MINNEHAHA CREEK
WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

**Meeting: OPC Meeting**
**Meeting date: 3/10/2022**
**Agenda Item #: 4.1**
**Item type: Permit Application & Partnership Briefing**

**Title:** Permit 22-016: Morningside Flood Risk Reduction Project

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**Purpose:**
Provide the Operations and Programs Committee (OPC) with briefing of the Morningside Flood Risk Reduction Project, which is anticipated to come before the Board on April 14th, 2022 for consideration of a permit; and to gauge interest in exploring a potential project partnership.

**Executive Summary:**
The City of Edina (Applicant) has applied for a Minnehaha Creek Watershed District (MCWD) permit for the Morningside Flood Risk Reduction Project. The project's principal goal of reducing flood risk for the Morningside Neighborhood is proposed to be accomplished by excavating and expanding two stormwater detention ponds in the Lynn/Kipling and Weber Park areas. During normal precipitation events, water will flow from Lynn/Kipling to Weber ponds. The Weber pond is proposed to be fitted with a pumping system that would manage water levels in the pond and create storage in by moving water downstream in advance of storms while not exacerbating downstream flood risk. Water conveyed downstream from the proposed project passes through the municipal stormsewer system of St. Louis Park, before entering the City of Minneapolis' system and discharging into stormwater ponds constructed in the 1990s by the Minneapolis Park and Recreation Board, the City of Minneapolis and the Minnehaha Creek Watershed District (MCWD), adjacent to Bde Mka Ska in the City of Minneapolis.

Based on the most recently submitted design information the project is expected to comply with all applicable MCWD regulations (Erosion Control, Floodplain Alteration, Stormwater Management). The project will meet water quality requirements, volume control, rate control, and will not increase water levels in downstream Bde Mka Ska.

However, a consequence of the proposed pumping is a decrease in efficiency in the downstream stormwater management ponds adjacent to Bde Mka Ska, due to their receiving a larger annual volume under the proposed project conditions. Therefore, as presently designed, while providing upstream water quality improvements, the project would have the unintended effect of increasing total phosphorus loading to Bde Mka Ska on the order of 8 lbs/year. This represents roughly 1% of the annual watershed phosphorus load to Bde Mka Ska.

While this impact falls outside of the scope of existing regulations, the City of Edina has expressed interest in working collaboratively with the Minnehaha Creek Watershed District, the Minneapolis Park and Recreation Board and the City of Minneapolis to explore solutions to offset this impact, which may also present the opportunity to create a net improvement in water quality by reducing phosphorus discharge to Bde Mka Ska beyond the 8 lb/year needed to mitigate the project increase.

**March 10, 2022 OPC Meeting**
At the March 10, 2022 meeting staff will summarize for the Operations and Programs Committee the proposed project, and how it fits within MCWD regulation, and frame opportunities for collaboration between the City of Edina, Minneapolis, the Minneapolis Park and Recreation Board and the MCWD.

The Committee will be asked to discuss its perspective on the potential for partnership. Pending OPC discussion, staff would continue working with the City of Edina and other partners to prepare the project to return to the Board for consideration of a permit and a preliminary partnership term sheet on April 14, 2022.

**Project Summary:**

Location:

The Morningside neighborhood is in the northeast corner of the City of Edina. It is bordered by St. Louis Park on the west and north and by Minneapolis on the east. The project is made up of three areas all within the Morningside Neighborhood of Edina: Weber Park, Weber Pond, and Lynn/Kipling areas (see site maps). Water flows east from the Lynn/Kipling area to Weber Pond via Edina stormsewer located on West 42nd Street and, in parallel, through pipes that run underneath the adjacent residential block, before entering Weber Pond. From Weber Pond, the stormwater travels northeast through the St. Louis Park and Minneapolis stormsewer networks before outletting into the Bde Maka Ska stormwater ponds. Both Weber Pond and the Lynn/Kipling Area are groundwater fed and therefore, have baseflow entering and discharging from the ponding areas; this flow is interchangeably referred to as baseflow and/or groundwater flow throughout this memo and the accompanying Stantec memo.

Project Goals:

Below is a summary subset of project goals:

1. Reduce flood risk, and protect principal residential structures, in Morningside neighborhood through a combination of additional flood storage, increased storm sewer capacity, and smart infrastructure.
2. Maintain or lower flood levels on the surface in the adjacent cities of St. Louis Park and Minneapolis such that no principal residential structures in these cities have an increase in flood risk.
3. Limit increases in flood volume to Bde Maka Ska and the adjacent ponds, such that the estimated rise for modeled design storm events can be considered negligible by applicable regulatory standards
4. Maintain usability of Weber Woods as a recreational area, particularly its use as an informal dog park.

Project Areas and Proposed Improvements:

The proposed project consists of work in three areas:

- Area 1 – Lynn/Kipling
- Area 2 – Weber Park
- Area 3 – Weber Pond/Weber Woods

*Lynn/Kipling:*

This total area is around 3 acres in size and the existing pond footprint is 1.6 acres. The change to the pond footprint is negligible while the pond bottom will be substantially lowered to provide additional storage capacity. Currently, the basin provides 10 acre-feet of storage between the NWL of 865 ft and elevation of 870 ft (equal to elevation of Lynn and Kipling Avenues). The proposed area will provide 20 acre-feet of storage by lowering the NWL to 862.5 feet. The Normal Water Level (NWL) will be lowered by lowering the pond from 864 ft to 856 ft via excavation. Additionally, stormsewer infrastructure will be modified.

Currently, the stormsewer pipe north of this area is lower than the inlets to the pond, which causes runoff to bypass this area and flow downstream. This pipe will be decommissioned to force high flows into the pond allowing for particulate setting and improving water quality after leaving the pond. The pond will gain an additional outlet in the southwest corner to accept potential outflow from this area to protect adjacent homes. Another outlet will be added in the northeast at elevation 862.3 to convey groundwater flow to Bde Maka Ska stormwater ponds after bypassing Webber Pond. Finally, low flows will be routed to Weber Pond via a new southeast pipe at elevation 863 that outlets to storm sewer infrastructure on West 42nd Street.

*Weber Park:*

Improvement proposed in 12-acre Weber Park include new pedestrian trails, reoriented baseball/softball areas, and a stormwater drainage swale. The drainage swale and adjacent corridor will provide (1) local drainage of the park during

rainfall and snowmelt events, (2) overflow and conveyance of water from Grimes Avenue to Weber Pond during larger (20-year) storm events, and (3) a walking trail that connects the park to the trails in Weber Woods.

*Weber Pond and Weber Woods:*
Weber Pond is an existing stormwater pond of 3.1 acres, bordered by single-family homes on the south and east, Weber Park on the west, and Weber Woods to the north. Weber Pond is proposed to be expanded in footprint to 6.1 acres, via excavation into the Weber Woods. The expanded pond will be accompanied with an earthen trail system around the perimeter, and two boardwalks traversing the ponds which will provide walking loops for the public. The expanded Weber Pond will include a pumped outlet, which will have three modes of operation:

1. Periodic pumping:
    a. The pond will be pumped for several hours each day to maintain the normal water level (NWL) below the gravity outlet to compensate for groundwater inflows. The current design proposes periodic pumping occurring over the course of 1-3 hrs/daily in order to draw pond levels down from 859.2-859.5 back to 859 feet. This will discharge around 0.82 acre-feet/day downstream.
2. Predictive pumping:
    a. The pump will also be used in advance of storm events to draw the water level down. The amount of drawdown will be determined through monitoring data from the water level in Weber Pond and the National Weather Service forecast. The predictive pumping is only proposed to be used for 10-year and above storm events. In advance of storm events, the pond will be lowered by up to 3 feet (5,441,711 gallons). The system will receive updated weather forecasts and water level data every 15 minutes and adapt accordingly. By pumping ahead of storms, more storage will be created to accept water from the surrounding neighborhood. The pond will draw down below the NWL in advance of large storm events
3. Pumping during and after events:
    a. The pond will be pumped during and after large (10-year and above) storm events to manage Weber Pond water levels. The amount pumped will be determined by water levels at Weber Pond and the National Weather Service Forecast. The exact parameters for this operation mode will be based on the developed algorithm.

**District Rule Analysis:**
The proposed project will trigger MCWD regulations for Erosion Control, Floodplain Alteration and Stormwater Management. Based on the current level of design, the project is anticipated to meet all applicable MCWD regulations, pending final adjustments to the design and permit application. Below is a summary of the triggered rules.

<u>Erosion Control</u>
The District's erosion control rule requires a sediment and erosion control plan for sites that disturb greater than 5,000 square feet or 50 cubic yards of material. The project is proposing over 5,000 square feet of land disturbance; therefore, the rule is triggered. An erosion and sediment control plan has not been submitted and will be required as a condition of approval to show that sediment transport to surrounding stormsewer systems is minimized during construction.

<u>Floodplain Alteration</u>
The District's floodplain alteration rule regulates grading within the 100-year floodplain of waterbodies and requires no net loss of floodplain by requiring projects to provide compensatory storage to offset any fill. The project proposes excavating below the 100-year high water elevation of Weber Pond; therefore, the rule is triggered. Applicant proposes a net cut of 402,331 cubic yards, increasing flood storage capacity and meeting the rule.

<u>Stormwater Management</u>
The project triggers the District's Stormwater Management Rule, and requires conformance with provisions of:

- Volume Control

- Phosphorus Control
- Rate Control
- Impact to Downstream Waterbodies

*Volume Control:*
The project requires the control of stormwater volume in an amount equal to 1" of runoff from the site's impervious areas. The project proses redevelopment of a site greater than five acres with more than 40% site disturbance. Therefore, volume control is required for the entire site's non-exempt impervious surface (12,470 square feet of proposed trail surface would be exempt under the District rule). The site's proposed non-exempt impervious surface is 1.24 (57,014 sf) acres, a decrease from 1.27 acres (53,771 sf) existing. This requires an abstraction volume of 4,481 cubic feet, or, alternatively, a filtration volume of 8,962 cubic feet.

Volume control is proposed to be achieved through soil amendments, in compliance with the Minnesota Stormwater Manual, in the irrigated sport fields.

*Phosphorus Control:*
Phosphorus control is required in an amount equal to what is provided by abstracting 1" of runoff volume from the site's impervious cover. Phosphorus control therefore is provided by virtue of the project abstracting 1" of volume through the proposed soil amendments. Combined, the project's soil amendments, structural components and expanded stormwater basins will result in a reduction of 34 lbs/year of phosphorus discharging from Weber Pond, compared to current conditions.

*Rate Control:*
The peak rate at which runoff leaves the project site boundary during specified (one-, 10- and 100-year) storm events may not increase from the existing condition. Applicant has modeled peak rates for the piped outlet of Weber Pond and they meet this standard. Rate control will be provided by regulating the flow from the piped outlet.

**Table 1: Existing and Proposed Rate Summary**

| *Location* | *Storm event* | *Pre-Development Discharge Rates CFS* | *Post Development Discharge Rates CFS* |
|---|---|---|---|
| City Boundary | 1-year | 20 | 12 |
| | 10-year | 29 | 14 |
| | 100-year | 65 | 34 |
| Bde Maka Ska | 1-year | 59 | 58 |
| | 10-year | 91 | 90 |
| | 100-year | 229 | 227 |

*Impact to Downstream Waterbodies*
MCWD's stormwater management rule requires analysis of potential impact to water levels of downstream waterbodies. In this instance the downstream receiving waterbody is Bde Mka Ska. For lakes, the District's stormwater rule does not permit any water level rise during the 1, 10, and 100-year design storms. Modeling shows that there will be no impact to water level during these events in excess of the DNR-defined "no-rise" criterion of 0.0044 ft.

**Table 2: Existing and Proposed Water Levels for Bde Maka Ska**

| | *1-year* | *10-year* | *100-year* |
|---|---|---|---|
| *Existing* | 853.66 | 854.33 | 855.68 |
| *Proposed* | 853.64 | 854.29 | 855.65 |
| *Change ft* | -0.02 | -0.04 | -0.03 |

**Additional Considerations & Partnership Opportunity**

Downstream Water Quality Impact

As described in the executive summary of this memo, while the District engineer is likely to find that the project complies with all applicable MCWD regulations, downstream phosphorus loading to Bde Mka Ska is projected to increase by 8 lbs per year. This represents roughly 1% of the annual watershed load to the lake.

This increase is a result of an increased annual volume of water passing through the downstream Bde Mka Ska stormwater ponds. The increased volume decreases the residence time of the ponds, or the average length of time water spends in the ponds, and so decreases the opportunity for sediment and associated nutrients in the water to settle out.

Opportunity for Partnership:

While the District stormwater rule does not explicitly regulate an impact of this nature, the City of Edina has expressed interest in a partnership to mitigate this downstream water quality impact in conjunction with the Minneapolis Park and Recreation Board and the City of Minneapolis, or exploring opportunities to adjust project design to alleviate the impact within the Morningside project area.

Based on very preliminary analysis, and with limited discussion amongst the prospective partners, Stantec has evaluated the potential for a variety of BMP retrofits that could exceed 8 lbs/year of phosphorus removal. An initial summary of retrofit categories contemplated, the potential range of phosphorus reduction, lifecycle costs, and cost-benefit are shown below.

| BMP Type | Implementation Locations | Total Phosphorus Reduction Range (lb/yr) | Lifecycle (20-year) Cost ($) | Cost Per Lb Phosphorus Removed ($) |
|---|---|---|---|---|
| Pumped Iron Enhanced Sand Filter | • Bde Maka Ska Ponds<br>• Weber Park | 9-66 | 620,000 - 2,400,000 | 1,200 – 5,100 |
| Pumped Cartridge (MTD) Filter | • Bde Maka Ska Ponds<br>• Weber Park | 10-38 | 1,400,000 - 2,100,000 | 1,900 – 10,000 |
| Stormwater Reuse via Irrigation | • Bde Maka Ska Ponds<br>• Weber Park<br>• Minikahda Vista Park<br>• Minikahda Golf Course | 7-88 | 240,000 - 1,800,000 | 700 – 3,200 |
| Alum Dosing Station | • Bde Maka Ska Ponds | 40-60 | 1,200,000 - 1,800,000 | 1,000 – 1,600 |

**Additional Considerations**

The project brought forth certain longer-range policy considerations that that the District as an organization may wish to consider.

MCWD's rules require abstraction of the first one inch of runoff from hardcover and standards limiting peak flow increases and water elevation bounce at downgradient waterbodies. District rules do not regulate changes in stormwater volume moved through stormwater conveyances within the watershed. As climate changes, with expected increases in storm intensities and event precipitation volumes, cities and others responsible for flood risk management may wish to adjust systems to send more volume downgradient. This may create a risk of cumulative downstream water quality and flooding impacts. The District may wish to consider whether there is value in assessing this issue and of coordinating with its partners in doing so.

Additionally, reliance on pumping regimes that require ongoing human oversight introduces greater uncertainty into the watershed-wide management of stormwater volumes and may call on more District resources to monitor.

**Conclusion**
At the March 10, 2022 OPC, staff will present the Morningside Flood Risk Reduction project, a regulatory summary, and a summary of potential opportunities to work in partnership with the City of Edina, Minneapolis and the Minneapolis Park and Recreation Board to go beyond mitigating the 8 lb a year increase in phosphorus loading to Bde Mka Ska.

Pending Board discussion, next steps following the meeting could involve the relevant parties developing a term sheet, on advice of District counsel and engineering, outlining a structure for partnership that would advance project concepts through stages of feasibility, design and construction, in advance of the permit returning for Board consideration on April 14, 2022.

**Supporting documents (list attachments):**

- Weber Pond Site Map
- Lynn/Kipling Site Map
- Flow Map
- Stantec Memo

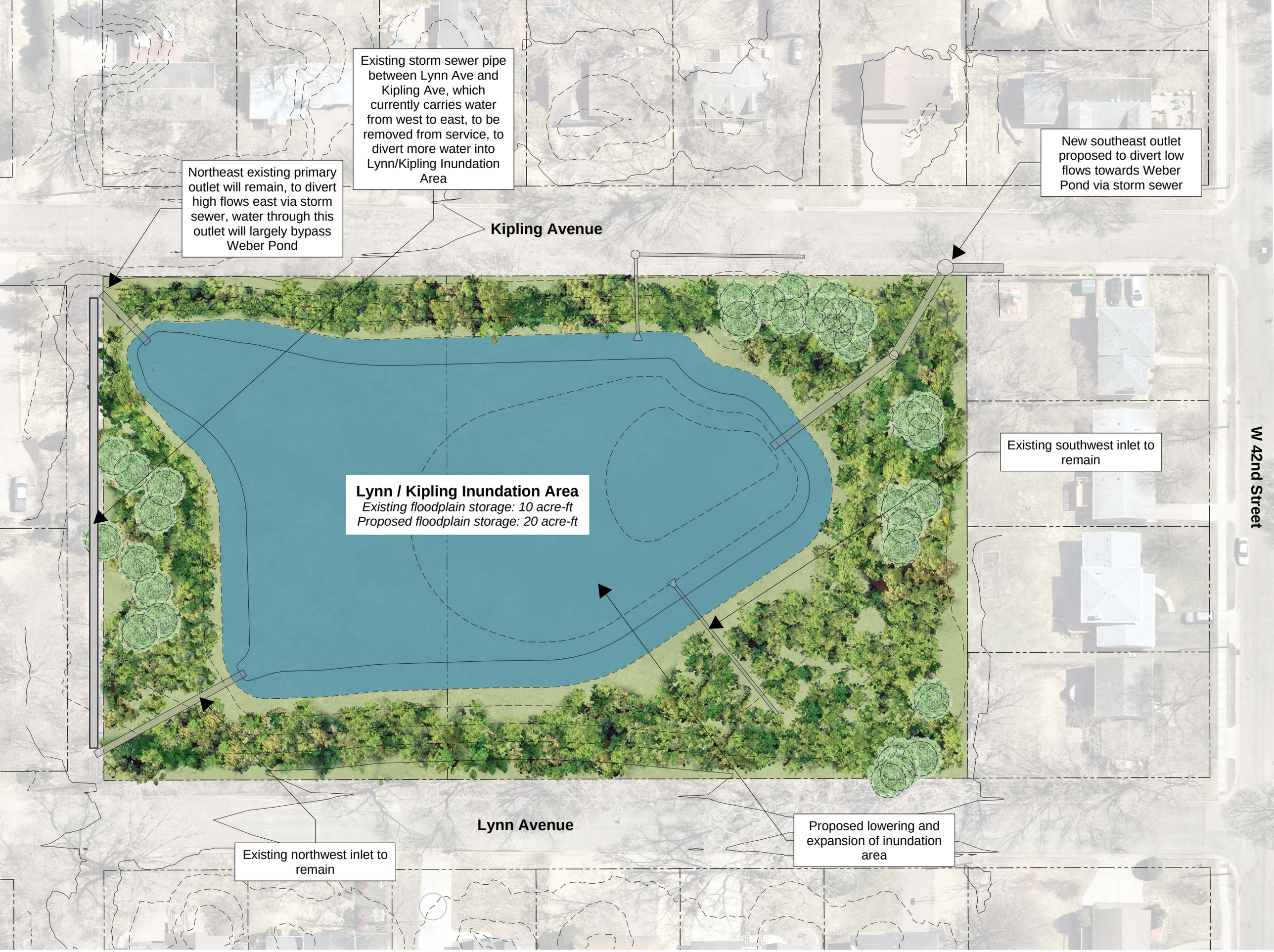
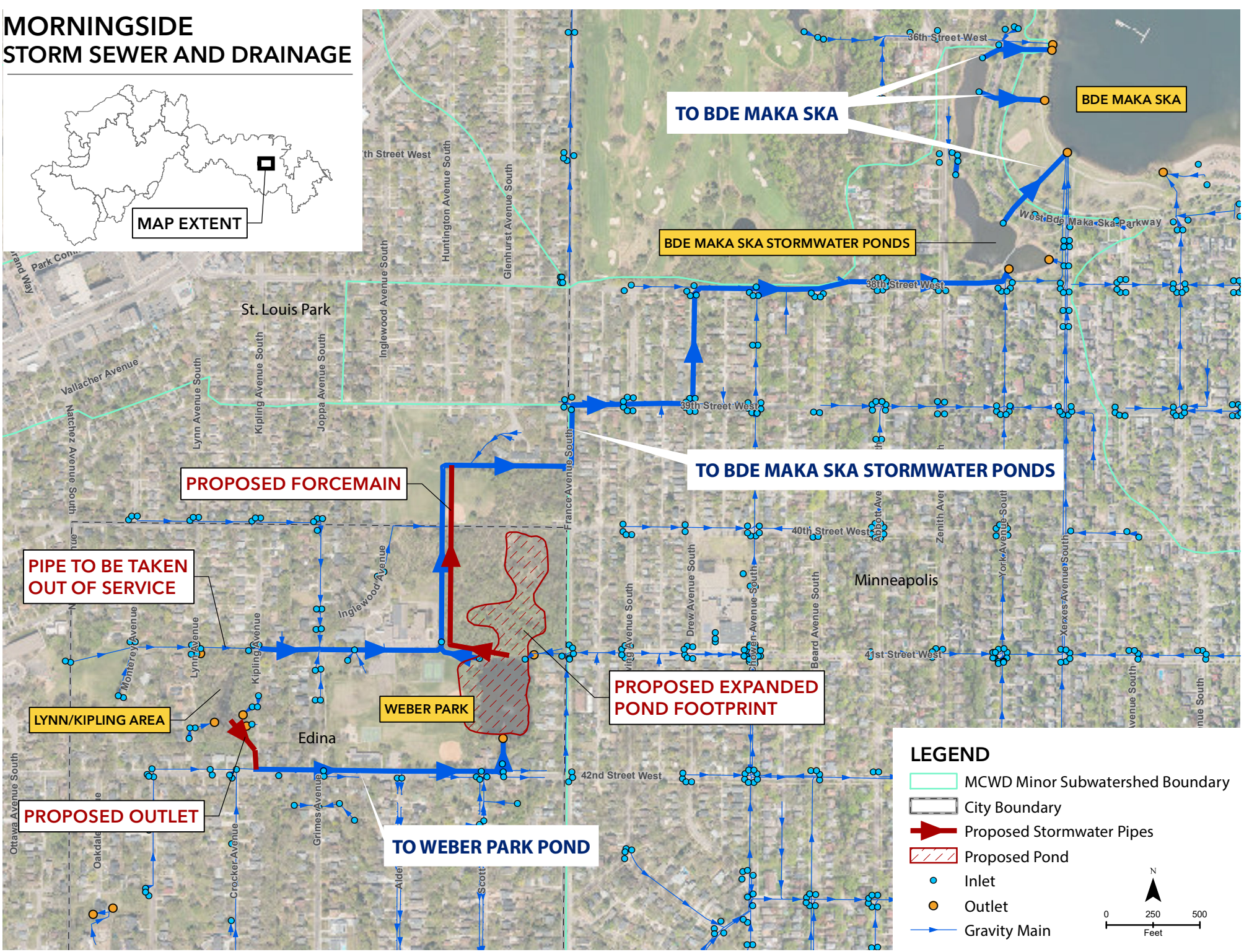



Figure generated by City of Edina, marked up by Stantec / MCWD as a visual aid based on project understanding 3/8/22.

0 30 60
SCALE IN FEET


Figure generated by City of Edina, marked up by Stantec / MCWD as a visual aid based on project understanding 3/8/22.

# MORNINGSIDE
## STORM SEWER AND DRAINAGE



Stantec

# Memo

| | | | |
|---|---|---|---|
| To: | James Wisker<br>Abigail Ernst | From: | Chris Meehan<br>Rena Weis |
| Project/File: | 227701403 22-016 | Date: | March 8, 2022 |

**Reference: Edina Morningside Flood Risk Reduction Project Technical Summary**

**Purpose:** This memorandum is intended to accompany the document prepared by Abigail Ernst (MCWD) for the March 10, 2022 OPC Meeting. The memo provides technical details about the Morningside Permit, extracted from the City of Edina's permit application, and provides concept-level design options for water quality improvement, prepared by Stantec. This memorandum is based on our current understanding of the proposed project, which is at 60-percent design.

# 1 Project Technical Summary

## 1.1 Project Infrastructure

### 1.1.1 OVERVIEW OF PROJECT AREA DRAINAGE

The project is proposed in the Morningside neighborhood of Edina, which discharges via storm sewer to St Louis Park, before entering the City of Minneapolis and subsequently, stormwater ponds that serve as pretreatment for Bde Maka Ska, and Bde Maka Ska itself. See the "Morningside Storm Sewer and Drainage" figure that accompanies these memos.

### 1.1.2 EXPANSION AND LOWERING OF LYNN / KIPLING INUNDATION AREA

The project proposes to expand and lower the Lynn / Kipling Inundation Area. The bottom of the basin will be lowered from 864 ft to 856 ft, and grading will expand the available storage volume. The project will construct a new outlet at the southeast corner of the area, set at 863 ft, which will route low flows to Weber Pond. High flows will discharge from the Lynn / Kipling Inundation Area at the northeast corner, set at 865.3 ft, and primarily bypass Weber Pond.

### 1.1.3 IMPROVEMENTS TO WEBER PARK

The project proposes changes to the site's impervious area, including trails; parking lot resurfacing; and concrete pads associated with the warming house, tennis courts, basketball courts, and ball fields. The proposed and existing impervious areas are summarized in Table 1.

*Table 1 Weber Park impervious surface summary*

| Impervious Surface Description | Area (square feet) |
|---|---|
| Existing *(total)* | 57,041 |
| Proposed (*total*) | 66,241 |
| Proposed (*trails exempt from stormwater treatment regulation*) | 12,470 |
| Proposed (*areas subject to stormwater treatment regulation*) | 53,771 |

The project is required to provide volume control for the site's entire impervious surface, except for exempt trails, which is equivalent to 4,481 cubic feet of volume abstraction. The project proposes to meet this requirement by implementing 120,900 square feet of soil amendments over disturbed pervious areas, primarily the park ballfields, in-line with MCWD's volume abstraction credit schedule.
The project also proposes to construct a swale through Weber Park to divert water from Grimes Avenue South to the east across Weber Park and into Weber Pond. The swale is anticipated to receive runoff from Grimes Avenue South during the 5-year event and larger.

### 1.1.4 EXPANSION AND LOWERING OF WEBER POND

The project proposes to create flood storage by expanding the footprint and lowering the normal water level (NWL) of Weber Pond. Expansion of Weber Pond into the present-day Weber Woods will result in Weber Pond's surface area increasing from 3.1 acres to 6.4 acres.
The NWL of Weber Pond will be lowered by 2.5 ft from 861.5 ft to 859.0 ft. This will be accomplished by the addition of a pumping station and forcemain, which will operate under three primary regimes. Weber Pond is currently drained via a gravity storm sewer outlet. The gravity outlet will still exist and function in the proposed condition, but it will be raised by 0.8 ft to 862.4 ft. The purpose of raising the gravity outlet is twofold, (1) it allows Weber Pond to retain more water during large events and (2) it minimizes backflow into Weber Pond from the adjacent storm sewer.

The pump station, designed to pump water out of Weber Pond at a rate of 10 cfs, will operate under three types of conditions:

1. Periodic pumping
    a. Pump will operate for 1-3 hours per day, to drain the groundwater baseflow from Weber Pond, allowing the NWL to be maintained at 859 ft. The applicant estimates that about 1 acre-ft of water will be pumped downstream per day.
    b. Maintaining the NWL at 859 facilitates the creation of 24 acre-ft of flood storage (between 859 ft and 862.4 ft).
2. Predictive pumping
    a. The project proposes to connect the pump to internet-based data and algorithms (proprietary system by Opti-RTC) that consider the weather forecast

and the current level of Weber Pond. The system will also be capable of utilizing a downstream monitoring point at Bde Maka Ska, though conversations about this are ongoing.

b. If an event larger than 5-inches over 24 hours is predicted (10-year event / 10% Annual Exceedance Probability), the pump station will begin the drawdown the water level in Weber Pond. The pump will be capable of drawing Weber Pond down from 859 ft to 856 ft over 24 hours. The algorithm will be able to make adjustments in real-time, based on changing forecasts.
c. The predictive pumping component creates 16.7 acre-ft of flood storage.

3. During-event and after-event pumping
   a. The pump station will turn on to limit water level rise in Weber Pond during and after large storm events.

## 1.2 Project Technical Impacts

### 1.2.1 FLOOD RISK REDUCTION

The primary goal of the project is to reduce flood risk within the City of Edina, while ensuring flood risk is not exacerbated in adjacent & downstream areas. The floodplain storage provided by the project is outlined in Table 2.

*Table 2 Floodplain storage summary*

| Location | Existing (acre-feet) | Proposed (acre-feet) |
|---|---|---|
| Weber Pond | 50 | 100 |
| Lynn / Kipling Inundation Area | 10 | 20 |
| TOTAL | 60 | 120 |

Through hydraulic & hydrologic modeling, the applicant has shown that peak water levels / flooding will not be exacerbated in St Louis Park or Minneapolis.

### 1.2.2 PEAK WATER LEVELS

Peak water levels were reviewed at key locations for design storm events, and are summarized in Table 3. The results show that changes to peak water levels meet District regulatory requirements of showing no increase in peak water elevation (modeled within 0.0044 ft) of Bde Maka Ska. For context, when reviewing the values provided, note that 0.1 ft is equivalent to 1.2 inches.

*Table 3 Peak modeled water levels throughout area of interest*

| Location / Parameter | Condition | 1-year, 24-hour | 10-year, 24-hour | 100-year, 24-hour | 1-year, 10-day | 10-year, 10-day | 100-year, 10-day |
|---|---|---|---|---|---|---|---|
| **Peak Weber Pond Elevation (feet)** | Existing | 866.2 | 868.3 | 869.3 | 866.0 | 868.2 | 869.5 |
| | Proposed | 862.8 | 868.6 | 868.3 | 862.6 | 864.5 | 868.5 |
| | Change | -3.4 | 0.3 | -1.0 | -3.3 | -3.7 | -1.1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Peak Bde Maka Ska South (cells 1 and 2) Stormwater Pond Elevation (feet)** | Existing | 853.7 | 854.3 | 855.7 | 853.8 | 854.7 | 856.2 |
| | Proposed | 853.6 | 854.3 | 855.7 | 853.8 | 854.7 | 856.1 |
| | Change | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Peak Bde Maka Ska North (cell 3) Stormwater Pond Elevation (feet)** | Existing | 853.9 | 854.4 | 855.7 | 853.8 | 854.7 | 856.2 |
| | Proposed | 853.9 | 854.4 | 855.7 | 853.8 | 854.7 | 856.1 |
| | Change | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Peak Bde Maka Ska Elevation (feet)** | Existing | 853.7 | 854.3 | 855.7 | 853.8 | 854.7 | 856.1 |
| | Proposed | 853.6 | 854.3 | 855.7 | 853.8 | 854.7 | 856.1 |
| | Change | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## 1.2.3 PEAK DISCHARGE RATES

The nature of the project allows water to be retained in Weber Pond and peak discharge rates to be attenuated. Therefore, the project maintains or reduces peak flow rates at the City of Edina / City of Minneapolis boundary and into Bde Maka Ska, as shown in Table XX.

| Location | Condition | 1-year, 24-hour | 10-year, 24-hour | 100-year, 24-hour |
|---|---|---|---|---|
| City Boundary | Existing | 20 | 29 | 65 |
| | Proposed | 12 | 14 | 34 |
| | Change | -8 | -15 | -31 |
| Bde Maka Ska | Existing | 59 | 91 | 229 |
| | Proposed | 58 | 90 | 227 |
| | Change | -1 | -1 | -2 |

## 1.2.4 ANNUAL VOLUME DISCHARGED DOWNSTREAM

The periodic pumping proposed by the project to maintain a lower NWL in Weber Pond results in more volume discharged to Bde Maka Ska on an annual basis. This increased volume results in decreased residence time within the Bde Maka Ska Stormwater Ponds. Table 4 summarizes the change in volume and pond residence time proposed by the project.

*Table 4 Annual volume and residence time summary*

| Parameter | Existing Condition | Proposed Condition | Change (Proposed – Existing) |
|---|---|---|---|
| Volume Leaving Project Area (through ponds and storm sewer) | 400 ac-ft/yr | 770 ac-ft/yr | + 370 ac-ft/yr |
| Residence time in Edina Ponds (flow leaving / dead storage) | 9 days | 14 days | + 5 days |
| Volume Leaving MCWD WQ Ponds (through ponds and storm sewer) | 850 ac-ft/yr | 1,220 ac-ft/yr | + 370 ac-ft/yr |
| Residence time in MCWD WQ Ponds | 9 days | 7 days | - 2 days |

The project proposes to conduct periodic pumping daily, running the pump at Weber Pond for approximately 1 hour per day. This periodic pumping is expected to result in a 0.1 ft rise of water levels in the stormwater ponds of Bde Maka Ska daily, which will drain and equalize with Bde Maka Ska in 2 to 3 hours.
As this additional volume discussed in this section is a result of increased groundwater baseflow into Weber Pond, it is important to note that the estimated values are based on modeling, and the applicant identified a potential range of anticipated groundwater inflow / baseflow rates. We anticipate that the groundwater inflow rates will be verified as the project progresses.

### 1.2.5 WATER QUALITY IMPACTS

The applicant completed modeling to evaluate the water quality impacts of the project at the project site, at the City of Edina / Minneapolis boundary, and where the Bde Maka Ska stormwater ponds discharge to Bde Maka Ska. The modeling is focused on total suspended solids (TSS) and total phosphorus (TP), and the results are summarized in Table 5.
*Table 5 Water quality summary*

| Parameter | Existing Condition | Proposed Condition | Change (Proposed – Existing) |
|---|---|---|---|
| **Edina Project Area Nutrients Summary (lbs/yr)** | | | |
| TSS Retained from the Edina Project Area | 43,850 | 58,450 | + 14,600 |
| TSS Flux from the Edina Project Area | 28,700 | 14,100 | - 14,600 |
| TP retained in the Edina Project Area | 86 | 120 | + 34 |
| TP Flux from the Project Area | 156 | 122 | - 34 |
| **MCWD WQ Pond Nutrients Summary (lbs/yr)** | | | |
| TSS Retained in MCWD WQ Ponds | 131,400 | 114,900 | - 16,500 |
| TSS Flux from the MCWD WQ Ponds | 19,600 | 21,500 | + 1,900 |
| TP retained in MCWD WQ Ponds | 290 | 248 | - 42 |
| TP Flux from the MCWD WQ Ponds | 276 | 284 | + 8 |

The modeling shows an increase in TP load to Bde Maka Ska of 8 lbs per year, which is primarily a result of decreased settling time in the ponds, caused by higher annual volumes of water being directed to the ponds via the project's periodic pumping.
This modeling, completed by the applicant, assumes that additional groundwater intercepted by Weber Pond and the Lynn / Kipling Inundation Area as a result of basin lowering and expansion, would have ultimately reached Bde Maka Ska via groundwater flows, regardless of the project.
For context, 8 lbs per year represents 0.7% of the total watershed loading to Bde Maka Ska, as estimated by a lake response model prepared in 1999.

# 2 Concept-level Design Options for Water Quality Improvement

At the request of MCWD staff, Stantec prepared preliminary concept designs for potential water quality improvement opportunities between Weber Pond and Bde Maka Ska. The purpose of this analysis was to determine the general scale of implementation projects that may be possible in the area. Estimated annual TP load removal and estimated lifecycle costs are shown for each potential project type in Table 6. A range of project scales was considered for each water quality improvement method identified below.
As a significant portion of the TP load is anticipated to be in dissolved form, rather than particulate, the identified opportunities focus on practices that are able to reduce dissolved phosphorus loads.

*Table 6 Preliminary concept-level design options for water quality improvement opportunities*

| BMP Type | Possible Implementation Locations | Estimated Potential Annual TP Load Removal (lb/yr) | | Estimated Lifecycle Cost ($) | | Cost-Benefit ($/lb) | |
|---|---|---|---|---|---|---|---|
| | | *Low-End* | *High-End* | *Low-End* | *High-End* | *Low-End* | *High-End* |
| Pumped Iron Enhanced Sand Filter | • Bde Maka Ska SW Ponds<br>• Weber Park | 9 | 66 | $ 620,000 | $ 2,400,000 | $ 1,200 | $ 5,100 |
| Pumped Cartridge (MTD) Filter | • Bde Maka Ska SW Ponds<br>• Weber Park | 10 | 38 | $ 1,400,000 | $ 2,100,000 | $ 1,900 | $ 10,000 |
| Stormwater Reuse via Irrigation | • Bde Maka Ska SW Ponds<br>• Weber Park<br>• Minikahda Vista Park<br>• Minikahda Golf Course | 7 | 88 | $ 240,000 | $ 1,800,000 | $ 700 | $ 3,200 |
| Alum Dosing Station | • Bde Maka Ska SW Ponds | 40 | 60 | $ 1,200,000 | $ 1,800,000 | $ 1,000 | $ 1,600 |

Major assumptions:

- Load removal calculations are based on input loads identified by modeling completed by the City of Edina
- 20-year project lifecycle
- Annual maintenance is 1% of initial capital investment
- Every 10-years, each option would require maintenance / overhaul that costs 10% of the initial capital investment
- Mobilization is 10% of project initial capital cost
- Does not account for groundwater intersections, variability, or impacts