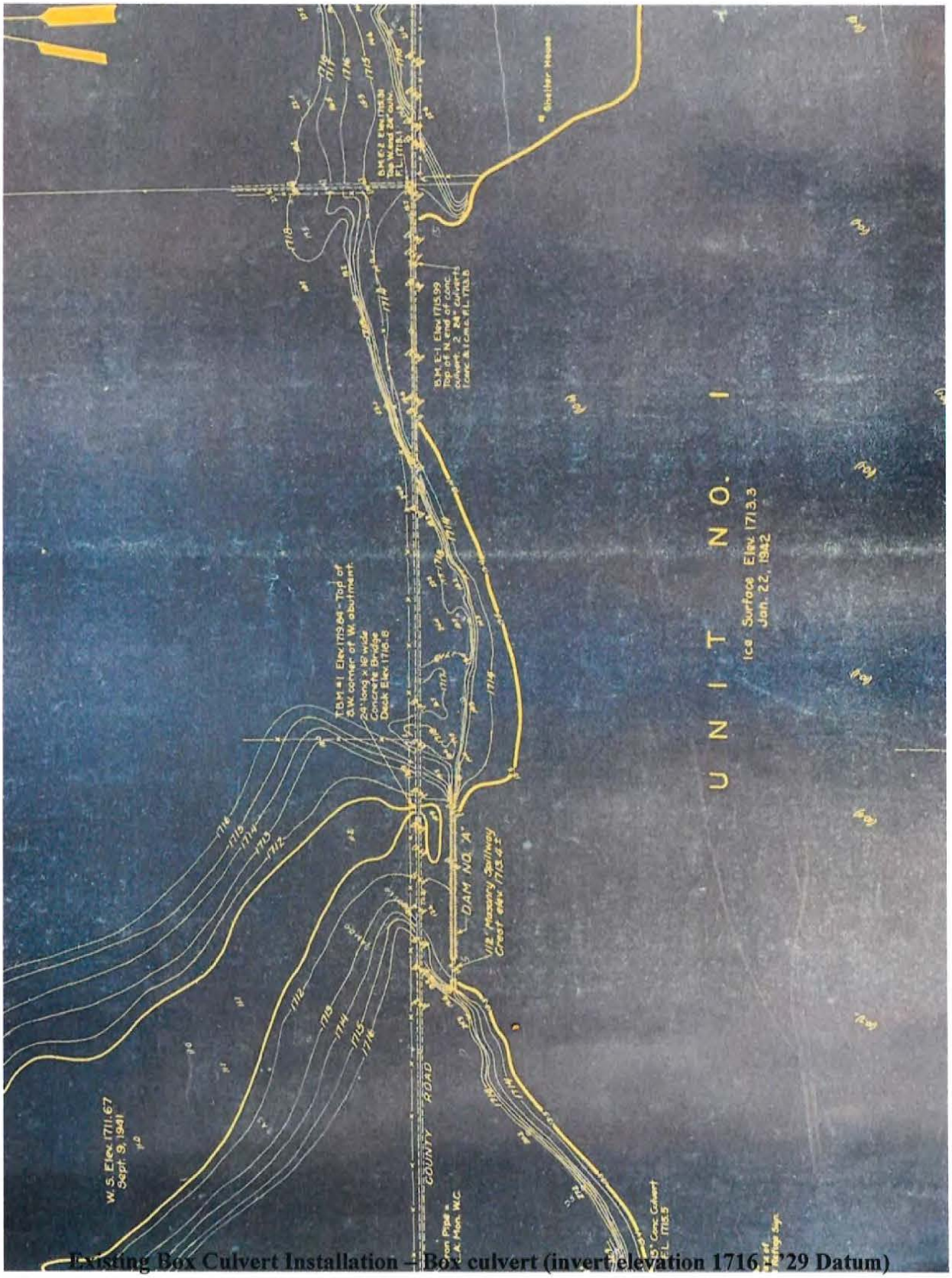
5. A gathering of landowner data and then working with each to evaluate and discuss claims and concerns. This can be accomplished with the assistance of the Burleigh County Water Resource District.

6. The refuge should evaluate the outfall structure to determine the modifications required to restore its capacity to remove waters from the lake based on a frequency designation and duration of flooding consistent with avoiding adverse backwater flooding in around and off the refuge. This may result in the size of the outfall needing to be modified to comply with the easements or a modification to reduce upstream impacts and potentially expanded easement requirements. Such modifications should not preclude a review of downstream flows released from the LLR to avoid historical changes that may create undesirable impacts.

7. There has been discussion that the increased water levels included in the 2000 renovation project were intended to reduce the risk for avian botulism. Information on this was not requested from the refuge, however a management plan for water levels should be prepared to define the uses and benefits to the refuge and avoidance of impacts on the surrounding properties.

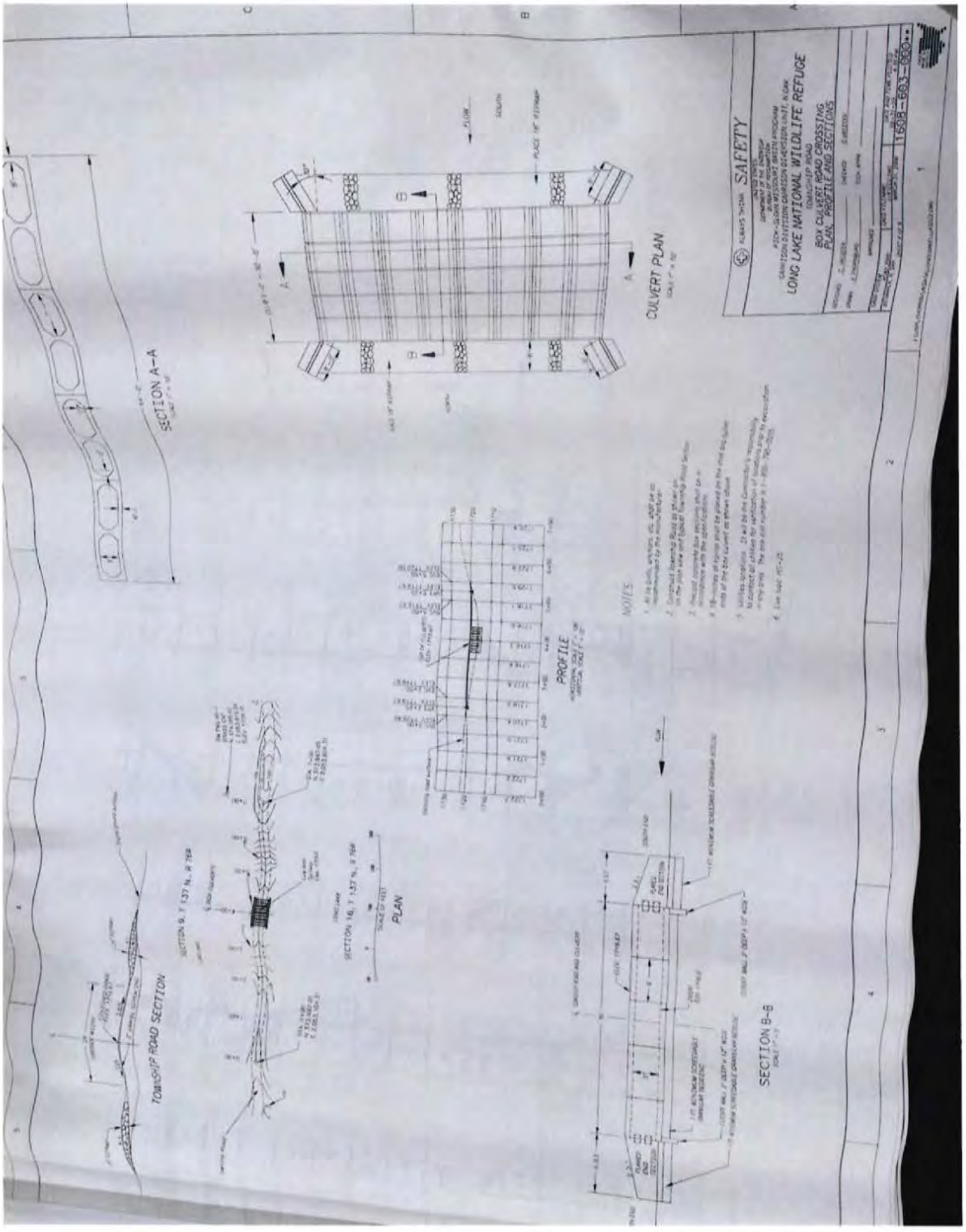
8. The FWS response to the information request (***Exhibit A***) is attached to this summary, and all other information provided is available from Houston Engineering for further review and consideration.

Orignal 112 foot masonry spillway structure (elevation 1713.4 – '29 Datum) with downstream road (102nd Avenue) with a 24' x 16' box culvert

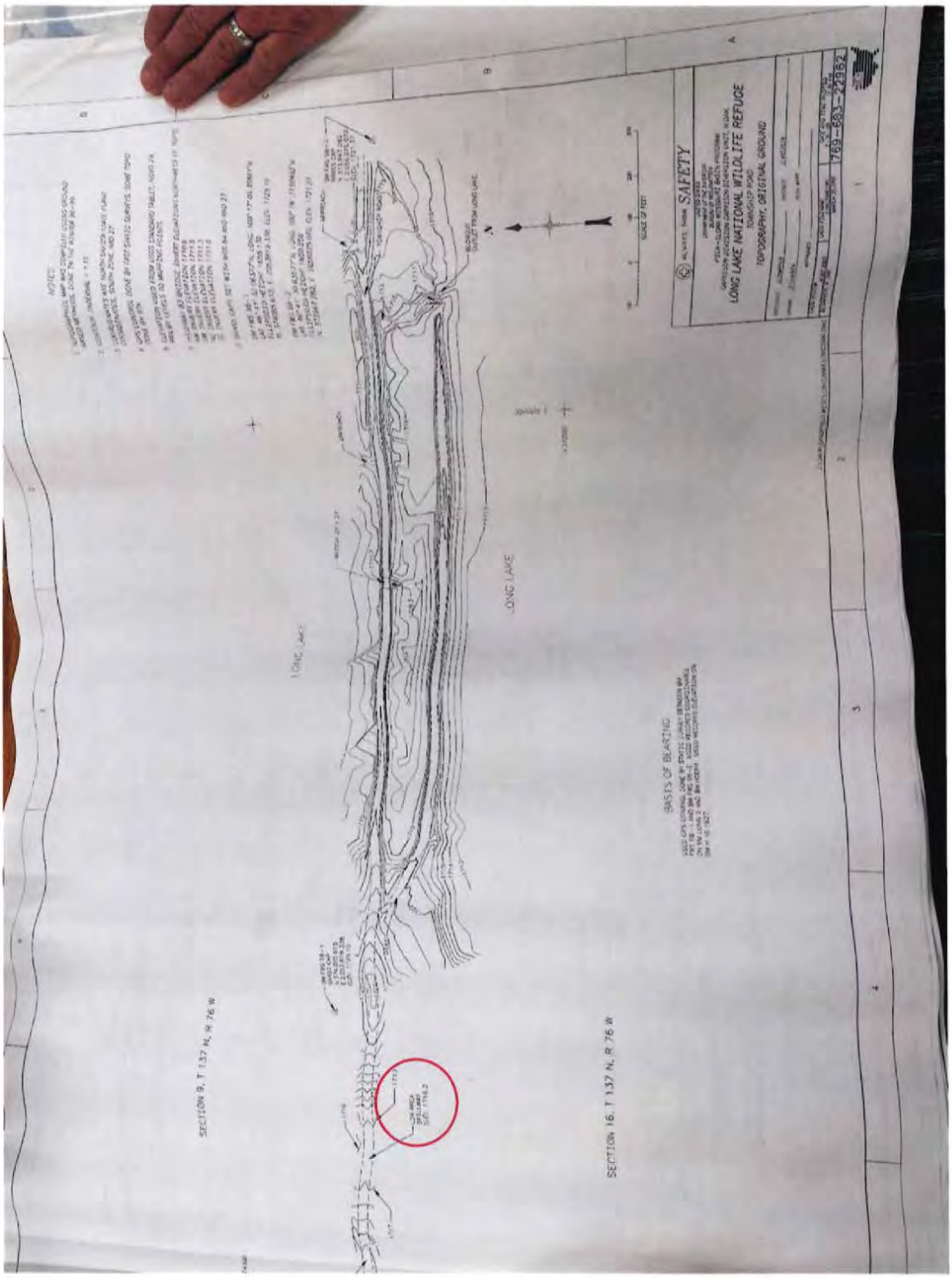


Existing Box Culvert Installation – Box culvert (invert elevation 1716.2' '29 Datum)

3 ft high by 7 foot wide – 8 boxes (effective 56 foot concrete wier)
Rating curve is a box culvert with limited backwater



Construction drawing for Dike A east of the outfall structure.
Note: The low point in the spillway was labled at 1716.2
This is higher than the 1716 permit authorization and should be verfied.



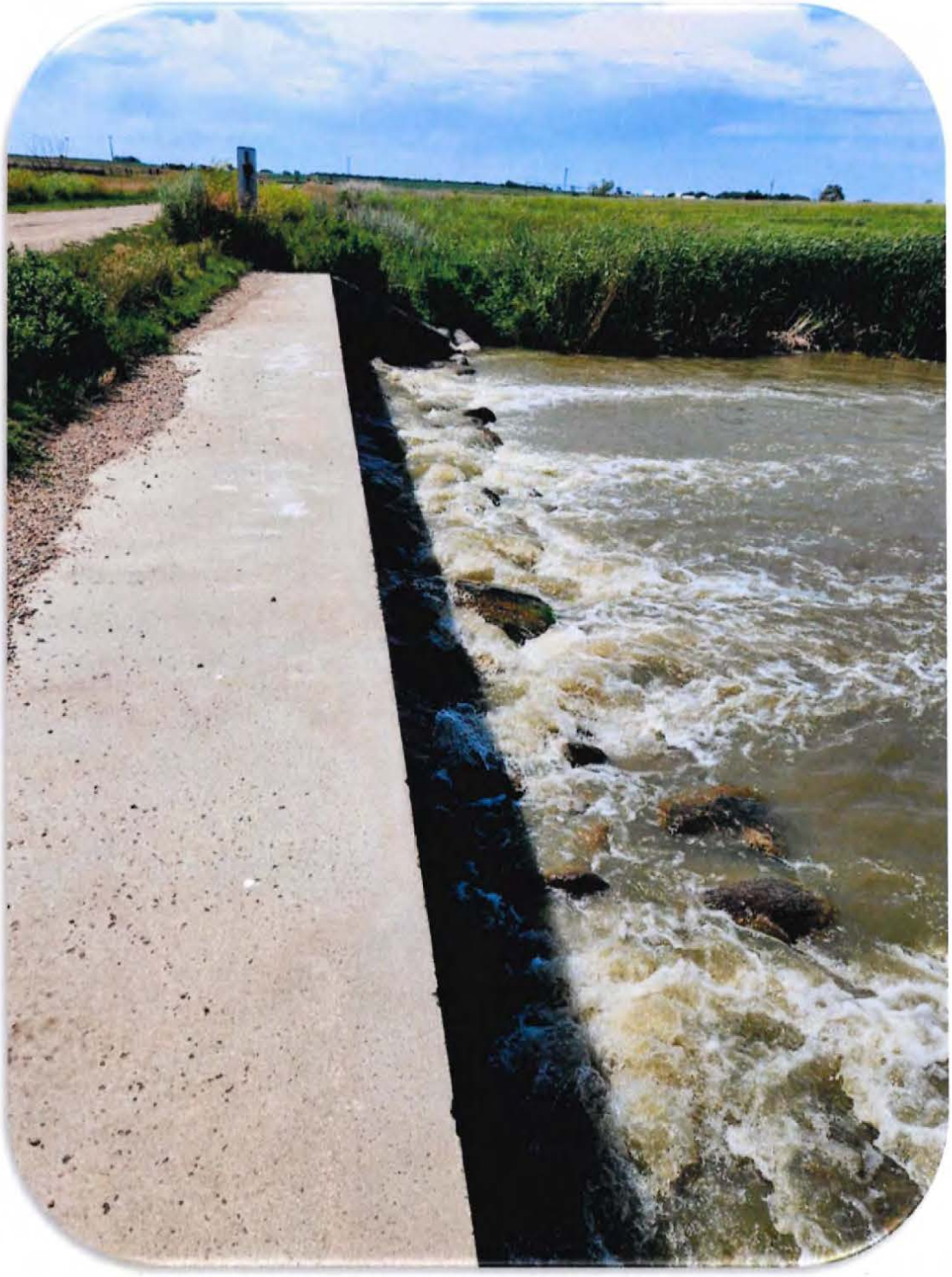
Construction drawing for Dike A east of the existing box culverts
Note: Again there is a notation that the culvert invert elevation is 1716.2

Stoplog structure upstream from the Refuge Headquarters at 102nd Avenue
On this day there were limited flows over the outfall,
however significant flows north (left) due to inflows and wind

Staff gage on upstream wing wall of the box cuvlert.
Note: It is not known if the readings related to specific elevations. This may have been an installation associatged with a temporary USGS gage that was placed in this location.

Looking at west at the south/upstream side of the outfall structure.

Looking west along the downstream side of the box culverts.
There is a noticable drop in water surface elevation after the rocks,



Looking east along the outfall box culverts and the drop created by fall into the downstream channel.

Looking North downstream from the LLR spillway toward Hwy #83

Aerial overview of 102nd Avenue and Outfall Culverts

Appendix R

Reference Documents

- ✓ The reference documents for this report are included only by reference.
- ✓ They are available on request or through the author or publishing entity.

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Appendix F

Figures 1-17

These are the figures presented in the report.

They are provided again in this appendix at a larger size to assist in readability.

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Contributing Watershed – Existing and Risk Projected

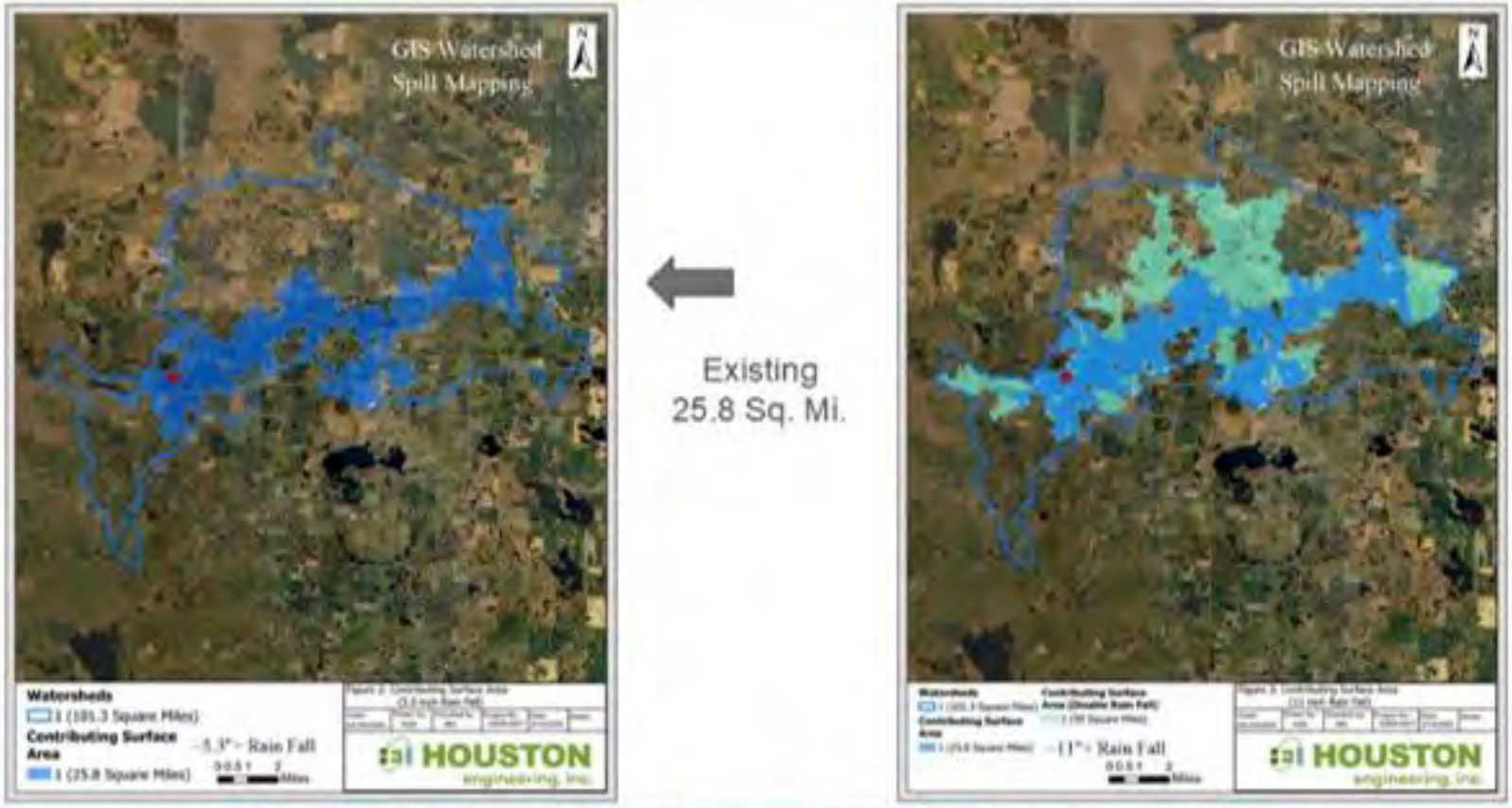

Figure 1 - GIS LiDAR Watershed Spill Mapping, Contributing Area Determination

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Historic Individual Lake Elevations

Crystal Springs Watershed Initiative
Aerial Photo/Lidar/Bathymetry Water Surface Elevations

Lake	Year	Elevation	Source	Difference
Crystal Lake	2024	1752.27	Aerial	0.28
	2023	1751.99	Aerial	0.48
	2021	1751.51	Aerial	1.46
	2015	1750.05	Aerial	1.49
	2010	1748.56	Aerial	-3.43 Fall in elevation?
	2003	1751.99	Aerial	5.28
	1980	1746.71	Aerial	0.35
	1957	1746.37	Aerial	3.90 Rise Since 1957
	Average	**1749.93**		
South Stink Lake	2024	1752.15	Aerial	-0.31
	2023	1752.46	Aerial	1.82
	2021	1750.64	Aerial	2.08
	2015	1748.56	Aerial	2.77
	2010	1745.79	Aerial	-1.41 Fall in elevation?
	2003	1747.20	Aerial	13.22
	1980	1733.98	Aerial	0.81
	1957	1734.79	Aerial	17.30 Rise Since 1957
	Average	**1746.76**		

Stink Lake is the primary infrastructure impact area. Used for projection analysis with all lakes connected

Stink Lake	2024	1753.47	Aerial	0.54
	2023	1752.93	Aerial	2.50
	2021	1750.43	Aerial	2.84
	2015	1747.59	Aerial	1.07
	2010	1746.52	Aerial	3.62
	2003	1742.90	Aerial	10.59
	1980	1732.35	Aerial	0.47
	1957	1731.88	Aerial	21.59 Rise Since 1957
	Average	**1744.76**		
Rustic Lake	2024	1753.27	Aerial	1.12
	2023	1752.15	Aerial	1.68
	2021	1750.46	Aerial	3.36
	2015	1747.10	Aerial	4.12
	2010	1742.98	Aerial	3.00
	2003	1739.98	Aerial	0.00
	1980	1739.98	Aerial	-0.81
	1957	1739.79	Aerial	18.43 Rise Since 1957
	Average	**1743.59**		

Note: Basin overflow to the Missouri River Elevation 1801 (NDDOT) 47 ft

Figure 2 - Historic Individual Lake Elevations

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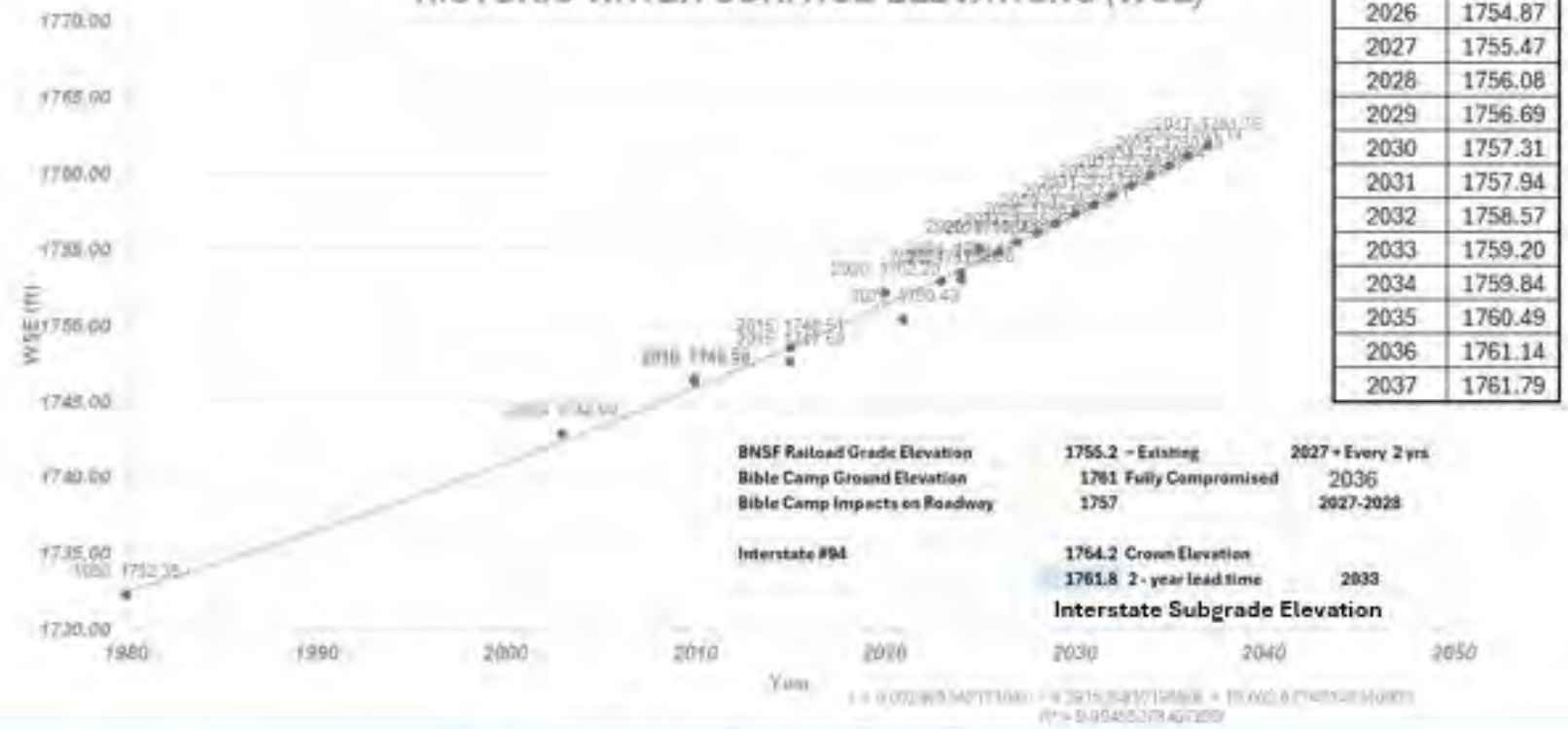
Elevation Projections – Future Planning and Impact Risks



Year	Elevation
2025	1754.27
2026	1754.87
2027	1755.47
2028	1756.08
2029	1756.69
2030	1757.31
2031	1757.94
2032	1758.57
2033	1759.20
2034	1759.84
2035	1760.49
2036	1761.14
2037	1761.79

Figure 3 - Stink Lake Historic Lake Level Projection

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Cleveland Water Level Increases and Trendline – Interstate #94

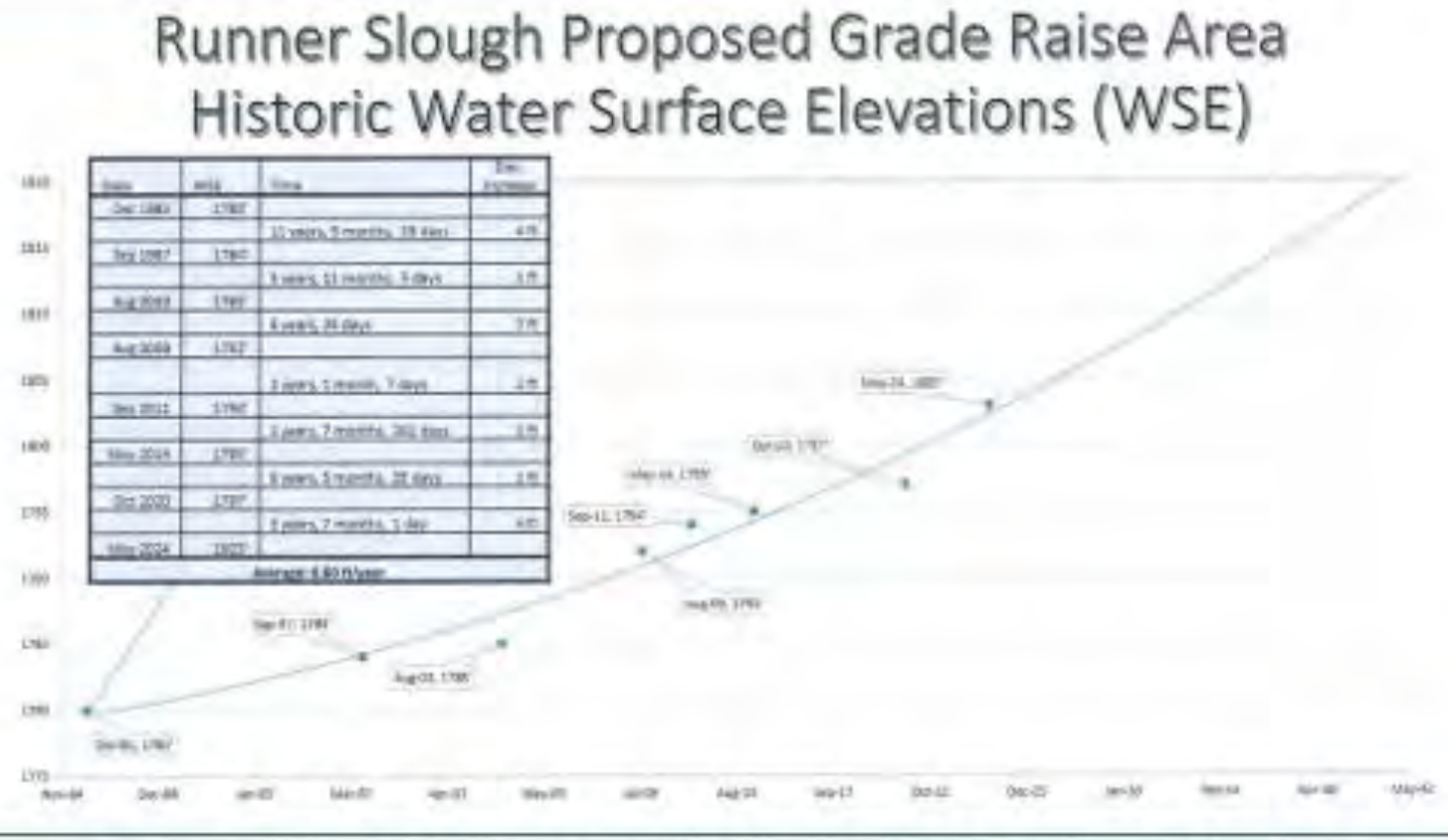

Figure 4 - Runner's Slough NDDOT Historic Water Elevation Projection [6]

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Figure 5 - Crystal Springs Baptist Camp Full Impacted Elevation

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Lake Control Elevations (Existing Culverts)

Elevation Considerations

Primary focus is to protect and provide benefits

Target Removal Elevation 1750

BNSF Rail	~1754
Interstate #94	~1762+
Baptist Camp	~1754
County Rd #39	~1750
Ruele Lake Cabins	>1756

Natural Overflow 1744

1750 – 1752 provides around one year of average inflow storage

Figure 6 - Lake Control Elevations (Existing Culverts)

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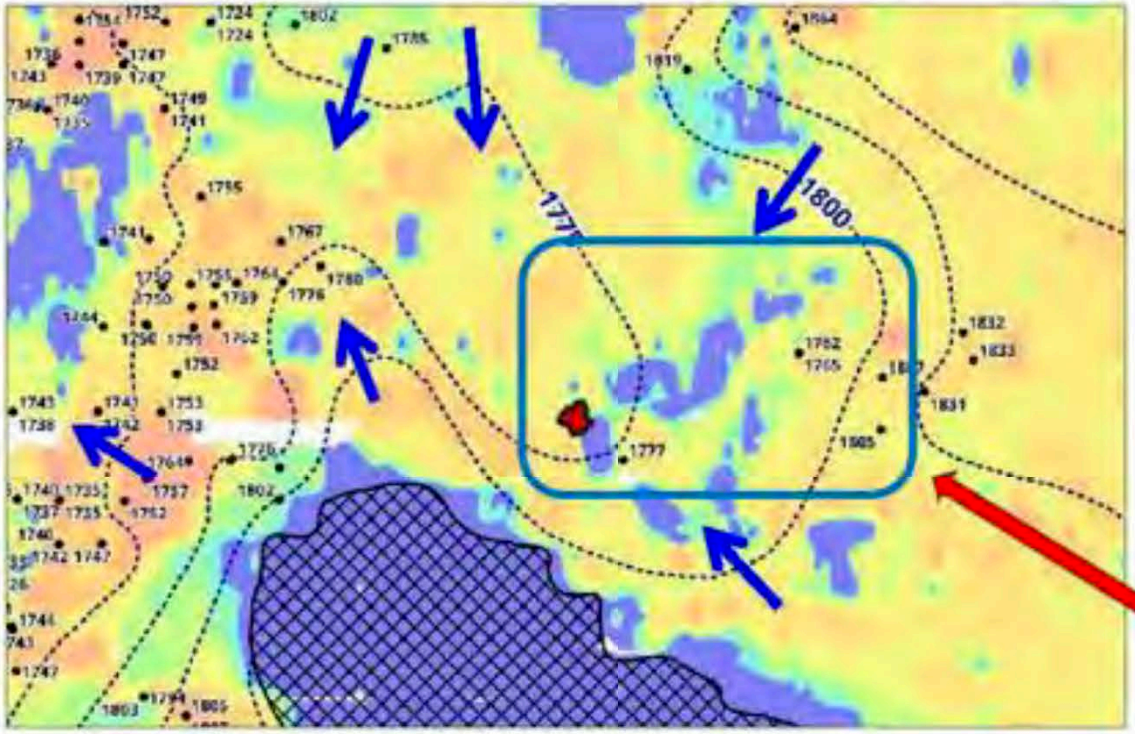
Groundwater Evaluation - 2025 Spring Potentiometric Surface



The lake system is effectively a groundwater window affected by surrounding water elevations that are above the lake system

The annual rise in levels ~0.5 to 0.7 feet per year, which will continue to impact the area

Crystal Springs Lake System
At elevation 1750
At the start of the study

Figure 7 - Groundwater Contours in the Crystal Springs area

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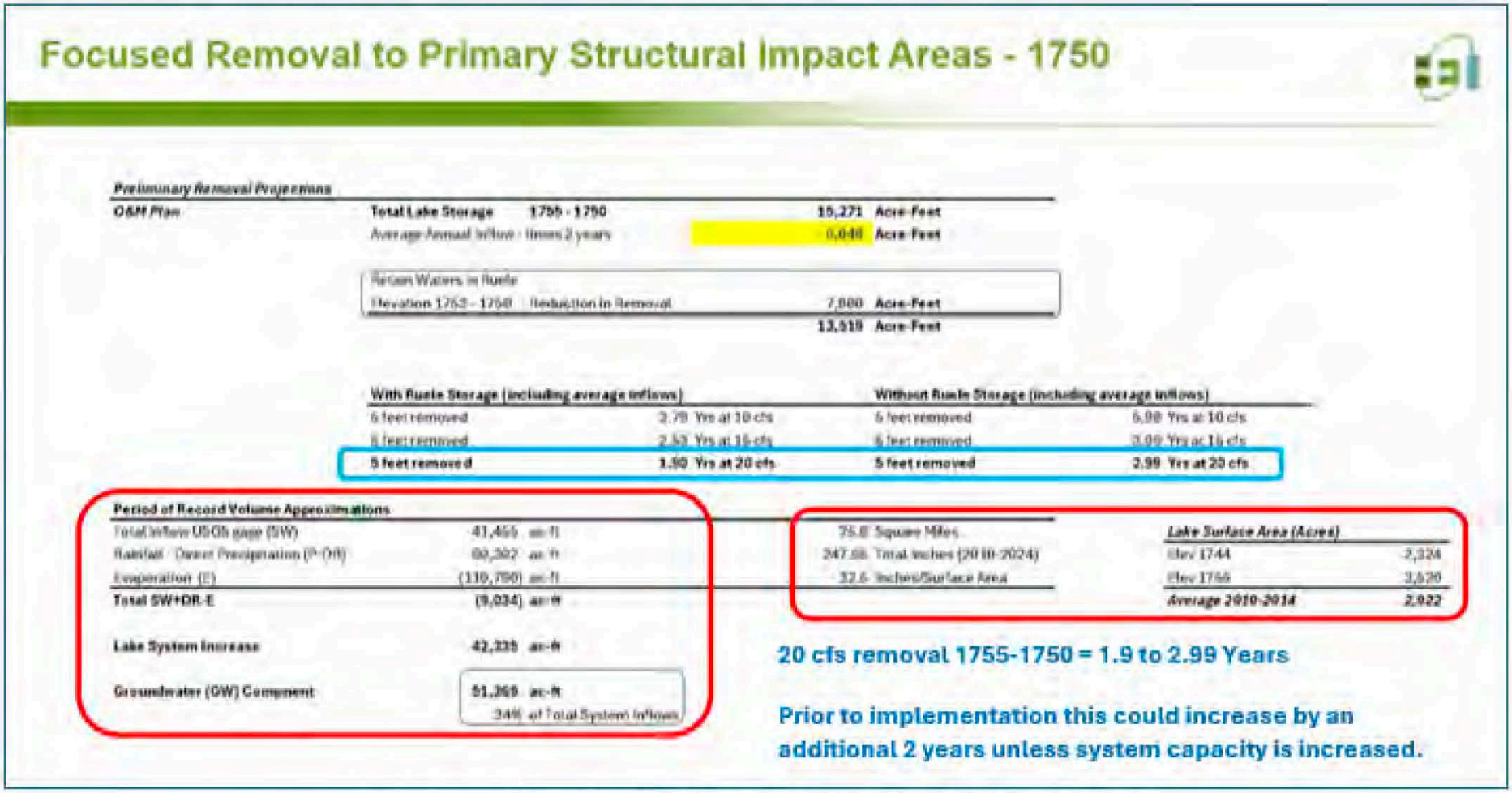

Figure 8 - Focused Water Removal to Primary Structural Impacts

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Alternative Route Comparison – Mileage and O&M Expenses

Headloss at 20cfs for 2ft diameter HDPE pipe run

Route	Max Elevation (ft)	Piping Length (ft) Shown in miles	Frictional Headloss (H_f) (psi)	Static Headloss (psi)	Total Headloss (psi)	Cost Factor (CF) (O&M cost for preferred route times CF)
Upper Pipestem	1930	32.6	276.6	78.4	355	2.96
Lower Pipestem	1946	37.8	326.8	82	408.8	3.40
South	2110	17.5	151.3	157.2	308.5	2.57
West RR	1836	13.5	116.4	36.2	152.6	1.27
West North	1810	11.5	95.1	25	120.1	1

Note: This does not consider system losses or minor losses.

Preferred Alternative is the most economical and least cost to operate

Figure 9 - Alternative Route Comparison - Mileage and O&M Expense

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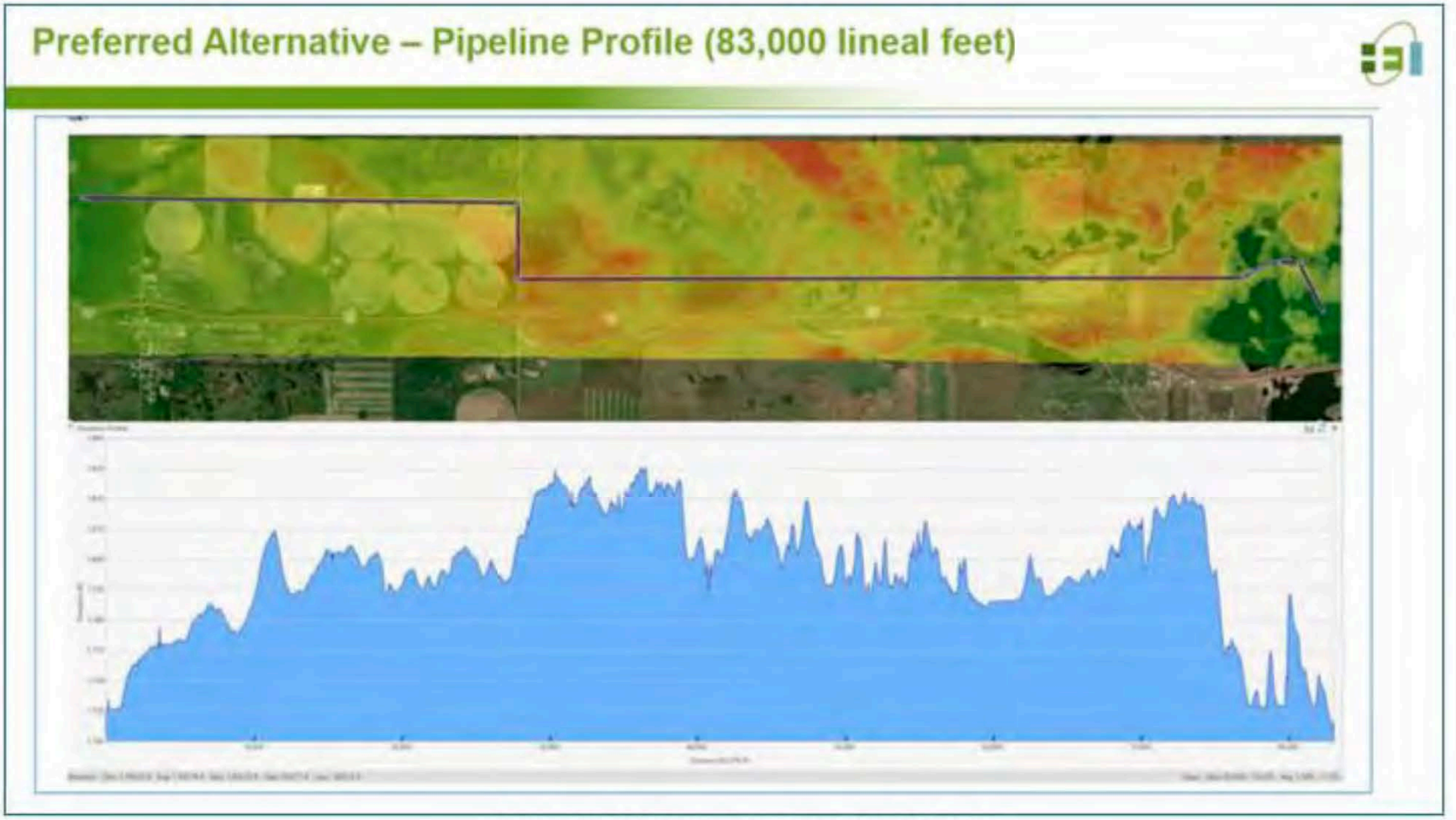

Figure 10 - Preferred Alignment and Profile

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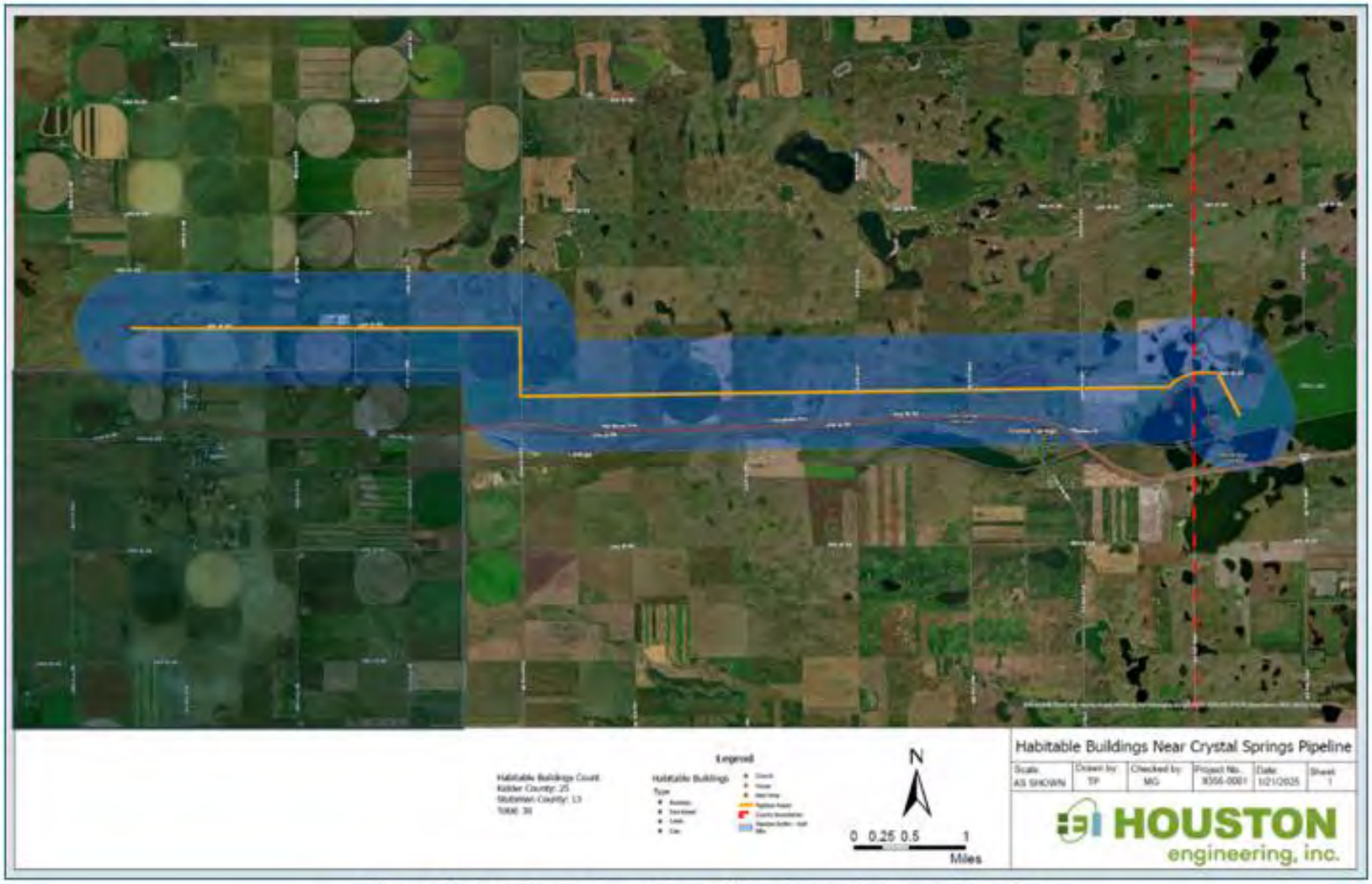
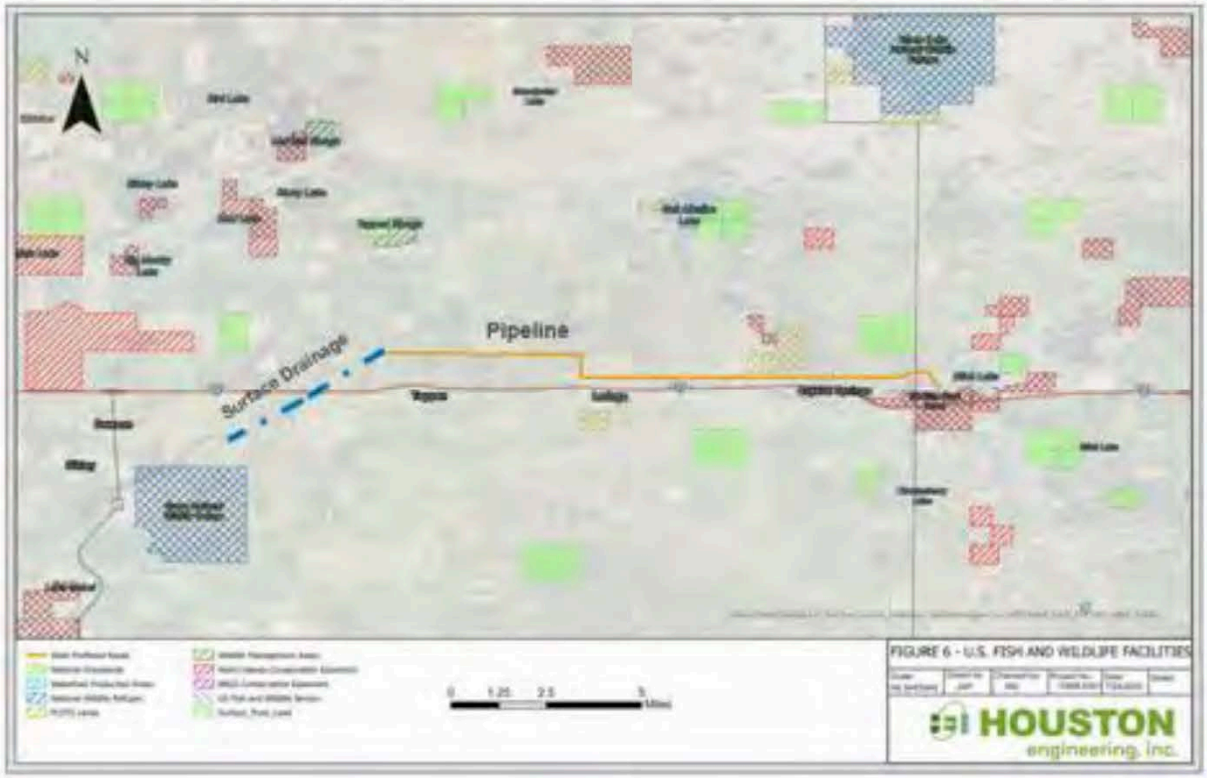


Figure 11 - Habitable Structures Near Crystal Springs Pipeline

Alignment – Regulatory Issues

USFWS Interests and Easement Map



- USFWS ownerships or easement impacts
- Drainage Permit Interdistrict Significance
- NDDWQ Water Quality Discharge Permit
- USACE Permit (Pump Station) and potential Wetland Mitigation

Figure 12 – USFWS Easements Along Preferred Alternative Pipeline Alignment

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Crystal Springs Lake Pump Removal System – Preferred Alternative

Opinion of Probable Construction Cost ~$24.6 Million

Construction Cost	$16,262,000.00		
Contingency	$3,252,400.00	20%	Feasibility Level
Opinion of Probable Construction Cost	$19,514,400.00		
Preliminary Engineering Report (w/operations plan)	$975,720.00	5%	
Final Design/CMS Services	$1,951,440.00	10%	
Legal and Administration (assessment district, easements, etc.	$1,170,864.00	6%	
Regulatory/Environmental	$975,720.00	5%	
Draft Preliminary OPC	*$24,588,144.00*	*26%*	

Potential Funding Sources - Consideration and Requests

Funding Opportunities

HMGP – Federal

SWC (Rural Flood Control) State

	Full Project OPC				*Preliminary Engineering Report*
HMGP	$18,441,108.00	Federal	75%	Up To	$731,790.00
	$2,458,814.40	State	10%	of Federal	97,572.00
	$3,688,221.60	Local	15%	Local	$146,358.00
	$24,588,144.00			*Total*	*$975,720.00*

	Full Project OPC			*Preliminary Engineering Report*
SWC Rural Flood Control	$11,064,664.80	State	45%	$439,074.00
	$13,523,479.20	Local	55%	$536,646.00
	$24,588,144.00		*Total*	*$975,720.00*

Design Considerations

1. Utilization of a 30" PVC allows for lower headlosses in the system and smaller pump requirements
2. The 30" PVC pipe will lower internal pressures and associated operations and maintenance and maintenace costs
3. The 30" PVC allow for the ability to add pump capacity at some point if conditions require.
4. Annual Operations and Maintenance Costs for the 24" PVC System $ –267,000

Preliminary Engineering Report ~$976,000

Figure 13 – Crystal Springs Lake Pump Removal System – Preferred Alternative Costs

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Economic Benefits of Excess Floodwater Removal

- **The total economic benefits were roughly determined using a *10-year planning horizon*, and in general included the following, which are rough approximations, which remain to be formalized**
  - BNSF – Grade Raises (3) more at $3.5 Million each = ~$10.5+ million (interstate commerce losses)
  - Baptist Camp Relocation = ~$9 to $11 Million
  - NDDOT – Single Grade Raise (4 feet) = ~$16.5 million (2022) – (10-foot raise 2011 Hydrology Report)
  - 780 acres of Ag Land ($2,200/ac) = ~$1.72 million
    - Land Value of inundated properties - no production recovery
  - County Roadways ($4.3 million/mile) = ~$8.6 million (2 Miles two ~2 ft grade raise – floodwater removal)
  - Interstate Commerce BNSF Lost Revenue = TBD (Loss of Use Days)
  - WAPA Power Line – Protection or Relocation (TBD)
  - Underground Utilities (TBD)

Total Benefit = $46.32 Million
Total Cost = $24.60 Million

Benefit/Cost > 1.88:1

BNSF Raiload Grade Elevation	**1755.2**	**~ Existing**	**2027 + every 2 yrs**
Bible Camp Ground Elevation	**1761**	**Fully Compromised**	2036
Bible Camp Impacts on Roadway	**1757**		**2027-2028**
County #39 - Roadway is Unundated - Viable at Elevation 1750?			
Interstate #94	**1764.2**	**Crown Elevation**	
	1761.8	**2 - year lead time**	**2033**

Subgrade elevation

Figure 14 – Economic Benefits of Excess Floodwater Removal

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Kidder County Tributary Evaluation and Improvements

Figure 15 - Location of Kidder County Discharge Tributary Stream Crossings

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Stream Crossing Compliance and Mitigation Evaluation

Crossing Name	Culvert Size (inch)	Culvert type	Invert of Culvert [1] [NADV88]	Design Event Return Frequency (ND Stream Crossing Standards)	Allowable Headwater Elevation [NADV88]	Water Surface Elevation for the Design Event [NADV88]		Change in Water Surface Elevation based on 15 cf added to roadway design event (inches)	Mitigation Measures [2]	Pass/Fail
						Existing Conditions	Proposed 15 cfs Pump		Added Culvert and Channel Construction to two feet to accommodate 20 cfs discchrages	
Highway 10	3-36	RCP	1737.00	25 Year	1742.00	1740.67	1740.89	2.6	35"X24" RCP	P - P - P
I-94	3-36	RCP	1737.00	50 Year	1742.00	1741.07	1741.27	2.4	35"X24" RCP	P - P - P
Railroad	36	RCP	1735.00	50 - 100 Year	1738.00 - 1739.50	1740.93 - 1741.71	1741.14 - 1741.84	1.6	42" Steel Pipe	F - F - F
Dawson Hook	2-30, 2-24	CMP	1731.50	15 Year	1736.00	1733.65	1734.02	4.4	35"X24" CMP	P - P - P
35th Ave	36	CMP	1723.23	10 Year	1728.23	1726.74	1727.86	13.4	35"X24" CMP	P - P - P
Highway 3	2-18	Box Culvert Unconfirmed	1724.5	25 Year	1728.00	1727.12	1727.43	3.7	35"X24" RCP	P - P - P
Whispering Stream	2-24	CMP	1723.60	10 Year	1727.60	1726.12	1726.12	0.0	35"X24" CMP	P - P - P

[1] Values are based on survey data, while HEC-RAS modeling of culvert inverts are based on the lowest LiDAR value near the culvert

[2] Channelization at " 2 feet in depth, 12 ft bottom width and 4:1 side slopes - target no water depth above existing channel bottom.

Recommendation for the Preliminary Engineering Report:

Evaluate downstream mitigation features early in the process to address concerns.

All increases in water surface elevations to be mitigated with channel and culvert improvements

Figure 16 – Kidder County Tributary and Stream Crossing Standards Compliance

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Long Lake Refuge Boundaries

Undefined Concerns:

- ✓ Control Elevation and Backwaters
- ✓ Gate Replacement in 2015
- ✓ Operations and Management
- ✓ Flood Impacts Outside Easement Boundaries
- ✓ Water Permit Compliance
- ✓ Flood Water Removal
- ✓ Highway #83 – Box Culvert (not a restriction)

Figure 17 – Long Lake Refuge Boundaries