TECHNICAL MEMORANDUM

To: Greg Johnson, PE, MCES
From: Mat Cox, PE, CFM, Kimley-Horn
CC: Uma Vempati, PE, Kimley-Horn
Date: March 24, 2026
Subject: White Bear Lake Comprehensive Plan: Study No. 1 Redirect Stormwater to Augment White Bear Lake (Initial Evaluation) – Amended Study

INTRODUCTION

The purpose of this technical memorandum is to provide an initial evaluation for redirecting stormwater to augment White Bear Lake. This work is part of Metropolitan Council's (Met Council) White Bear Lake Area Comprehensive Plan Work Group efforts to ensure communities in the White Bear Lake area have access to sufficient drinking water to allow for municipal growth while ensuring the sustainability of surface and groundwater resources.

Study evaluated one method within a wide range of water sustainability and conservation methods to support the efforts of the White Bear Lake area work group. This study is identified as an initial evaluation to reflect that it is a screening-level analysis, intended to understand the potential benefits as well as the challenges, issues and concerns associated with the approach. Depending on the results of this initial evaluation and the extent of identified potential benefits, challenges and issues, a more detailed analysis may be completed in a second study phase if the work group decides to proceed with further evaluation.

The scope of work for the initial evaluation for Study No. 1 includes:

1. Review and estimate the number of existing stormwater ponds within two miles of White Bear Lake.
2. Identify the potential challenges, issues, and concerns with redirecting stormwater to the lake including:
    - Pumping and/or redirecting up to 780 million gallons per year (DNR estimate to keep WBL above protective elevation) from local stormwater ponds.
    - Existing stormwater pond contaminant issues (metals, nutrients, etc.)
    - System reliability during dry weather conditions
    - Distribution challenges with piping and need for utility easements and multiple pump stations
    - Potential property value changes for properties near stormwater ponds

Following the initial evaluation, the Work Group requested that additional data collection and evaluations be completed. The additional evaluations include:

3. Review Bald Eagle Lake, Ramsey/Washington Counties Ditch 1, areas of the City of Grant and Centerville Lake as potential surface water sources to augment White Bear Lake.
4. Identify challenges, issues, and concerns associated with redirecting surface water to White Bear Lake from these sources including conveying surface water from one regulatory watershed jurisdiction to another watershed as it relates to areas within the City of Grant.

DATA COLLECTION AND REVIEW

The following section describes the data collection and review process for existing stormwater ponds within a 2-mile radius of White Bear Lake. The Minnesota DNR Hydrography Dataset from the Minnesota Geospatial Commons was used as a starting point for determining the existing stormwater ponds within the 2-mile radius of White Bear Lake. Upon initial review, the dataset was found to have limited detail to identify specific stormwater features (including wet ponds) with any certainty.

The project team subsequently contacted two of the cities bordering the lake and the Rice Creek Watershed District (RCWD) to request available stormwater pond data. RCWD had no storm treatment system feature data. Both cities provided access to their data. These datasets consisted of a mix of lake/ponds/wetland features. The datasets were not coded to a level of detail to specifically identify only stormwater treatment ponds. For one of the cities, storm pond features consisted mostly of rain gardens.

EXISTING STORMWATER PONDS

Using the DNR Hydrography dataset as a starting point, the lakes and wetlands were first filtered out from the selected water features based on their USGS 100K DLG Class including small named ponds, lakes and public waters wetlands within the two-mile boundary. Exhibit 1 shows the full water features dataset within the 2-mile boundary of White Bear Lake.

The full set of water features were then filtered out by removing named lakes and water features and then removing any remaining unnamed public waters. Exhibit 2 shows the remaining waters that were used in the calculations for available pond volume in the next section. As shown in Exhibit 2, the remaining water features appear to include some non-stormwater pond features. The most apparent of these areas is in the Dellwood area where many of the small basins are more likely natural ponds and wetlands and not true stormwater treatment ponds. This rough sorting approach resulted in a greater number of pond features than just true stormwater ponds being tallied in the volume assessment below. However, it is recommended to have a consistent screening process at this early study phase instead of removing ponds on an individual basis.

As summarized in Table 1, this analysis identified an estimated 188 stormwater ponds/water features within the two-mile radius of the shoreline of White Bear Lake. Further review sorting was completed by watershed boundary resulting in 108 features being located within the contributing RCWD watershed boundary to the lake and 80 features being outside the contributing watershed to the lake.

POND VOLUME CALCULATIONS

The GIS boundary of each pond feature was assumed to be the top surface area of each pond. The area at a 4-foot depth of the pond was calculated by assuming a 4:1 side slope and an average depth of 4 feet. A volume calculation using these parameters and an assumed trapezoidal prism geometry provided a volume stored in each basin. Volumes were totaled by watershed and are summarized in Table 1.

This analysis shows that an estimated total volume of 100 million gallons of stored stormwater may be available within the 2-mile radius of White Bear Lake. Table 1 below shows the estimated volume of water within the five different watershed districts in the 2-mile radius. On an annual basis, the volume available within the 108 ponds located in the contributing drainage area of Rice Creek watershed would only be available a single time as the excess runoff volume from these basins is already routed to the lake. For the 80 ponds located outside of the contributing watershed, there may be potential to pump the pond volume multiple times annually, depending on outcome of permitting discussions and public input processes.

As a point of reference for the available volume of stormwater, the Minnesota Department of Natural Resources (DNR) recently completed a groundwater modeling analysis that estimated that 780 million gallons of groundwater would need to be pumped over 8 months out of the year to maintain a water level at or above 922.0 ft. in White Bear Lake, roughly six times the amount estimated as available in ponds within a 2-mile radius of the lake.

Table 1. Estimated Available Storm Pond Volume Within 2-Mile Radius of White Bear Lake

Watershed	Number of Ponds	Total Pond Area (Ac)	Volume (MG)
Browns Creek	10	13.2	15
Ramsey-Washington	10	4.8	5
Rice Creek	108	62.7	67
Vadnais Lake Area	22	12.1	13
Valley Branch	38	25.5	28
Total	**188**	**118**	**128**

CHALLENGES, ISSUES AND CONCERNS

The following section describes the assessment of challenges, issues, and concerns associated with redirecting stormwater to augment White Bear Lake.

PUMPING AND ROUTING

For ponds within the contributing watershed drainage area, the most feasible routing approach in most cases would be to pump stored stormwater into existing storm sewer conveyances that already route to the lake. This approach would consist of a pump system that would effectively pump water ponded and stored below the outlet invert into the gravity outlet pipe. The complexity arises as each subsequent pond in the downstream system, or at least those that have a meaningful volume of stored water to pump, would also need a pump system.

For ponds within two miles but located outside the contributing watershed drainage area, the engineering challenge would be to evaluate route options, applicability, and assess if that approach would meet regulatory requirements. Options may include a direct pump and forcemain to the lake for one or more adjacent pond systems, a single pump and forcemain discharged into one of the gravity systems within the watershed to route to the lake, or some combination of these options.

In both cases, there are a number of challenges and issues that would need to be further evaluated to determine the feasibility and cost-effectiveness of these options. Some of these issues include:

- Length and routing of forcemain, especially for ponds located outside of the watershed drainage area. A more thorough review of where gravity could remain to reduce the extent and length of forcemains while maintaining some level of benefit to lake water levels. The system could easily become a complex network of interconnected ponds. Easements for forcemain piping would need to be acquired for installation and maintenance of the system.

- It seems that the preferred discharge locations would be where forcemain routing could connect to existing storm discharge pipes into the lake. The intent would be to avoid or reduce the extent of DNR public waters permitting process for new discharge locations.
- Existing easements in some or most public storm pond locations may allow for pump systems to be added to current pond systems.
- Additional challenges and issues with new pump stations include:
    - Availability of power sources relative to where pump systems are located.
    - The need to remotely build and maintain a complex Supervisor Control and Data Acquisition (SCADA) system to monitor and control multiple pump stations or monitor them through cellular service.
    - Identifying ownership, operation and maintenance responsibilities for pump systems and forcemains.
    - Evaluating the reliability of pump system intakes, which are susceptible to clogging, especially during periods of low(er) water where vegetation, debris and solids can plug screens. This has been a challenge on a number of stormwater reuse systems installed in recent years that are reusing water from stormwater wet ponds.
    - Pumping system would need to be set above the bottom of the basin to reduce the extent of sediment and organic matter that would be agitated and pumped downstream. Leaving several feet of standing water in the bottom of the basin would be the preferred approach and using floating intakes. Even with those practices employed, the shallow remaining water could tend to cause mosquito habitat to impact the area.
- For ponds located outside current RCWD boundaries, an agreement would be needed between the adjacent watershed organizations to route some portion of water across watershed boundaries. This agreement would also likely require a complete review of impacts to downstream systems as a result of reduced stormwater discharge volume. The process to move stormwater between watersheds has been completed in the past. A more thorough review of requirements and direct discussions with adjacent watershed representatives would need to be completed in subsequent phases of analysis.
- An operation and maintenance plan and agreement would likely be required to define the operational conditions of each of the pump-to-outlet systems. Some of the issues that would need to be defined further include: what times of year the pump system could and could not be operated and what water levels on White Bear Lake would trigger the activation of the systems, what high and low water levels in the ponds would trigger on and off conditions, what level of water quality sampling and/or monitoring would be needed, and on what frequency.

STORMWATER CONTAMINANTS

Table 2 in this section summarizes common stormwater pollutants, concerns and mitigation strategies. The Minnesota Stormwater Manual provides a more complete summary of concentrations of pollutants found in stormwater runoff for several different land uses and provides some basic information related to mobility, toxicity, and other properties of each contaminant. The Stormwater Manual also provides some limited information on the concentrations of a small set of pollutants in stormwater ponds. Data are fairly consistent between the two datasets. Water appropriations permits would be contingent on any necessary permits required for the discharge (e.g., from the MPCA).

All of the pollutants found in typical stormwater runoff and, therefore also in stormwater pond detention and treatment facilities, would likely be mobilized during pumping operations from the stored water. The primary concern with pumping water from ponds into White Bear Lake would be the possibility of increased concentrations of these parameters and pollutants when compared to the water discharged from the same storage and treatment facilities under normal operating conditions.

Table 2. Stormwater Contaminants, Concerns and Mitigation Strategies

Pollutant	Sources	Potential Concerns	Mitigation Strategies
Nutrients (N, P)	Sediment, organic debris, fertilizer, animal feces, combined sewer overflows	Algae growth, microbial growth	Anoxic zone for denitrification
Organic Matter	Organic debris (leaves, twigs, etc.)	Decomposition causing low dissolved oxygen and odors	Infiltration
Suspended Sediment	Paved surfaces, bare soil, construction, stockpiles	Clogging intake/distribution, increased maintenance	Sedimentation, Infiltration
Chlorides	De-icing and water softening chemicals	Corrosive to pipes, toxic to plants and fish (irrigation)	No cost effective treatment
Pathogens	Animal feces, insects, sewage overflows, waste management drainage	Risk to human health	Increase temperature, low soil pH, finer clay soils
Metals	Vehicle exhaust, roofing materials, vehicle repair drainage	Toxic to plants	Infiltration
Organic Chemicals (pesticides, industrial chemicals, petroleum chemicals)	Drainage of sources of organics	Human/animal health risk, toxic to plants	Microbial degradation

DRY WEATHER CONSIDERATIONS

The primary challenges with drawing down storm pond volumes during dry periods is a combination of aesthetics and unwanted vegetation establishment. Ponds generally have available volume to be pumped and conveyed in the spring after snowmelt and spring rain fills the basins. However, dry weather periods following the draw down would tend to allow vegetation growth in and around the basin that may need more extensive maintenance than a typical stormwater basin would require and may create aesthetic issues and odor concerns (decaying organic matter at the basin bottom) for nearby property owners.

DISTRIBUTION CONSIDERATIONS

The distribution and routing concerns were addressed previously in the pumping and routing section above. The more significant issues to overcome relate to the availability of existing easements and needs for additional easements, the regulatory ability to move stored water across the watershed organization boundaries, and defining and agreeing on the ownership, operation and maintenance requirements and responsibilities of the systems.

PROPERTY VALUE CONSIDERATIONS

According to an EPA study on the Economic Benefits of Runoff Controls, urban runoff systems with standing water (i.e., wet ponds) often appear to be natural systems and can be a great benefit to adjacent property owners (and add value). Poorly maintained wet ponds or constructed wetlands are often unsightly due to excessive algal growth or garbage build-up. These conditions are considered detriments by area residents and people passing through the areas. Wet ponds and constructed wetlands can also become mosquito breeding grounds. Mosquito problems usually can be reduced or eliminated by designing the wet pond so that all portions of the basin are connected to open water to allow natural predators to control the mosquito larvae (Tourbier and Westmacott, 1992). (Source: Economic Benefits Of Runoff Controls | Polluted Runoff | US EPA).

A study completed in Columbia, Maryland, and a similar study in Boulder, Colorado, both indicated that properties located adjacent to stormwater ponds regularly sell at a premium in relation to neighboring properties. The Boulder study found that properties located adjacent to constructed wetlands sold with up to a 30 percent premium. Inherent in both studies was that these ponds were designed and operated with aesthetic appeal as an important feature.

Pumping or directing stormwater away from existing ponds to White Bear Lake may have potential to decrease property values for existing developments that are located next to stormwater ponds. This would need to be further evaluated if this alternative is further studied by the White Bear Lake Area work group.

The following subsections address the areas identified by the work group as potential augmentation sources during the review of the initial study. These initial assessments address only water quantity (volume) and potential pumping and routing issues. Water quality, which could be a much greater challenge for these sources, has not been thoroughly addressed at this stage.

ADDITIONAL SURFACE WATER SOURCES

Prior to this analysis and review of potential surface water sources, Rice Creek Watershed District (RCWD) made a motion on August 11, 2025 in support of the investigation of potential sources for re-use and diversion for the purpose of hydraulic augmentation of White Bear Lake, where the water is not needed to sustain existing surface water levels and/or the diverted water addresses capacity constraints/flooding concerns. This motion passed on a 2-1 vote during the RCWD workshop meeting. The motion raises concerns of nutrient loading from downstream sources being redirected to White Bear Lake and the lack of previous flooding or capacity concerns on Bald Eagle, Centerville, or Peltier Lakes. In addition to the RCWD motion, it is important to note that withdrawals from these lakes would be limited according to the criteria in Minn. Statutes 103G.285. The Bulletin No. 25 area of Centerville Lake (464 ac) is less than 500 acres (Subd4). The Bulletin No. 25 area of Bald Eagle Lake is 849 aces. The requirements for surface-water appropriations are addressed in MN Rules 6115.0660-670 and

6115.0750, and water-level maintenance for basins is also subject to 6115.0700. In addition to protective elevations and limits on collective annual withdrawal from basins, withdrawals could be limited to protect downstream flows and would be subject to suspension during low-flow periods in the watershed.

While this motion doesn't provide direct support for redirecting water from the surface water sources (Bald Eagle, Centerville, Peltier Lakes), it does provide support and acknowledgement for the overall need for augmentation to White Bear Lake to support lake levels. The city of Grant was not included in the motion as it lies outside of the Rice Creek Watershed District.

BALD EAGLE LAKE

Bald Eagle Lake is located to the north and downstream of White Bear Lake. All of the water that is discharged through the outlet of White Bear Lake flows into Bald Eagle Lake. Bald Eagle Lake has a contributing drainage area of 30.67 square miles, 2.5 times that of White Bear Lake (12 square miles) contributing drainage area.

Historical lake level and corresponding discharge rates were reviewed between White Bear Lake and Bald Eagle Lake. Both lakes experience fluctuations in relation to water surface elevations throughout a year and over a period of multiple years. The levels between the lakes do not appear to have a direct correlation to each other based on the historical dataset. For instance, White Bear Lake experienced significant drawdown and low lake levels from 2004-2020 with no discharge except in 2019, whereas Bald Eagle Lake fluctuated as expected with varying lake levels and discharges with periods of lower lake levels with no discharge. Only the 2008-2011 timeframe showed prolonged low lake levels on Bald Eagle Lake with no discharge.

Separately, an estimated discharge volume was calculated using the recorded lake levels, outlet elevation, and an outlet rating curve. The outlet rating curve was obtained from Rice Creek Watershed District on December 12,2025 from the district's XPSWMM model. The lake level data was translated to a depth value based on the current outlet elevation. The outlet elevation was taken from the supplied outlet rating curve at elevation 910.80 (NAVD88). The rating curve was then applied to estimate discharge volumes between each time step in the lake level dataset. The depth value was averaged on a trailing average of two data points. This was done to limit overestimation of high overflow rates at the outlet as the lake level data is somewhat coarse. The lake level data is obtained on average every 11 days and is generally continuous from 1923 to Present. The level of detail increases to every 9 days from 2000 to present and with only the elevation readings between April 1st and October 31st.

The discharge volume dataset was reviewed in multiple different ways to better understand the possible diversion volume and rate. Table 3 details the average monthly discharge volumes from Bald Eagle Lake from 2000 to present. The average monthly discharge volume was 177 million gallons with peak discharge volumes during March and April, likely due to snowmelt runoff from the contributing watershed. Eliminating the months from October through April from the calculation results in an average monthly discharge volume of 128 million gallons. Collecting and pumping 100% of the average monthly discharge from Bald Eagle Lake to White Bear Lake would result in approximately 640 million gallons from May to September. This pumped volume is less than the estimated 780 million gallons that is required to maintain White Bear Lake levels at elevation 922.0 ft. annually. There is also the challenge of rerouting all of the discharge from Bald Eagle Lake, which would negatively impact the downstream receiving water courses.

Table 3. Bald Eagle Lake – Average Monthly Discharge Volume

Month	Discharge Volume	
	Million Gallons	Acre-Feet
January	179	549.4
February	197	604.9
March	493	1,515.1
April	404	1,240.3
May	279	856.4
June	125	385.2
July	115	355.4
August	66	203.2
September	56	174.3
October	58	179.0
November	64	197.9
December	91	280.8
Yearly Total	2,131	6,541.9

Significant stretches of residential areas exist between White Bear Lake and Bald Eagle Lake, along with multiple county and state highway systems. Previously, it was discussed pumping water from downstream of Bald Eagle Lake at the confluence with Clearwater Creek. See Exhibit 3 for contributing area to Bald Eagle Lake and Coldwater Creek, pump station location, and forcemain route to White Bear Lake. The pump station could be located near the Oneka Parkway crossing of Clearwater Creek. This would result in approximately 5 miles of forcemain pumping required to reach White Bear Lake. Moving the pump station farther downstream will increase the amount of time that the system can run as the contributing area grows. The contributing area at the proposed location along Clearwater Creek is 37.7 square miles (vs. 30.7 square miles at the outlet of Bald Eagle Lake). The length of forcemain and size of pumps will increase as the distance from White Bear Lake increases. The pumps could be managed by a system of sensors at the Bald Eagle and White Bear Lakes outlet to manage when pumping occurs. There is a secondary option to pump water from downstream of the outlet of Bald Eagle Lake. This would result in less than half of the distance of pumping that would be required to reach White Bear Lake.

RAMSEY/WASHINGTON COUNTIES DITCH 1

Ramsey/Washington Counties Ditch 1 (Ditch 1) is the main tributary to Bald Eagle Lake, along with White Bear Lake. Ditch 1 has a contributing area of 12.2 square miles, where it crosses Highway-61, prior to discharging to Bald Eagle Lake. At its closest point, where it crosses Portland Avenue, Ditch 1 is approximately 0.5 miles away from White Bear Lake.

If the full volume required on White Bear Lake (780 million gallons annually) were to be supplied by Ditch 1 then the equivalent of 3.7 inches of rainfall runoff would need to be pumped to White Bear Lake. This estimation is based on the assumption that all of the contributing area to Ditch 1 (30.67 sq. mi.) is contributing flow. The average annual rainfall of 31.6 inches likely supplies sufficient rainfall runoff to provide the required volume to White Bear Lake through pumping.

One of the challenges of utilizing Ditch 1 is the overall similar contributing watershed size and location between White Bear Lake and Ditch 1. During times of drought and lack of rainfall, both Ditch 1 and White Bear Lake could be in a low flow/water surface elevation condition. Additionally, an offline retention basin could be constructed to hold the excess flow from Ditch 1 prior to pumping to White Bear

Lake. Assuming that an offline basin is used, the basin would need to be approximately 60 acres in surface area with a 5-foot average depth to be able to capture and supply sufficient water to White Bear Lake. This calculation assumes that the average annual rainfall (31.6 inches) would allow the basin to fill 8-9 times in a year and continuous pumping to White Bear Lake would occur. While there is space in the wetland complex upstream of Portland Avenue, the presence of wetlands along with the ditch law precedent and rules would likely make this challenging and require extensive coordination with Rice Creek Watershed District and the DNR. An offline system would provide more resiliency and be able to function between rainfall events (See Exhibit 4 for contributing area to Ditch 1, pump station location, and forcemain route to White Bear Lake). The water quality of Ditch 1 has not been assessed.

AREAS OF CITY OF GRANT

The southern portion of the City of Grant near Indian Hills Golf Club has historically experienced flooding between Jocelyn Road and Keats Avenue. This area of the city of Grant is located within Valley Branch Watershed District (VBWD) and is approximately 2.8 miles east of White Bear Lake. This area is discussed in detail in Section 5.21 (Sunnybrook Lake) of the VBWD Watershed Management Plan. Sunnybrook Lake and much of the area east of the lake is designated as a FEMA floodplain.

The VBWD has completed extensive study of the Sunnybrook Lake flood hazard area dating back to the 1970's and has considered numerous options to divert flood flows and manage high-water levels over the years. Table 5.21-3 in the VBWD Watershed Plan summarizes more than a dozen study efforts related to the area. At least two of those options included pumping excess water from the area to other watersheds (Brown's Creek) or water bodies (Lake McKusick), although these options were not ultimately pursued due to lack of support from DNR or other challenges.

The project team contacted the City of Grant city engineer to get an update on the status of the Sunnybrook Lake area flood and high-water level issues. The most recent work in that area was a 2017 Road Improvement Project to raise portions of Keats Avenue and Jocelyn Road to contain flood water and reduce roadway overtopping.

A quick assessment of the volume of water available in the area assumes an average depth of 2 feet of flood waters over the FEMA flood hazard area (Flood Elevation 982.7). This would result in lowering the water level in the flood area below the lowest low home elevation noted in the VBWD studies (981.02). The resulting volume is approximately 80 acre-feet or 26 million gallons. This volume is significantly less than the estimated 780 million gallons that is required to maintain White Bear Lake levels at elevation 922.0 ft annually.

As it relates to White Bear Lake low water levels, one of the primary challenges with this area as a source of excess water is that the excess volume would only be available after extreme rainfall events and would not be available on an annual basis. In addition, as discussed for some of the pond areas during the original assessment, the ability to pump water from one regulatory watershed to another would require an agreement between the agencies and an operational plan to define the conditions for operation (See Exhibit 5 for contributing area to the low area in Grant, pump station location, and forcemain route to White Bear Lake).

CENTERVILLE LAKE

Centerville Lake is located approximately 5.6 miles northwest of White Bear Lake. Based on a 1970s description of the Saint Paul Regional Water Services (SPRWS) system, the Centerville Lake pump station had a capacity of 40 million gallons and would move water from Centerville Lake through a 54-

inch conduit through Deep Lake and ultimately into Pleasant Lake, Sucker Lake and Vadnais Lake before flowing through an aqueduct to the McCarrons water treatment plant. SPRWS recently demolished the Centerville Lake pump station since they have no plans to use Centerville Lake again as a backup water supply source. Centerville Lake has a natural contributing area of 2.6 square miles.

If the full volume required on White Bear Lake (780 million gallons annually) were to be supplied by the natural drainage area of Centerville Lake, then the equivalent of 17.2 inches of rainfall runoff would need to be pumped to White Bear Lake. The average annual rainfall of 31.6 inches may not supply sufficient rainfall runoff to provide the required volume to White Bear Lake through pumping.

Centerville Lake is located across multiple highways (interstate, state, and county) that could make construction of a conveyance system a challenge. While Centerville Lake is approximately 5.6 miles from White Bear Lake, the distance of an installed forcemain would likely be much longer (~8.0 miles) due to routing through public right-of-way and around existing large water bodies. Water from Centerville Lake could be pumped to Bald Eagle Lake, then pumped again to White Bear Lake. This type of system would allow for more resilience to drought conditions but would be significantly more expensive due to pumping distance and an additional pump station needing to be constructed (See Exhibit 6 for contributing area to Centerville Lake, pump station location, and forcemain route to White Bear Lake).

In all of the alternatives, a 6.7 cfs (3,000 gpm) pump running continuously for 180 days would be required to meet the runoff volume required in White Bear Lake. Depending on desired flow rates, a 12-inch to 18-inch forcemain would be required to carry the water to White Bear Lake. This assumes that sufficient volumes of water are available to pump on a continuous basis throughout the year.

Following initial discussions with Rice Creek Watershed District, district staff presented to their board about the review of utilizing surface water sources within the district to augment White Bear Lake. Following review of background data provided by district staff, the board was supportive of investigating surface water level augmentation on White Bear Lake but not at the detriment of other surface water sources. In addition, the board does not necessarily see “excess” water at the surface water sources that were previously presented.

Additional water quality analysis of Centerville Lake was completed to supplement the review of water quantity analysis included in this technical memorandum. The water quality analysis took samples from Centerville Lake, Sucker Lake, and White Bear Lake in September and October of 2025. Sucker Lake is being evaluated under Study 7A as an alternative surface water source to augment White Bear Lake, thus its water quality is being compared to Centerville Lake. The water samples were also analyzed for primary and secondary drinking water parameters. Results from the water quality analysis show significantly elevated Chlorophyll in Centerville and Sucker Lakes compared to White Bear Lake. Turbidity is also significantly higher in Centerville Lake than White Bear Lake. The chloride levels in Centerville Lake are approximately 50 percent higher than in Sucker Lake, but lower than White Bear Lake’s chloride levels. Table 4 details the preliminary water quality analysis results. In addition, the per- and polyfluoroalkyl (PFAS) substances of PFOA, PFHxA, and PFBA were detected in Centerville Lake at concentrations of 4.2 ng/L, 2.6 ng/L, and 34.6 ng/L, respectively. The PFOA concentration exceeds the EPA maximum contaminant level (MCL) of 4.0 ng/L for drinking water. A chlorine dioxide concentration of 0.33 mg/L was also detected in Centerville Lake although this concentration is below the EPA MCL concentration of 1.0 mg/L.

Table 4. Preliminary Water Quality Analysis Comparison

Pollutant	Sucker Lake Concentration		Centerville Lake Concentration		White Bear Lake Concentration	
Chloride	30.6	mg/L	46.1	mg/L	57.7	mg/L
Chlorophyll	33.7	mg/L	29.1	mg/L	7.5	mg/L
Total Nitrogen	0.84	mg/L	0.93	mg/L	0.63	mg/L
Total Phosphorus	0.059	mg/L	0.038	mg/L	0.025	mg/L
Dissolved Organic Carbon	9.2	mg/L	6.8	mg/L	4.8	mg/L
Total Organic Carbon	9.4	mg/L	6.4	mg/L	4.2	mg/L
Turbidity	1.3	NTU	11.8	NTU	3.2	NTU
Total Coliform Bacteria	2,420	MNP/ML	1,046	MNP/ML	225	MNP/ML

CONCLUSIONS

Based on this preliminary assessment, there may be on the order of 100 million gallons of water available annually in existing stormwater ponds and features within 2 miles of White Bear Lake that could be pumped or directed into the lake. This approach would involve a complex network of pumps systems and conveyances to route the stored water to the lake, especially from the areas currently outside the contributing watershed drainage areas. While physically possible, there are likely significant public acceptance concerns from property owners near the ponds and from lake users on the quality of water to be augmented as well as significant regulatory challenges with moving water between watersheds. There are also a number of details related to operation and maintenance that would need further analysis and definition to develop an acceptable overall operations and maintenance plan for the systems. It is recommended that the White Bear Lake Area work group consider these potential challenges and issues before deciding to further evaluate this alternative in detail.

The additional surface water sources that were reviewed in amended Study 1 could potentially supply White Bear Lake with sufficient water to hydraulically augment the lake level on White Bear Lake during typical or average rainfall precipitation for these watersheds. Drought conditions that are caused from low rainfall precipitation could provide significantly less stored water for lake augmentation and should be further evaluated. The sources with the highest probability of being able to supply White Bear Lake are Bald Eagle Lake and Ramsey/Washington Counties Ditch 1. Both sources should have sufficient contributing drainage area during typical or average rainfall precipitation to be able to divert flow without significant, detrimental impacts to their current conditions. The potential water quality issues with Centerville Lake and the lack of sufficient base flow for the areas in the City of Grant present challenges to sustained pumping and augmentation to White Bear Lake.

As directed by the work group, this study includes evaluating these potential surface water sources for lake augmentation with respect to the hydrology only and does not include evaluating the water quality in detail or the water treatment requirements that may be required to treat these surface waters to a quality that would maintain the existing water quality in White Bear Lake.

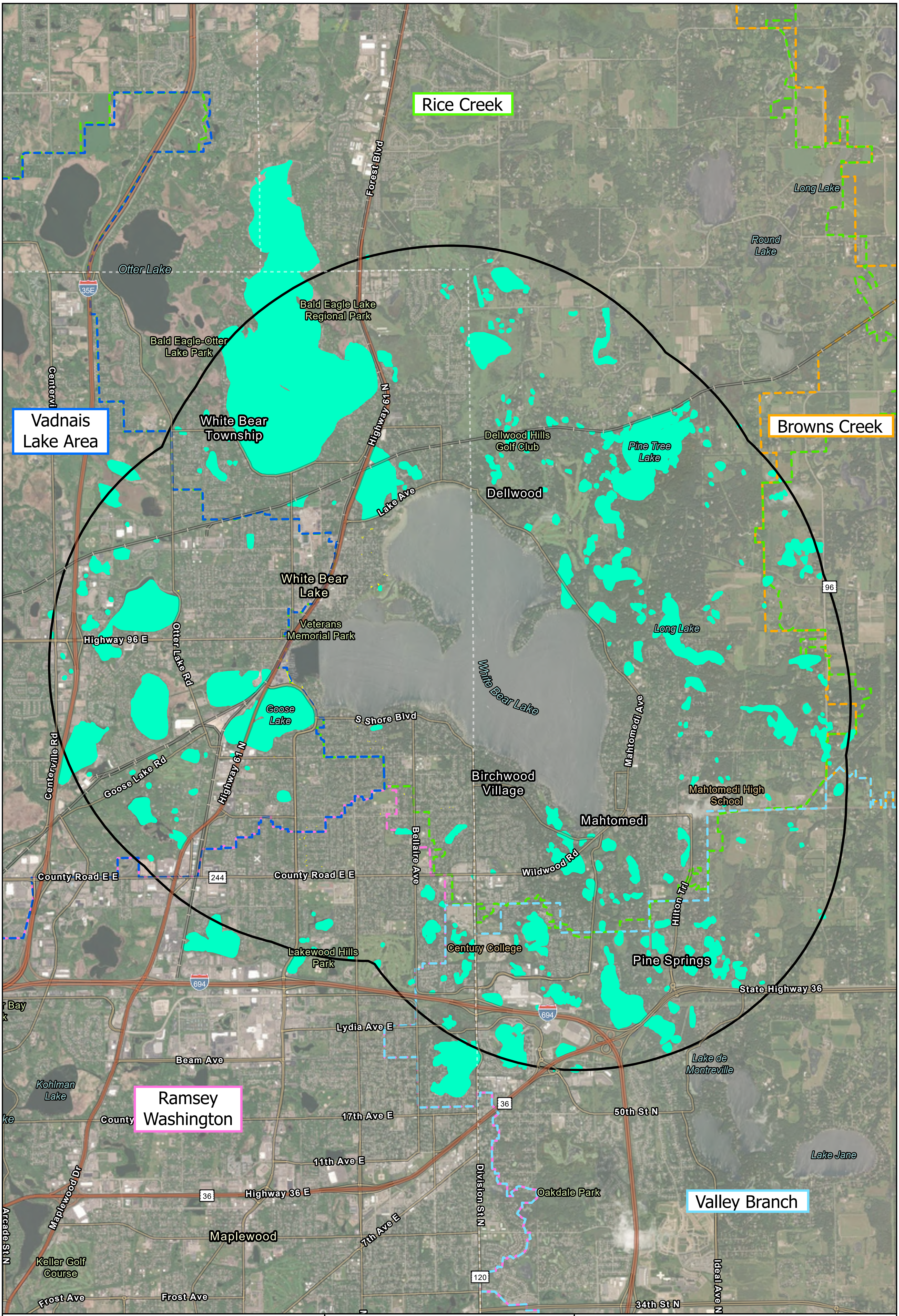
Kimley-Horn recommends the following as next steps:

- Review and analysis of water quality of Bald Eagle Lake and Ramsey/Washington Counties Ditch 1 to further determine feasibility and impacts on both the surface water sources and White Bear Lake.
- Review pump station siting at Coldwater Creek and routing of forcemain back to White Bear Lake.

- Review possible locations and sizing for a retention basin along Ramsey/Washington Counties Ditch 1 to capture excess flow and provide additional pumping volume to White Bear Lake.
- Review impacts of reduced flow downstream to waterbodies due to pumping.

Exhibits:

1 Divert Stormwater to Augment White Bear Lake
2 Remaining Stormwater Features
3 Bald Eagle Lake
4 Washington/Ramsey Counties Ditch 1
5 Areas of City of Grant, MN
6 Centerville Lake
7 Bald Eagle Lake, White Bear Lake Level Comparison
8 Bald Eagle Lake Outlet Discharge



N

0 0.38 0.75 1.5 Miles

Earthstar Geographics, Metropolitan Council, MetroGIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

EXHIBIT 1

Study 1 - Divert Stormwater to Augment White Bear Lake

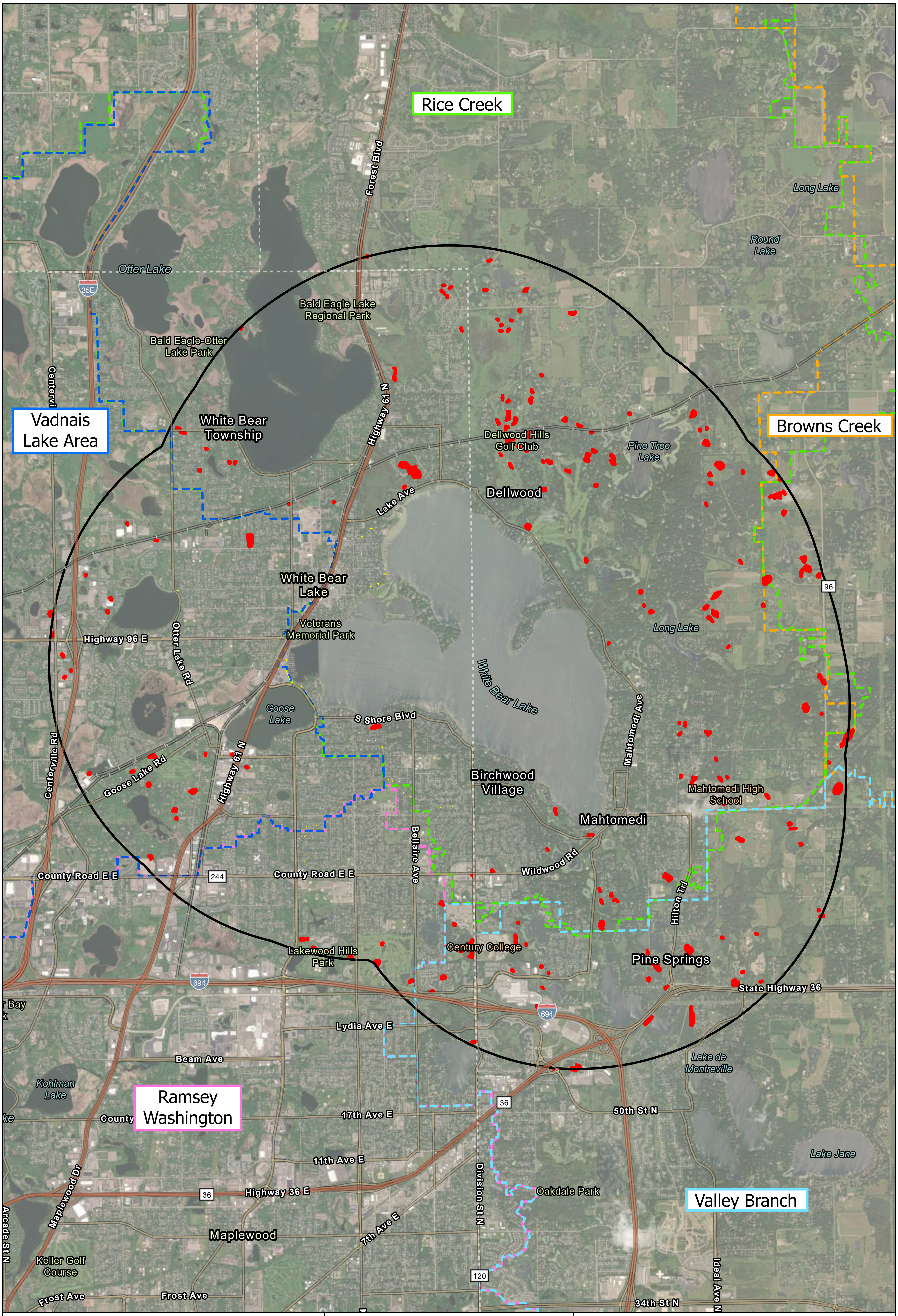
4/17/2025

Legend

- 2-mile Boundary
- DNR Water Bodies
- Raingarden

Watershed Districts

- Browns Creek
- Ramsey-Washington
- Rice Creek
- Vadnais Lake Area
- Valley Branch



N

0 0.38 0.75 1.5 Miles

Earthstar Geographics, Metropolitan Council, MetroGIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

EXHIBIT 2

Study 1 - Remaining Stormwater Features to Augment White Bear Lake

4/17/2025

Legend

- 2-mile Boundary
- Reduced DNR Water Bodies
- Raingarden

Watershed Districts

- Browns Creek
- Ramsey-Washington
- Rice Creek
- Vadnais Lake Area
- Valley Branch

N

0 0.15 0.3 0.6 Miles

Vantor, Metropolitan Council, MetroGIS, MN Dept Natural Resources, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS

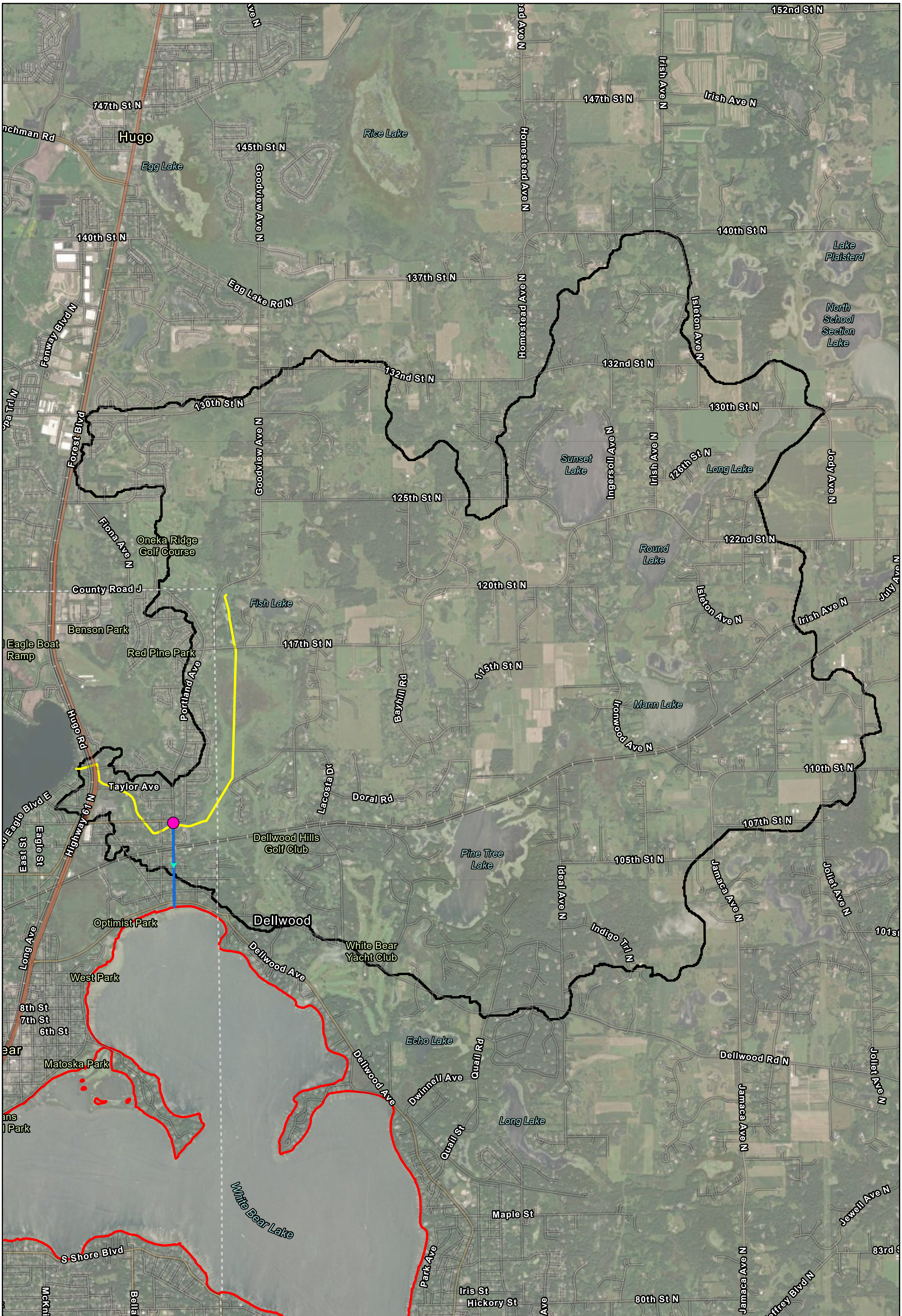
EXHIBIT 3

Study 1 Amendment 1- Redirecting Bald Eagle Lake to Augment White Bear Lake

3/24/2026

Legend

- White Bear Lake
- Bald Eagle Lake
- Contributing Area
- Possible Force Main
- Possible Pump Station
- ClearwaterCreek



N

0 0.25 0.5 1 Miles

Earthstar Geographics, Metropolitan Council, MetroGIS, MN Dept Natural Resources, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA,

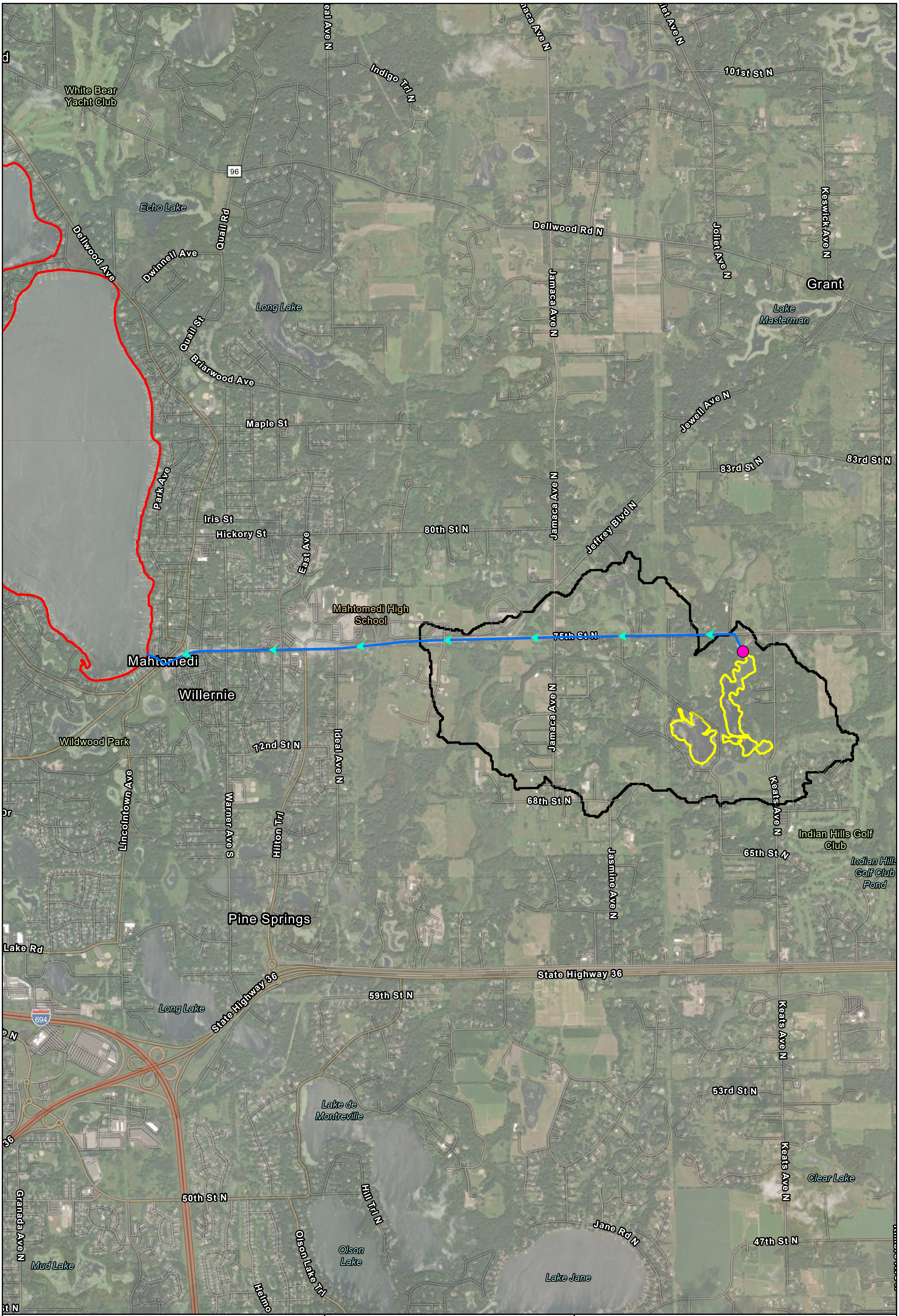
EXHIBIT 4

Study 1 Amendment 1 - Redirecting Ramsey/Washington Counties Ditch 1 to Augment White Bear Lake

10/21/2025

Legend

- White Bear Lake
- Contributing Area
- Ramsey/Washington Counties Ditch 1
- Possible Force Main
- Possible Pump Station



N

0 0.2 0.4 0.8 Miles

Metropolitan Council, MetroGIS, MN Dept Natural Resources, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Maxar

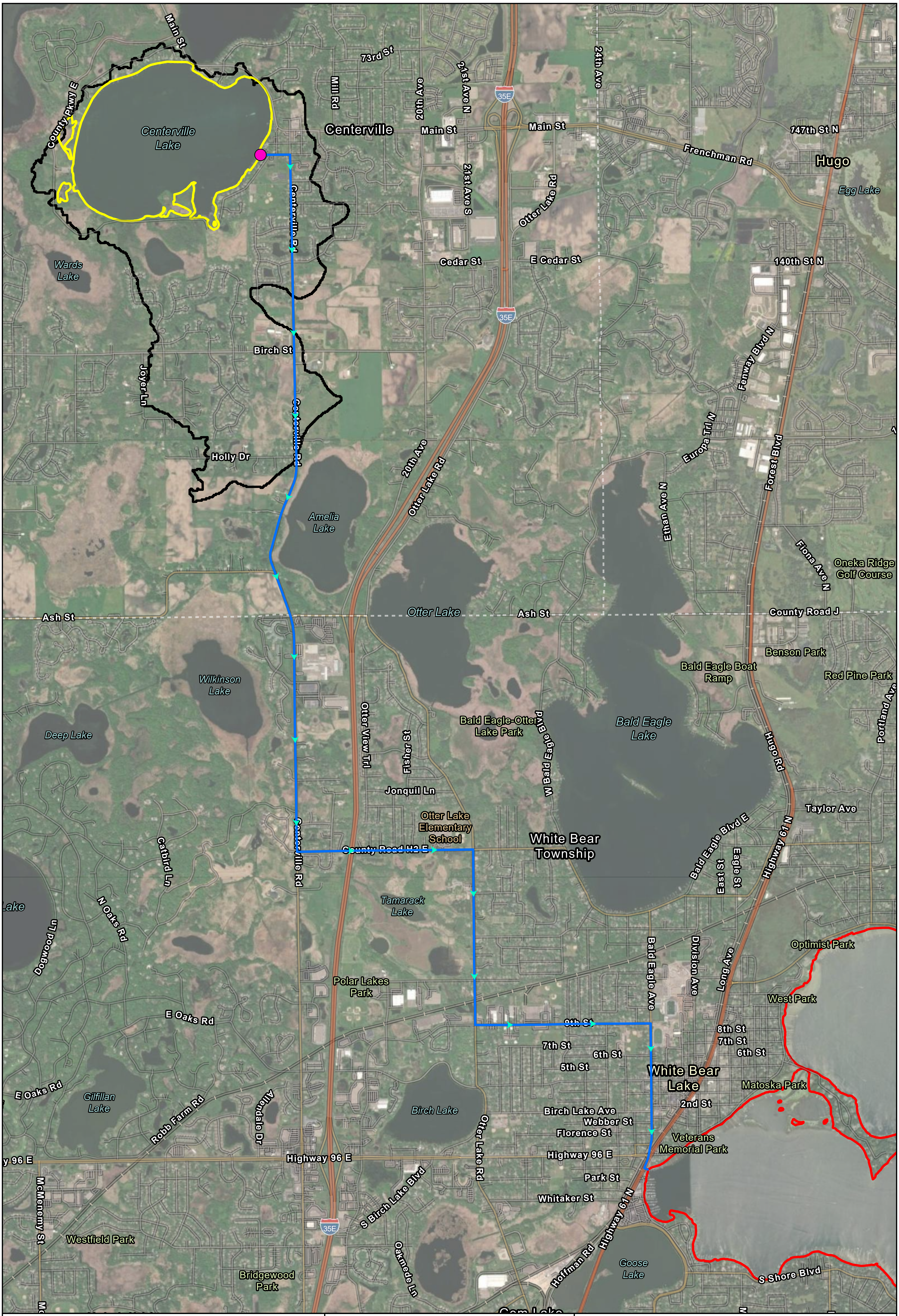
EXHIBIT 5

Study 1 Amendment 1 - Redirecting Areas of Grant to Augment White Bear Lake

10/21/2025

Legend

- Areas of Grant
- Contributing Area
- White Bear Lake
- Possible Force Main
- Possible Pump Station



N

0 0.25 0.5 1 Miles

Metropolitan Council, MetroGIS, MN Dept Natural Resources, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Maxar

EXHIBIT 6

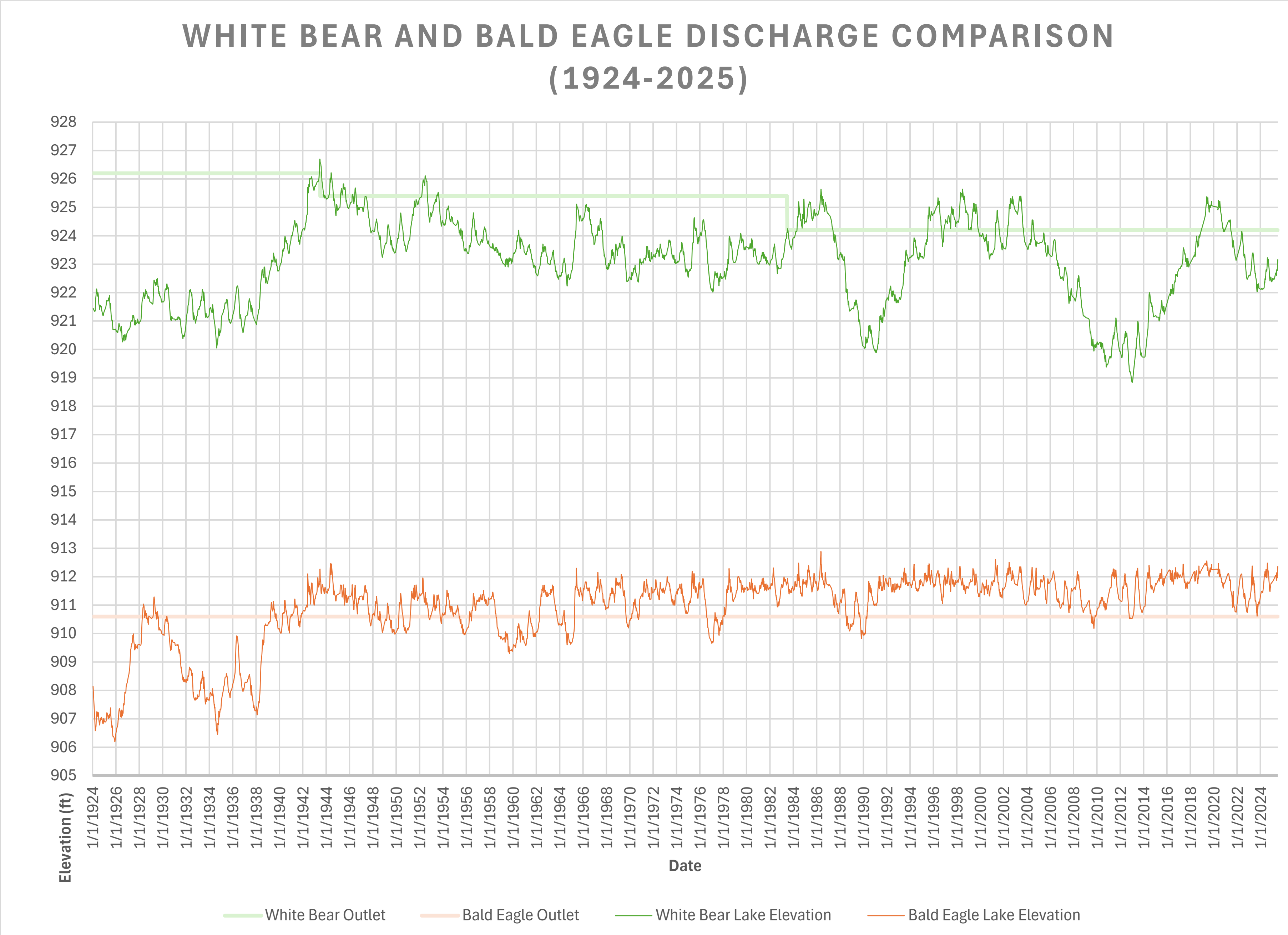
Study 1 Amendment 1 - Redirecting Centerville Lake to Augment White Bear Lake

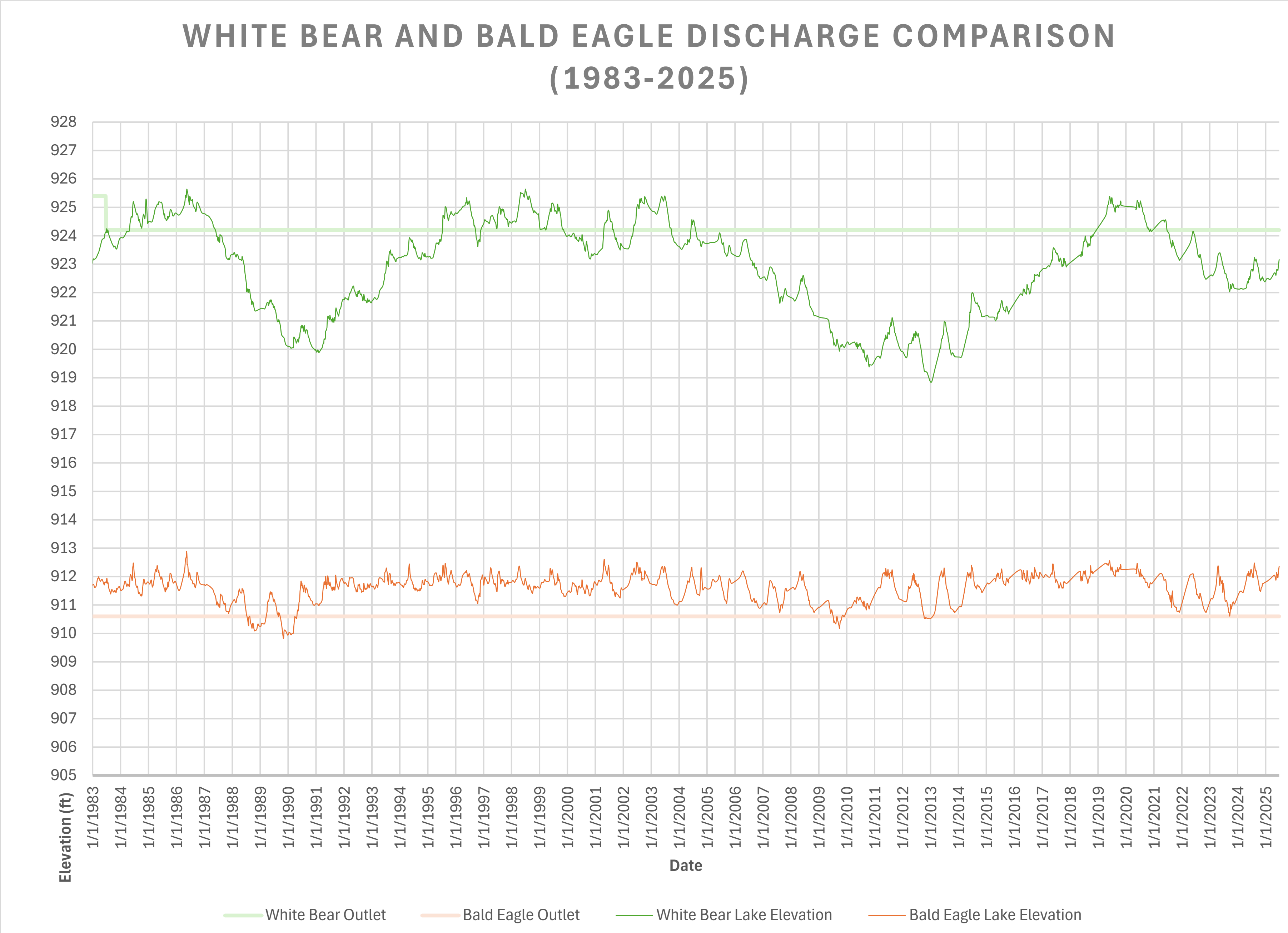
10/21/2025

Legend

- Centerville Lake
- Contributing Area
- White Bear Lake
- Possible Force Main
- Possible Pump Station

EXHIBIT 7 - BALD EAGLE LAKE, WHITE BEAR LAKE LEVEL COMPARISON




WHITE BEAR AND BALD EAGLE DISCHARGE COMPARISON (1983-2025)
928
927
926
925
924
923
922
921
920
919
918
917
916
915
914
913
912
911
910
909
908
907
906
905
Elevation (ft)
1/1/1983
1/1/1984
1/1/1985
1/1/1986
1/1/1987
1/1/1988
1/1/1989
1/1/1990
1/1/1991
1/1/1992
1/1/1993
1/1/1994
1/1/1995
1/1/1996
1/1/1997
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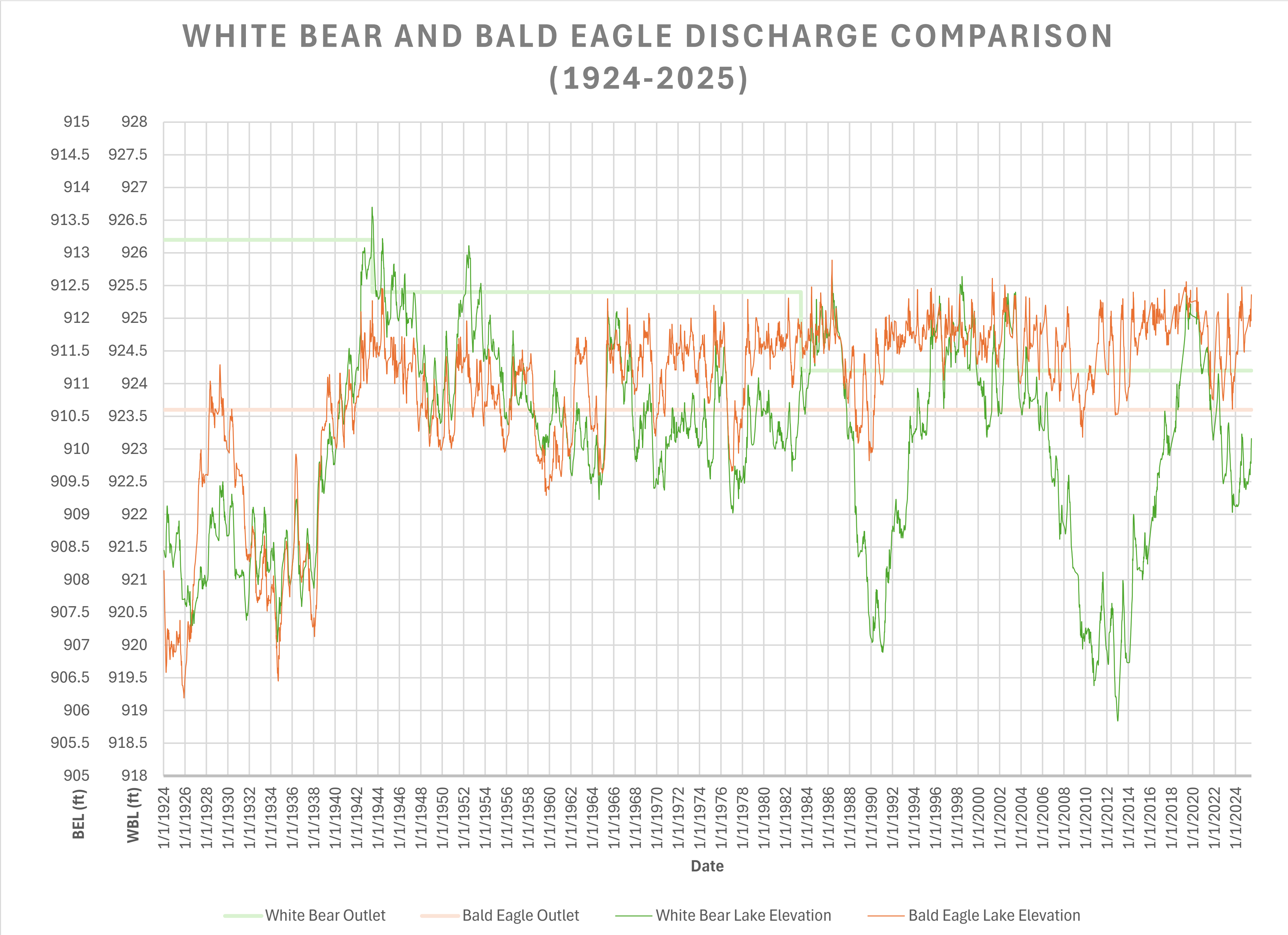
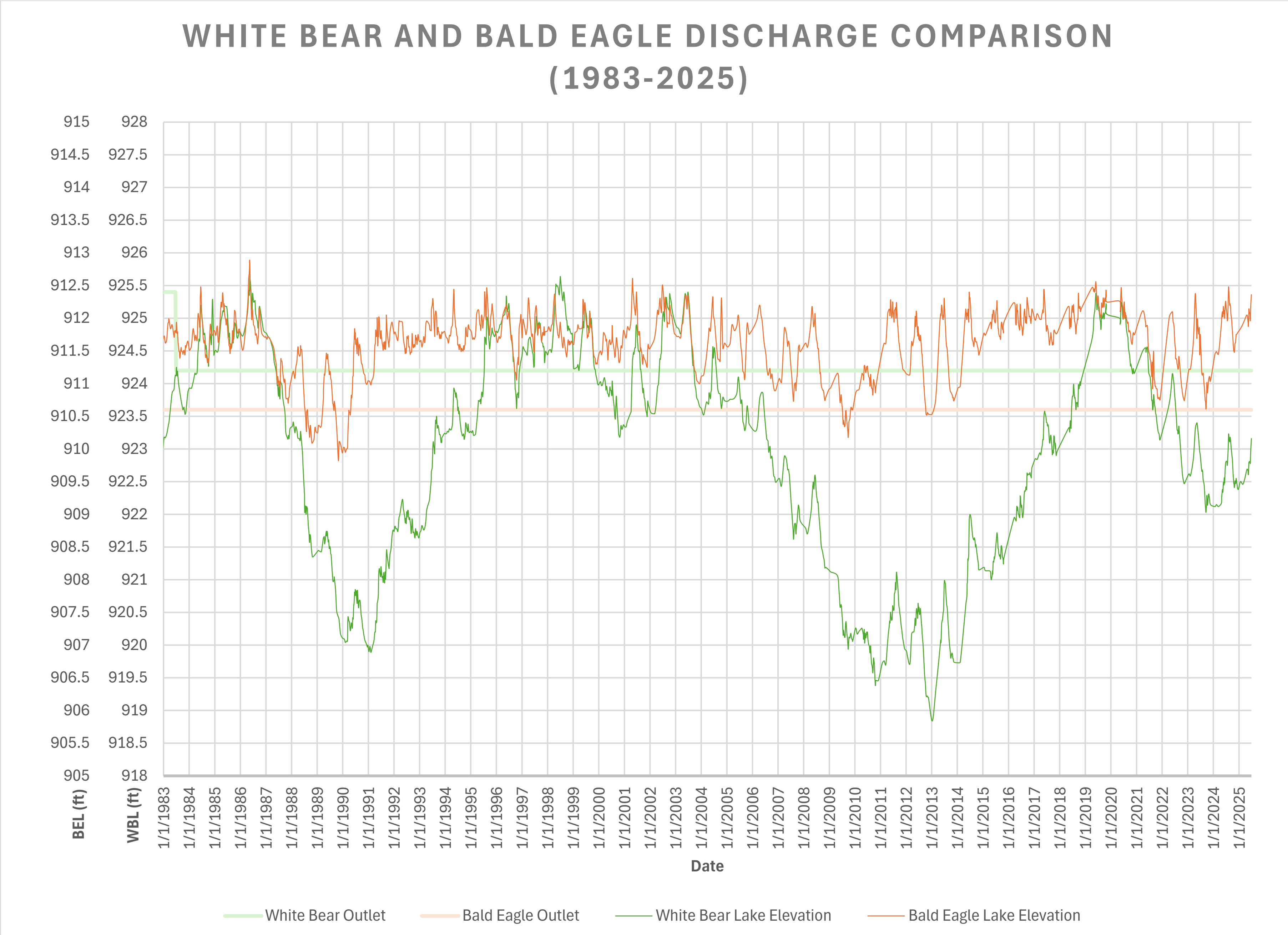
1/1/2012
1/1/2013
1/1/2014
1/1/2015
1/1/2016
1/1/2017
1/1/2018
1/1/2019
1/1/2020
1/1/2021
1/1/2022
1/1/2023
1/1/2024
1/1/2025
Date
White Bear Outlet
Bald Eagle Outlet
White Bear Lake Elevation
Bald Eagle Lake Elevation

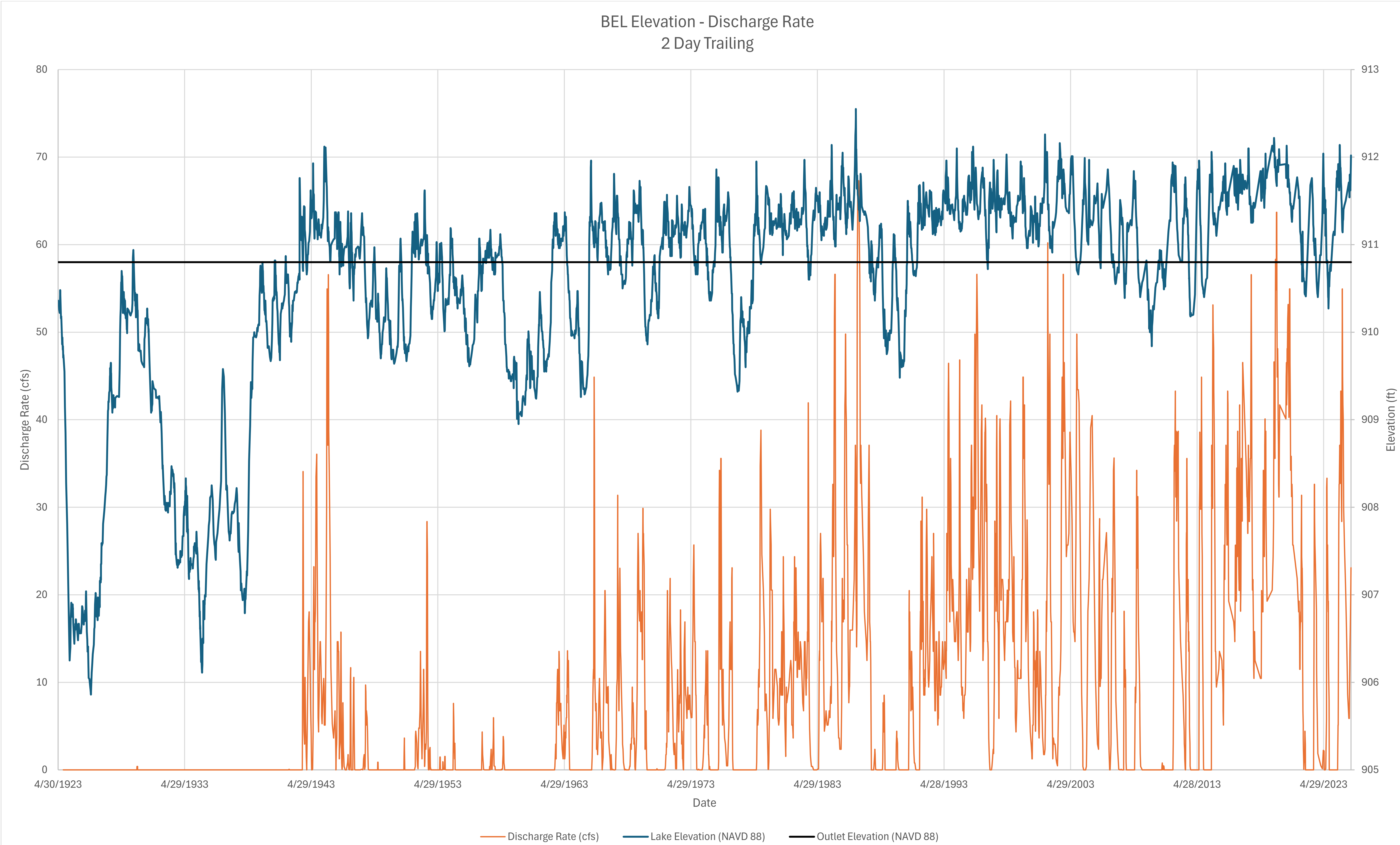


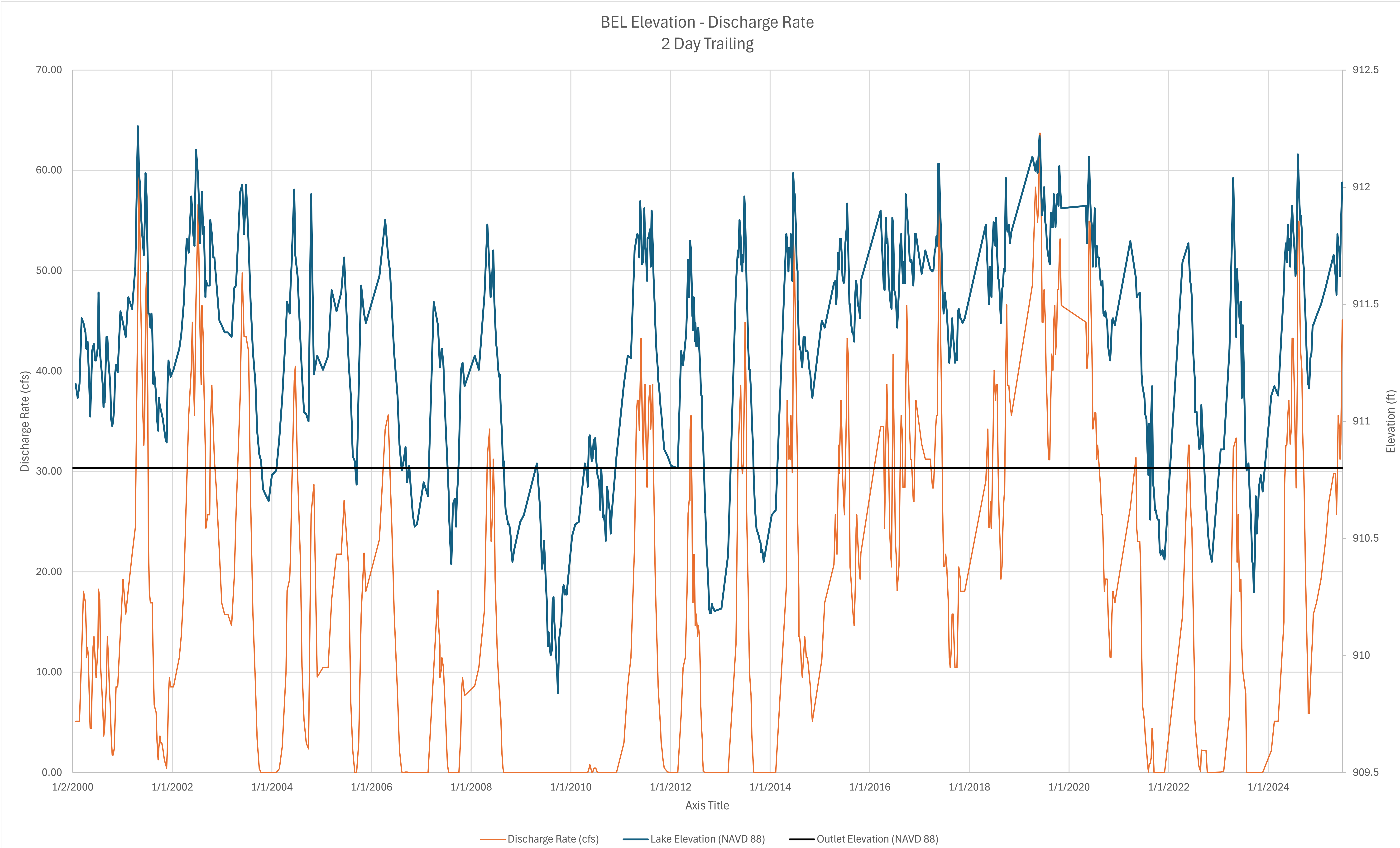
WHITE BEAR AND BALD EAGLE DISCHARGE COMPARISON (1924-2025)
BEL (ft)
WBL (ft)
Date
White Bear Outlet
Bald Eagle Outlet
White Bear Lake Elevation
Bald Eagle Lake Elevation

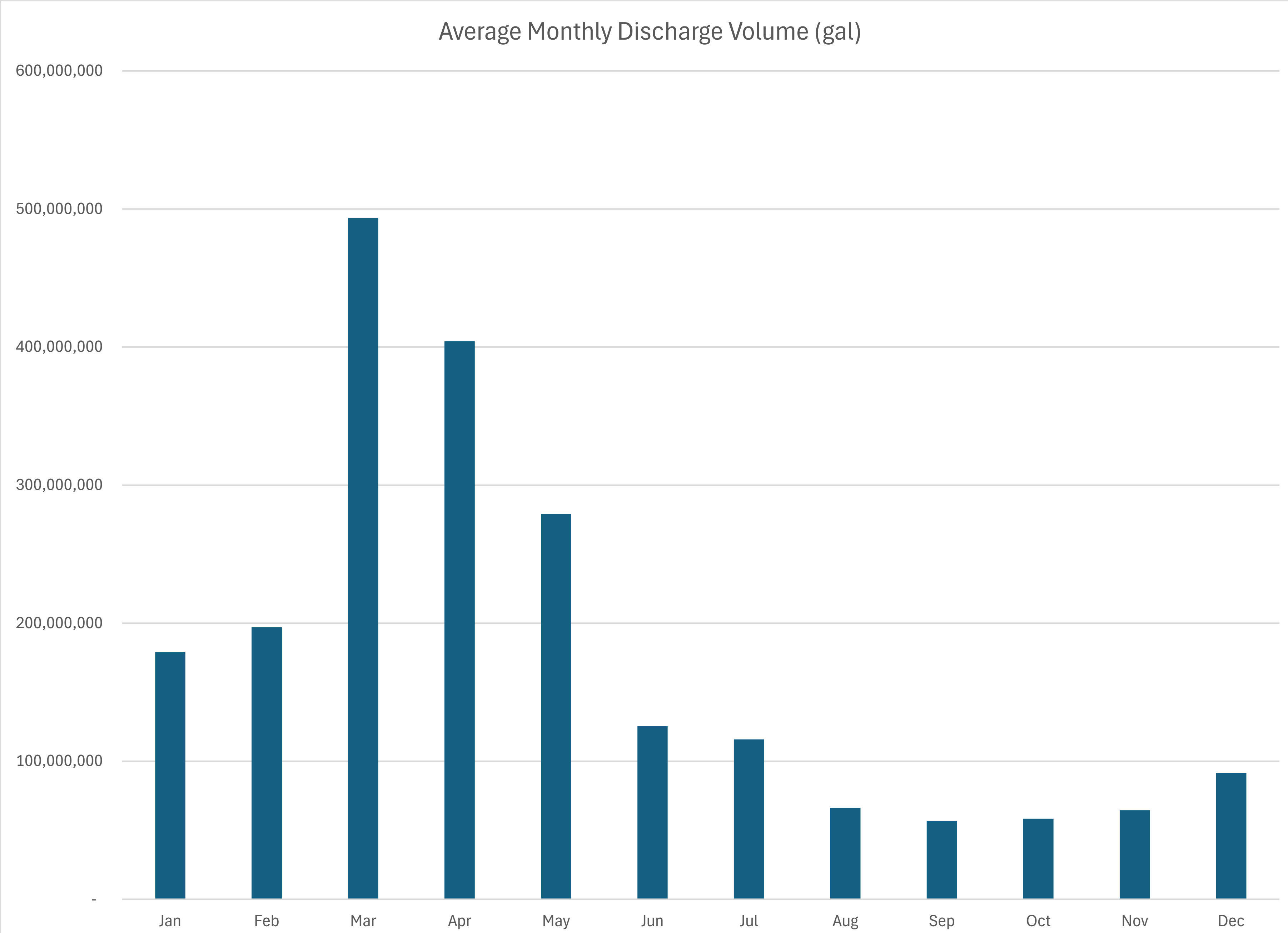


WHITE BEAR AND BALD EAGLE DISCHARGE COMPARISON (1983-2025)
915 914.5 914 913.5 913 912.5 912 911.5 911 910.5 910 909.5 909 908.5 908 907.5 907 906.5 906 905.5 905
928 927.5 927 926.5 926 925.5 925 924.5 924 923.5 923 922.5 922 921.5 921 920.5 920 919.5 919 918.5 918
BEL (ft)
WBL (ft)
1/1/1983 1/1/1984 1/1/1985 1/1/1986 1/1/1987 1/1/1988 1/1/1989 1/1/1990 1/1/1991 1/1/1992 1/1/1993 1/1/1994 1/1/1995 1/1/1996 1/1/1997 1/1/1998 1/1/1999 1/1/2000 1/1/2001 1/1/2002 1/1/2003 1/1/2004 1/1/2005 1/1/2006 1/1/2007 1/1/2008 1/1/2009 1/1/2010 1/1/2011 1/1/2012 1/1/2013 1/1/2014 1/1/2015 1/1/2016 1/1/2017 1/1/2018 1/1/2019 1/1/2020 1/1/2021 1/1/2022 1/1/2023 1/1/2024 1/1/2025
Date
White Bear Outlet
Bald Eagle Outlet
White Bear Lake Elevation
Bald Eagle Lake Elevation

EXHIBIT 8 - BALD EAGLE LAKE OUTLET DISCHARGE




BEL Elevation - Discharge Rate
2 Day Trailing
Discharge Rate (cfs)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Elevation (ft)
912.5
912
911.5
911
910.5
910
909.5
1/2/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
1/1/2022
1/1/2024
Axis Title
Discharge Rate (cfs)
Lake Elevation (NAVD 88)
Outlet Elevation (NAVD 88)


Average Monthly Discharge Volume (gal)
600,000,000
500,000,000
400,000,000
300,000,000
200,000,000
100,000,000
-
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec