Feasibility Report for Bassett Creek Park Pond and Winnetka Pond East Dredging Project

Crystal, Minnesota

May 2017

 

Prepared for
Bassett Creek Watershed Management Commission

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Certifications

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Karen Chandler

PE #: 19252

May 25, 2017

Date

1.0 Executive summary

1.1 Background

The Bassett Creek Watershed Management Commission's (BCWMC) current Capital Improvement Program (CIP) (Table 5-3 in the 2015-2025 Bassett Creek Watershed Management Plan) includes project BCP-2 Bassett Creek Park Pond dredging. The BCWMC approved the 5-year (working) CIP at their March 17, 2016 meeting, and at their May 19, 2016 meeting, the BCWMC approved adding the Winnetka Pond dredging project to this feasibility study.

This study examines the feasibility of dredging accumulated sediment from Bassett Creek Park Pond and Winnetka Pond (see Figure 2-1). The project will improve water quality downstream by trapping sediment in the ponds, thus minimizing sediment passing downstream to Bassett Creek. The project will also provide other benefits. Based on the CIP (and if ordered), the project will be implemented in 2018. Funding for the project will be through an ad valorem tax levied by Hennepin County on behalf of the BCWMC.

1.2 Site conditions

Both ponds are located in the City of Crystal along the North Branch of Bassett Creek and are Minnesota Department of Natural Resources (MDNR) public waters—Bassett Creek Park Pond is MDNR #27064600P and Winnetka Pond is MDNR #27062900P. Bassett Creek Park Pond is located west of Highway 100 and north of 29th Avenue North (see Figure 2-2). Winnetka Pond is located east of Winnetka Avenue and north of 36th Avenue North (see Figure 2-3).

Bassett Creek Park Pond is located in Bassett Creek Park, which consists of open grassy fields used for sports and recreation, wooded uplands, and various wetland communities. Bassett Creek Park is surrounded by medium density residential area. Winnetka Pond is located south of the Winnetka Village Apartments and is partially surrounded by a narrow buffer of hardwood trees, and grasses with manicured lawn further upslope. Areas surrounding Winnetka Pond consist of commercial and industrial land with medium density residential land located further beyond.

Bassett Creek Park Pond and Winnetka Pond were field-delineated in October 2016 to identify the wetland extent of each pond. Wetland plant communities within each delineated pond were also identified. The delineation report is included as Appendix C. Wetlands delineated at Bassett Creek Park Pond totaled approximately 11.3 acres and were made up of five wetland communities: Shallow Open Water, Type 5; Shrub Swamp, Type 6; Shallow Marsh, Type 3; Floodplain Forest, Type 1L; and Deep Marsh, Type 4. Wetlands delineated at Winnetka Pond East totaled approximately 3.5 acres and were made up of two wetland communities: Shallow Open Water, Type 5 and Floodplain Forest, Type 1L.

1.3 Recommended project alternatives

Multiple alternatives were evaluated for removing sediment, improving water quality, and improving habitat along the North Branch of Bassett Creek within the project area. The measures considered for potential implementation include the following:

- Removing accumulated sediment to restore water quality treatment capability
- Removing native material to deepen the permanent pool of the ponds to provide additional water quality treatment or fish habitat
- Installing a native vegetative buffer to improve wildlife habitat and provide water quality treatment
- Installing a sediment forebay to isolate sediment deposition and improve ease of maintenance
- Managing goose populations

The recommended alternatives are discussed in Section 8.

1.4 Project impacts and estimated costs

Potential impacts from the dredging project are discussed in Section 6.0 and include permit requirements (e.g., Minnesota Department of Natural Resources public waters work permit), temporary impacts to wetlands, temporary trail closures and park impacts (at Bassett Creek Park), tree loss, and impacts to bat habitat. Of these, the most significant consideration for the project is the need to manage trail usage to maintain pedestrian safety and park use at Bassett Creek Park during the project. Continued coordination with the Crystal Parks and Recreation Department will be required during final design of the Bassett Creek Park Pond project to address this issue.

The proposed project will result in increased permanent pool volume and sediment storage volume in both ponds and, therefore, reduced sediment and phosphorus loading to the North Branch of Bassett Creek and all downstream water bodies, including the Mississippi River. Estimates of existing pollutant loading are presented in Section 6.0. P8 model results estimate the total reduction in pollutant loading as a result of deepening Bassett Creek Park Pond to 10 feet (alternative 2) would be 1,792 pounds per year of total suspended sediment and 7 pounds per year of total phosphorus. For deepening Winnetka Pond East to 6.0 feet (alternative 3), the model estimates the total reduction in pollutant loading would be 1,823 pounds per year of total suspended sediment and 7.1 to 51.7 pounds per year of total phosphorus (total phosphorus load reductions based on P8 model results and professional judgment, respectively). If both projects are implemented, the estimated treatment effectiveness of Bassett Creek Park Pond is reduced to 1,217 pounds per year of total suspended sediment and 4.7 pounds per year of total phosphorus.

The proposed native vegetated buffer would filter pollutants such as phosphorus, sediment, and bacteria from stormwater runoff. Although a native buffer would provide these water quality benefits, the amount of the load reductions cannot be quantified without more study. The buffer would also provide habitat for wildlife, provide food for pollinators, and deter geese.

The proposed goose management could help to reduce the bacteria (and phosphorus) loading to the North Branch of Bassett Creek. Although goose management measures could provide these water quality benefits, the amount of the load reductions cannot be quantified without more study.

The feasibility-level opinion of cost for implementing the 2018 Bassett Creek Park Pond alternative 2 (deepening to 10 feet) project, along with add-on 1 and add-on 2 (construction of a forebay and native vegetation buffer) is $1,818,000. This cost includes an estimated $1,137,000 in construction costs, $342,000 in construction contingency, and $342,000 in design, permitting, and construction observation costs (all costs rounded to the nearest $1,000). The costs result in a 30-year annualized cost of approximately $13,160 per pound of phosphorus reduction and approximately $51 per pound of TSS reduction.

The feasibility-level opinion of cost for implementing the Winnetka Pond East alternative 3 (deepening to 6.0 feet) project, along with add-on 1 and add-on 2 (construction of a native buffer and goose management) is $913,000. This cost includes an estimated $571,000 in construction costs, $173,000 in construction contingency, and $173,000 in design, permitting, and construction observation costs. The costs result in 30-year annualized costs ranging from approximately $960 to $6,960 per pound of phosphorus reduction (total phosphorus load reductions based on professional judgment and P8 model results, respectively) and approximately $27 per pound of TSS reduction.

The cost per pound of phosphorus removed for these dredging projects using the current P8 model analysis is high compared to other BCWMC CIP projects—for example, the previous highest cost per pound of phosphorus removed for a BCWMC CIP project was $5,900 for the Northwood Lake Improvement Project (project NL-1). The high cost per pound of phosphorus removed for this project is likely due to several factors. The P8 model was developed at the watershed scale; this means that many of the watersheds are relatively large and the model may not be accurately reflecting the time it takes runoff to reach the ponds. This could be causing the model to over-predict flows and thus under-predict pollutant removals because the model is flushing more pollutants downstream and not allowing them to settle in the ponds. The P8 model does not account for pollutant load from the creek upstream of the ponds. For example, there are sections of the North Branch of Bassett Creek, upstream of Bassett Creek Park Pond, which have eroded banks that are contributing sediment and pollutants to the creek. This additional pollutant load is not included in the P8 model and the ponds are likely removing some of this additional load, providing a pollutant removal benefit that is not reflected in the modeling. This creek bank erosion could contribute an additional phosphorus load estimated between 3 and 92 pounds per year to Bassett Creek upstream of Bassett Creek Park Pond depending on the severity of the erosion. This additional potential phosphorus load represents 15 percent—450 percent of the P8 modeled phosphorus inflow to Bassett Creek Park Pond.

The P8 model also does not account for resuspension of the sediment accumulated in the ponds. Once sediment (and the associated pollutants) have settled in the pond, the P8 model assumes they remain trapped. Calculations to determine the velocity of water through the ponds indicate that in Winnetka Pond East under current conditions, the velocities are high enough to resuspend sediment particles up to medium silt size and carry them downstream. This means that the model is over-estimating the current performance of the pond. Based on the scour/resuspension analysis, the BCWMC Engineer's professional judgment is that Winnetka Pond East under current conditions is removing only 20% of the total phosphorus predicted by the P8 model. Under current conditions, the P8 model estimates that the pond removes 55.7 pounds of total phosphorus per year. Applying the 20% effectiveness to the 55.7 pounds of phosphorus removal per year results in an estimate of 11.1 pounds of phosphorus removal per year under current conditions at Winnetka Pond East. The P8 model estimates for the Winnetka Pond East alternatives reasonably predict the total phosphorus removal provided by the pond. Therefore, another way to analyze the annual pollutant removal costs for total phosphorus is to compare the predicted phosphorus removals for the alternatives to the professional judgment phosphorus removal under current conditions. This results in lower costs per pound of phosphorus removal.

Constructing the Winnetka Pond East project to remove the accumulated sediment and deepen the pond would reduce the velocities through the pond, reducing the potential for resuspension and increasing the actual pollutant removal efficiency of the ponds.

For Bassett Creek Park Pond under current conditions, the calculations showed that the pond was not experiencing any scour or resuspension. However, approximately half of the pond surface area is located in an ineffective flow or shallow backwater area (north/northeast side of pond). As a result, the BCWMC Engineer's professional judgment is that the model may be overestimating by 50% the TP removal provided by the pond. Under current conditions, the P8 model estimates that Bassett Creek Park Pond removes 151.3 pounds of total phosphorus per year. Applying the 50% effectiveness to the 151.3 pounds of phosphorus removal per year results in an estimate of 75.7 pounds of phosphorus removal per year under current conditions. As none of the proposed alternatives address the ineffective flow area in the north part of the pond, the predicted phosphorus removals for the Bassett Creek Park Pond alternatives would also be only 50% effective. The proposed conditions total phosphorus removals predicted by the P8 ranged from 155.5-158.3 pounds per year; applying the 50% effectiveness results in 77.8-79.2 pounds per year of phosphorus removal. This results in higher costs per pound of phosphorus removal.

In addition to providing pollutant removal benefits, removing accumulated sediment from Bassett Creek Park Pond and Winnetka Pond East is necessary to continue to provide flood storage in these areas along the trunk line of the North Branch of Bassett Creek. An area near the center of Winnetka Pond East just downstream of two inlets to the pond is fairly shallow due to sediment buildup. As additional sediment accumulates, the sediment will form an island near the center of the pond, thus reducing the flood storage available in the area. This could lead to additional flooding on other areas that would normally not be inundated. The sediment islands may deflect flow creating erosion along the banks and may also cause flow restrictions, resulting in additional flooding during smaller storm events. A similar situation will eventually occur at Bassett Creek Park Pond, though the island formation is not as dramatic at this time. Eventually some sediment will need to be removed to maintain flood storage capacity, regardless of the water quality benefit provided. Furthermore, when the flood control project at Bassett Creek Park Pond was designed and constructed, it assumed additional excavation volume to allow for sediment storage that would not interfere with providing the designed flood control benefits. Maintenance removal of the accumulated sediment is necessary to maintain functionality of the flood control project. The methodology and assumptions used for the cost estimates are discussed in Section 7.0, and the cost estimates for all alternatives considered for this study are provided in Table 7-1 and Table 7-2.

1.5 Recommendations

Because the modeling results do not show the expected pollutant removals from completing the projects, the BCWMC Engineer recommends completing first the Winnetka Pond East alternative 3 project (deepening to 6.0 feet), along with add-on 1 (native buffer) and add-on 2 (goose management), completing further investigation on Bassett Creek Park Pond, and ordering a project at this location in the future if it is determined to be feasible. This additional analysis on Bassett Creek Park Pond would allow time for the City of Crystal to complete its parks planning process at this location, which may result in identifying other feasible options for improvements at Bassett Creek Park Pond. The P8 model could be calibrated using City of Plymouth/Three Rivers Park District information and using BCWMC information that will be collected as part of a proposed 2018 monitoring program on the North Branch of Bassett Creek. After calibrating the model, the pollutant removal efficiencies for this project could be updated to more accurately predict the pollutant removals provided by the proposed project.

Removing accumulated sediment and deepening the permanent pool to 6.0 feet at Winnetka Pond East (alternative 3), creating a native buffer (add-on 1) and implementing goose management methods (add-on 2), will provide water quality improvement by (1) providing additional permanent pool storage for increased sedimentation, (2) minimizing downstream transport of sediment, (3) filtering pollutants such as phosphorus, sediment, and bacteria from stormwater runoff, and (4) reducing phosphorus and bacteria loads from geese. We recommend that the opinions of cost identified in this study be used to develop a levy request for the selected project and that the Winnetka Pond East project proceeds to the design and construction phase.

2.0 Background and objectives

The BCWMC's 2015-2025 Watershed Management Plan (Plan, Reference (1)) addresses the need to remove accumulated sediment from ponds on the trunk system of Bassett Creek to provide increased storage and decreased downstream sediment transport. This project is consistent with the goals (Section 4.1) and policies (Sections 4.2.1 and 4.2.10) in the Plan. The Plan's 10-year CIP (Table 5 3 in the Plan) includes project BCP-2 Bassett Creek Park Pond dredging. The BCWMC approved the 5-year (working) CIP at their March 17, 2016 meeting, which included implementation of the Bassett Creek Park Pond dredging project in 2018. Although not currently listed as a separate project in the BCWMC CIP, the BCWMC approved adding the Winnetka Pond dredging project to this feasibility study at their May 19, 2016 meeting.

This feasibility study follows the protocols developed by the U.S. Army Corps of Engineers (USACE) and the BCWMC for projects within the BCWMC Resource Management Plan (RMP). Although these pond dredging projects were not included in the RMP, the USACE has allowed the RMP protocols to be applied to other projects not specifically included in the RMP.

2.1 Project area description

The Bassett Creek Park Pond project area (Figure 2-2) is located in Bassett Creek Park between the north-south streets of Brunswick Avenue and Highway 100 and north of 29th Avenue North. The North Branch of Bassett Creek enters the pond at the northwest corner of the pond. The outlet structure from the pond is located at the southeast corner of the pond and connects to the Main Stem of Bassett Creek, which flows to the east under Highway 100. There is a heavily used pedestrian trail surrounding the pond and the park includes other amenities such as volleyball courts, baseball fields, a dog park, and a playground. Bassett Creek Park Pond is approximately 11 acres in area.

The Winnetka Pond project area (Figure 2-3) is located in the northeast quadrant of the intersection of Winnetka Avenue and 36th Avenue North. The pond is south of the Winnetka Village Apartments. The pond is bisected by the driveway to the apartment complex forming two ponds considered as Winnetka Pond West and Winnetka Pond East. The North Branch of Bassett Creek flows into the west side of Winnetka Pond West, through a culvert under the driveway to the apartment complex, into Winnetka Pond East, and through an outlet structure at the southeast corner of Winnetka Pond East where it continues downstream to Bassett Creek Park Pond. The area surrounding Winnetka Pond includes mowed turf grass and some trees. Both Winnetka Pond West and East were considered for the bathymetric survey as part of this feasibility study; however, the results of the survey and comparison to drawings from the construction of the ponds indicated that very little sediment had accumulated in Winnetka Pond West. Therefore, further investigation focused only on Winnetka Pond East. Winnetka Pond East is approximately 3 acres in area.

The BCWMC Engineer visited both project sites in August 2016 and identified areas of greatest sediment deposition, surrounding site characteristics, and site access options.

2.2 Goals and objectives

The goals and objectives of the feasibility study are to:

1. Review the feasibility of removing accumulated sediment at Bassett Creek Park Pond and Winnetka Pond and identify multiple alternatives for each site.
2. Develop conceptual designs.
3. Provide an opinion of cost for design and construction of the alternatives.
4. Identify potential project impacts and permitting requirements.

The goals and objectives of the dredging projects are to:

1. Reduce sediment loading to the North Branch of Bassett Creek and improve downstream water quality by providing additional permanent pool storage in the ponds.
2. Preserve natural beauty along the North Branch of Bassett Creek and contribute to natural habitat quality and species diversification by improving the native vegetated buffer around Bassett Creek Park Pond.
3. Maintain Bassett Creek Park Pond in accordance with the Flood Control Project Operations and Maintenance Manual (U.S. Army Corps of Engineers).
4. Maintain the flood control functions of Winnetka Pond.
5. Improve fish habitat by deepening a portion of Bassett Creek Park Pond.

2.3 Scope

Bassett Creek Park Pond is a BCWMC-identified storage area along the North Branch of Bassett Creek. Due to the significant amount of sediment that has accumulated in the pond, the BCWMC included in its CIP a project to remove the accumulated sediment (CIP project BCP-2). As originally described in the CIP, the project was to cover the portion of the pond that was part of the 1995 BCWMC Flood Control Project. City staff recommended expanding the scope of the feasibility study to include all of Bassett Creek Park Pond. Winnetka Pond is also on the North Branch of Bassett Creek, so City staff recommended adding this location to the feasibility study to evaluate the need to perform similar work. The BCWMC approved the City's recommendations.

The BCWMC is considering including the Bassett Creek Park Pond and Winnetka Pond projects in its CIP, based on the following "gatekeeper" policy from the BCWMC Plan:

110. The BCWMC will consider including projects in the CIP that meet one or more of the following "gatekeeper" criteria.

    - Project is part of the BCWMC trunk system (see Section 2.8.1, Figure 2-14 and Figure 2-15)
    - Project improves or protects water quality in a priority waterbody

- Project addresses an approved TMDL or watershed restoration and protection strategy (WRAPS)
- Project addresses flooding concern

The BCWMC will use the following criteria, in addition to those listed above, to aid in the prioritization of projects:

- Project protects or restores previous Commission investments in infrastructure
- Project addresses intercommunity drainage issues
- Project addresses erosion and sedimentation issues
- Project will address multiple Commission goals (e.g., water quality, runoff volume, aesthetics, wildlife habitat, recreation, etc.)
- Subwatershed draining to project includes more than one community
- Addresses significant infrastructure or property damage concerns

The BCWMC will place a higher priority on projects that incorporate multiple benefits, and will seek opportunities to incorporate multiple benefits into BCWMC projects, as opportunities allow.

Both projects meet one or more of the gatekeeper criteria—both projects are part of the BCWMC trunk system, and they would improve water quality in the North Branch of Bassett Creek. Because both projects are on the trunk system, this differentiates these projects from other pond maintenance projects. As discussed later in this report, the projects would provide multiple benefits.

2.4 Considerations

Key considerations for project alternatives included:

1. Maximizing the amount of permanent pool storage and water quality benefit.
2. Minimizing the permitting required to construct the project.
3. Maintaining or improving the functionality of Bassett Creek Park Pond and Winnetka Pond, including water quality, flood control, and habitat functions.
4. Minimizing wetland impacts.
5. Minimizing tree loss.

The considerations listed above played a key role in determining final recommendations and will continue to play a key role through final design.

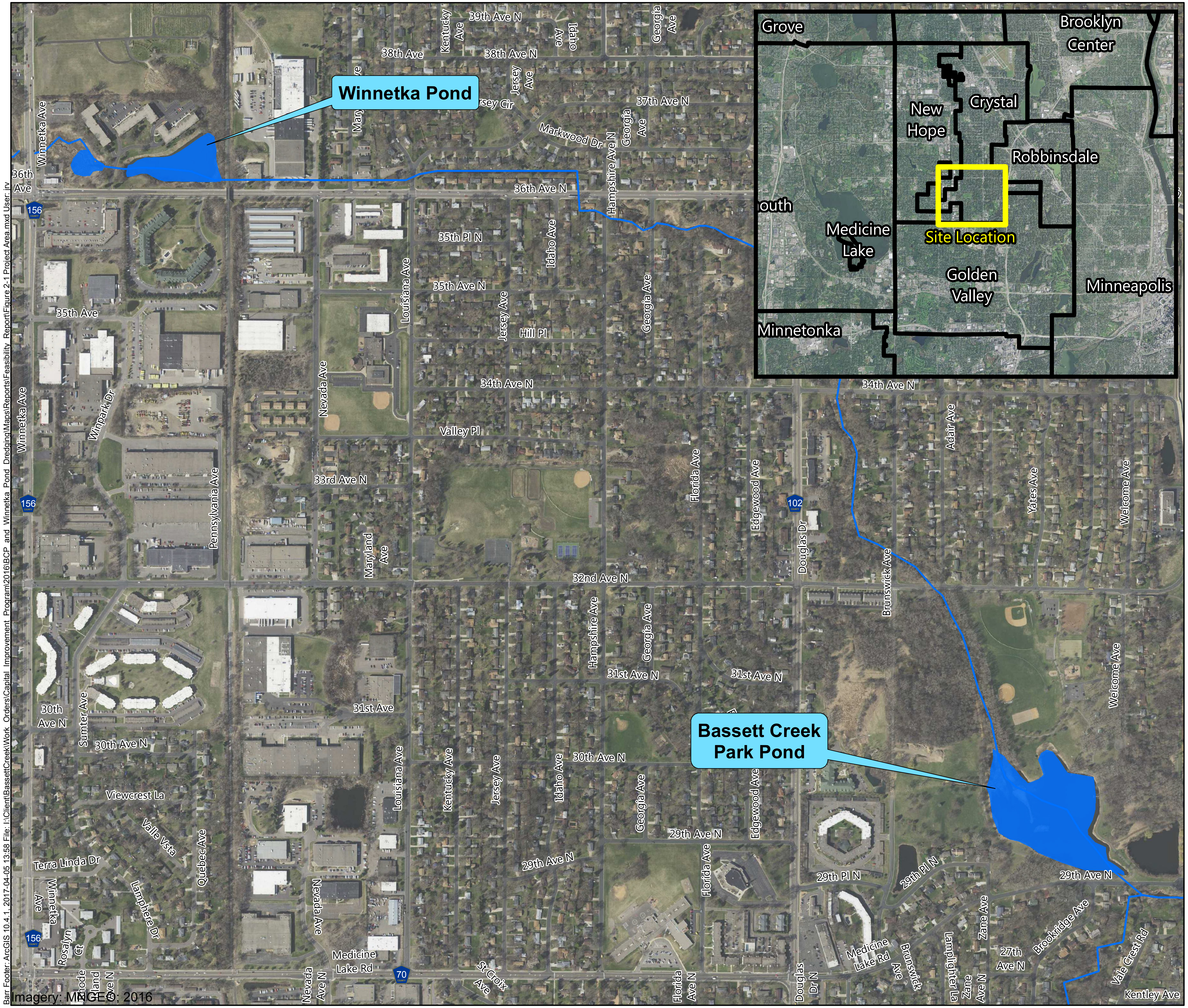
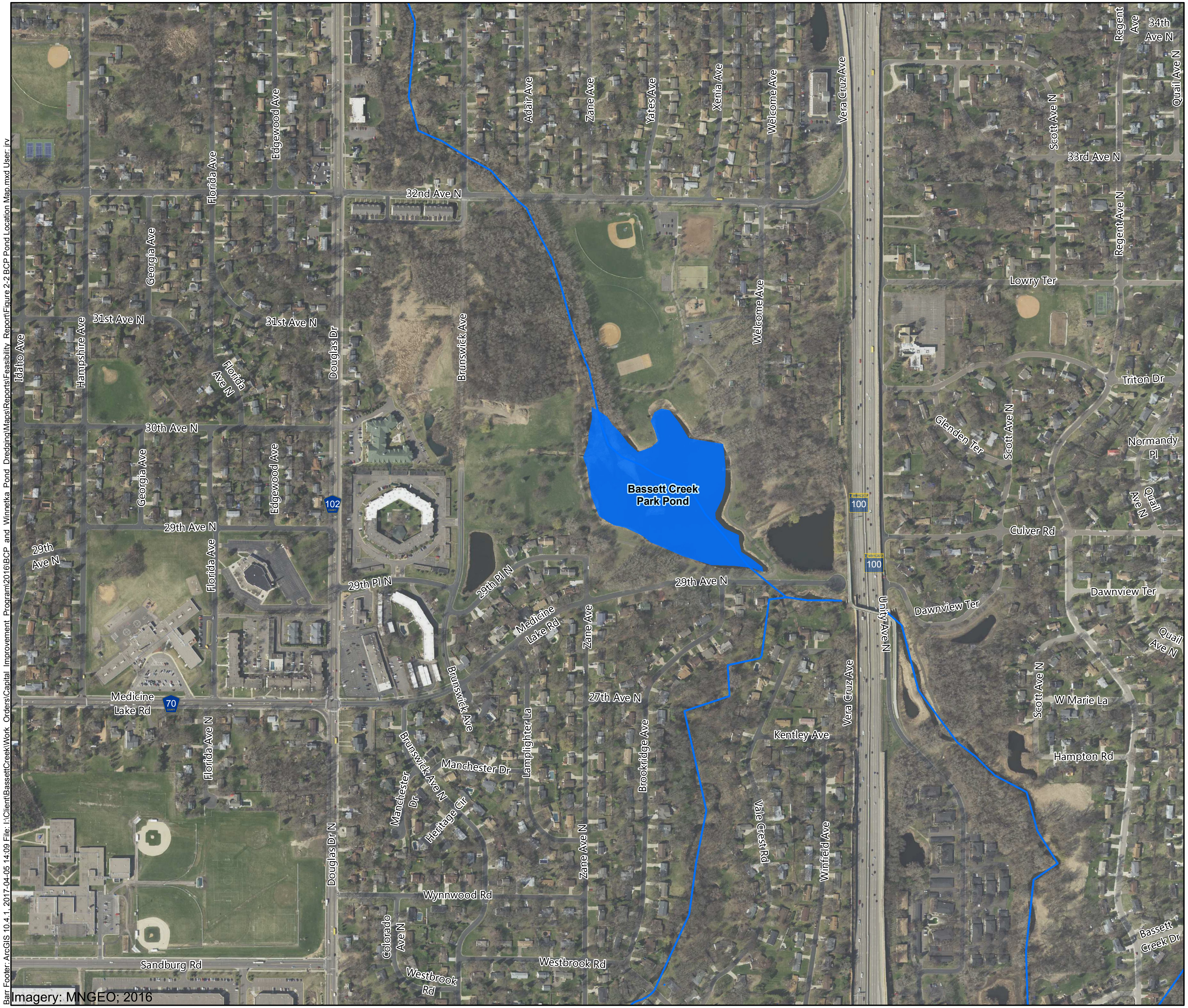


Figure 2-1

LOCATION MAP
Bassett Creek Park Pond &
Winnetka Pond Dredging
Bassett Creek Watershed
Management Commission



Legend

Project Area

Bassett Creek

Feet: 250 0 250 500

Meters: 80 0 80 160

Figure 2-2

LOCATION MAP
Bassett Creek Park Pond
Bassett Creek Watershed
Management Commission

Legend

Project Area

Bassett Creek

N

Feet

150 0 150 300

Meters

50 0 50 100

Figure 2-3

LOCATION MAP
Winnetka Pond
Bassett Creek Watershed
Management Commission

3.0 Site conditions

3.1 North Branch Bassett Creek Watershed

The watershed area tributary to Winnetka Pond East along the North Branch of Bassett Creek (downstream of Northwood Lake) is approximately 243 acres and drains portions of the cities of Crystal and New Hope. The watershed area tributary to Bassett Creek Park Pond along the North Branch of Bassett Creek (downstream of Winnetka Pond East) is approximately 847 acres and drains portions of the cities of Crystal and New Hope. The watershed is nearly fully developed; existing land use includes single-family residential, commercial/industrial, highway, parks and undeveloped land, multi-family residential, and water surface. Exact percentages for land-use type in this subwatershed have not been determined.

3.2 Proposed project location characteristics

The Bassett Creek Park Pond project area (Figure 2-2) is located in Bassett Creek Park, and the Winnetka Pond project area (Figure 2-3) is located in the northeast quadrant of the intersection of Winnetka Avenue and 36th Avenue North.

3.2.1 Available hydrologic and hydraulic models and water quality models

Hydrologic and hydraulic information and water quality information is available for Bassett Creek Park Pond and Winnetka Pond in the form of an XP-SWMM hydrologic and hydraulic model and a P8 water quality model. The BCWMC completed the XP-SWMM model in 2016 for Bassett Creek and its contributing watersheds. The BCWMC developed the P8 model in 2012 for Bassett Creek and its contributing watersheds, and updates the model annually.

Hydrologic and hydraulic information was not reviewed or analyzed as part of this feasibility study because no changes are proposed that would impact the information included in the XP-SWMM model (i.e., work is only occurring below the normal water level of the ponds). However, the XP-SWMM model information was used to determine the watershed areas to the ponds for consideration in conceptual design of sediment forebays.

This study included updating the P8 model with current site conditions for Bassett Creek Park Pond and Winnetka Pond, and used the P8 water quality model to estimate the water quality improvement expected from each proposed alternative at each pond location.

Final design efforts should include additional refinements to the P8 water quality modeling as the design components are finalized and incorporation of the constructed improvements into the P8 model after completion of the project.

3.2.2 Site access

Because the project locations are on public property (Bassett Creek Park) or within City of Crystal easements, construction access will be fairly straightforward. Relatively few obstacles or infrastructure elements block access to the proposed work areas. Potential site access locations and staging areas are presented in the figures in Section 5.0.

3.2.3 Sediment sampling

The purpose of sediment sampling and characterization is to determine whether the sediment in the pond, when excavated or dredged, could potentially be reused as "Unregulated Fill" (e.g., serve as a beneficial reuse), or if other management methods such as landfill disposal would be required. The use and/or disposal of excavated or dredged material is determined based on concentrations of potential contaminants in the sediments, including metals and polycyclic aromatic hydrocarbons (PAHs). Excavated sediment and soils that do not exhibit field screening impacts and do not exceed the Minnesota Pollution Control Agency's (MPCA) Soil Reference Values (SRV) or applicable Screening Soil Leaching Values (SLVs) may be considered Unregulated Fill that is suitable for off-site reuse according to the MPCA document *Best Management Practices for the Off-Site Reuse of Unregulated Fill*. Sediment or soil excavated from stormwater ponds with constituents that exceed SRVs or applicable Screening SLVs are often disposed at a solid waste landfill, but other options involving specific land uses (e.g., non-residential) could be explored if there are suitable disposal locations elsewhere on city-owned property.

Sediment sampling was conducted in accordance with the MPCA's *Managing Stormwater Sediment, Best Management Practice Guidance June 2015* (Reference (2)). This document provides technical guidance for characterizing sediment in stormwater ponds, including the number of samples that should be collected and potential contaminants to be analyzed.

The MPCA guidance for stormwater pond sediment management lists the baseline parameters that should be analyzed to determine whether excavated sediment is contaminated or could be considered Unregulated Fill. The baseline parameters listed in the MPCA guidance are arsenic, copper, and PAHs. PAHs are organic compounds that are formed by the incomplete combustion of organic materials, such as wood, oil, and coal. They are also naturally occurring in crude oil and coal.

The analyzed PAHs are grouped into two categories: cancer-causing and non-cancer-causing. To assess the contamination level of the cancer-causing PAHs in stormwater pond sediment, the MPCA requires the calculation of a "BaP equivalents value." The BaP equivalents value is a single value representing the combined potency of 17 individual cancer-causing PAH compounds with BaP (benzo[a]pyrene) acting as the reference compound.

3.2.3.1 Bassett Creek Park Pond

The BCWMC Engineer collected four sediment samples; each sample was the composite of five coring locations, consistent with MPCA guidance recommendations for ponds 4 acres in size or larger. A plastic coring tube was used to collect sediment cores where it was possible to push the coring tube manually; a stainless steel auger was used where sediment was too firm to manually push the coring tube. Collected sediment was then composited in a clean plastic 5-gallon bucket. A GPS unit was used to record the locations of each sample, which are shown in Figure 1 in Appendix A. Sediment sample BCPP-1 is the composite of coring locations BCPP-1A, BCPP-1A, BCPP-1C, BCPP-1D, and BCPP-1E; sediment sample BCPP-2 is the composite of coring locations BCPP-2A, BCPP-2B, etc. Samples were sent to Pace Analytical laboratory in Minneapolis for analyses of potential contaminants. In addition, a composite of all sampling locations was created (BCPP 1-4 Comp) for waste characterization sampling in the event that material is disposed in a landfill (landfills often require Toxicity Characteristic Leaching Procedure, or TCLP, testing for metals).

Results of laboratory analytical testing on the sediment samples were compared to the MPCA's current SRVs and Screening SLVs. Results of field screening for staining, sheen, or odor, were negative for all four sediment samples. Therefore, no additional analytical testing was conducted beyond the baseline parameter list for stormwater pond sediment characterization.

One of the four sediment samples collected in the pond had a BaP equivalents value exceeding the Screening SLV. Sediment sample BCPP-1 (composite of sampling locations BCPP-1A through BCPP-1E), located in the northwest side of the pond, just downstream of the creek entrance, had a BaP equivalents value of 1.7 mg/kg, exceeding the Screening SLV of 1.4 mg/kg. Results in the other three sediment samples collected from Bassett Creek Park Pond were below Minnesota's SRVs and Screening SLV. The sediment sampling results indicate that the sediment to be removed from the northwest portion of the Bassett Creek Park Pond may need to be taken to a landfill for disposal, and that the remaining sediment to be removed from the pond is suitable for off-site reuse under MPCA's Unregulated Fill Best Practice.

Screening SLVs represent conservative criteria. The BCWMC could evaluate other potential re-use sites for the sediment from the northwest portion of the pond, taking into account site-specific factors for the receiving site (e.g., property ownership, depth to groundwater, soil type, etc.). If successful, additional evaluation might reduce the transportation and disposal costs associated with landfilling the sediment.

The MPCA has proposed changes to SRVs that could impact the interpretations in this analysis. The MPCA had originally intended that the SRV changes would be implemented later this year (2017), but recent conversations with MCPA staff indicated that the timing of these potential changes may not occur in 2017. The proposed changes to the SRVs would result in the material at sample BCPP-1 exceeding the proposed SRV of 1.0 mg/kg. The status of MPCA's SRV revisions should be reassessed prior to proceeding with the sediment excavation and management.

A full summary of the sediment sampling process and results at Bassett Creek Park Pond, including figures and tables, is in Appendix A.

3.2.3.2 Winnetka Pond East

The BCWMC Engineer collected three sediment samples, consistent with MPCA guidance recommendations for ponds 2 to 3 acres in size. Sampling locations were recorded with a handheld GPS unit; locations are shown on Figure 1 in Appendix B. Aluminum coring tubes were used to collect sediment cores. The entire depth of the sediment core was homogenized in a clean stainless steel bowl before transferring portions to sample containers provided by the laboratory. Samples were sent to Pace Analytical laboratory in Minneapolis for analyses of potential contaminants.

Results of laboratory analytical testing on the sediment samples were compared to the MPCA's current SRVs and Screening SLVs. Results of field screening for staining, sheen, or odor, were negative for all three sediment samples; therefore, no additional analytical testing was conducted beyond the baseline parameter list for stormwater pond sediment characterization. Results of arsenic, copper, and PAHs in the sediment of Winnetka Pond East were below Minnesota's SRVs and Screening SLVs for all three samples collected from the pond, with the exception of the arsenic Screening SLV. Sample WPE-01 had an arsenic concentration of 6.3 mg/kg, which is slightly above the SLV of 5.8 mg/kg. However, MPCA guidance for Screening SLVs states that SLVs for metals should only be applied if there has been a significant release of metals documented. Since no significant release of metals has been documented in the pond's watershed, the observed arsenic concentration of 6.3 mg/kg in sample WPE-01 should not preclude the reuse of the material as Unregulated Fill. Overall, the sediment sampling results indicate that the sediment to be removed from Winnetka Pond East is suitable for off-site reuse under MPCA's Unregulated Fill Best Practice.

Results of sediment testing were also compared to the MPCA's proposed changes to SRVs. Results of arsenic, copper, and PAHs were below the proposed changes to SRVs for all three of the sediment samples collected from Winnetka Pond East. The MPCA had originally intended that the SRV changes would be implemented later this year (2017), but recent conversations with MPCA staff indicated that the timing of these potential changes may not occur in 2017. The status of MPCA's SRV revisions should be reassessed prior to proceeding with the sediment excavation and management.

A full summary of the sediment sampling process and results at Winnetka Pond East, including figures and tables, is in Appendix B.

3.2.4 Wetland delineation

Bassett Creek Park Pond and Winnetka Pond East were field delineated to identify the wetland extent of each pond. Wetland plant communities within each delineated pond were also identified.

The Wetland Delineation Report was prepared in accordance with the U.S. Army Corps of Engineers 1987 Wetland Delineation Manual ("1987 Manual," USACE, 1987), the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (USACE, 2010) and the requirements of the Minnesota Wetland Conservation Act (WCA) of 1991. The BCWMC Engineer delineated the wetland boundaries and determined wetland types within the evaluation areas on October 11, 2016.

A full summary of the wetland delineation, including figures and field data sheets, is in Appendix C.

3.2.4.1 Bassett Creek Park Pond

The Bassett Creek Park Pond project site generally has steep topography in areas leading into the pond along the delineated edges. Topography within the basin generally has moderate undulations in areas that are not open water. Adjacent upland areas are generally flat or moderately undulating throughout most of the park area with the exception of some steep hilly areas to the west.

Bassett Creek Park Pond is an 11.3-acre wetland complex made up of five wetland communities: Shallow Open Water (Type 5), Shrub Swamp (Type 6), Shallow Marsh (Type 3), Floodplain Forest (Type 1L), and Deep Marsh (Type 4).

A Minnesota Rapid Assessment Method (MNRAM) analysis was not performed as part of this feasibility study. However, based on general observations made during the wetland delineation and general knowledge of the site, it is expected that the wetland would be considered a Manage 1 wetland.

Shallow open water community is the dominant wetland type within Bassett Creek Park Pond and totals approximately 9.3 acres. Shallow open water community is mostly located in the central and southern areas of Bassett Creek Park Pond and generally has a steep and abrupt wetland boundary.

Shrub swamp community is located on the northwest side of Bassett Creek Park Pond (0.9 acres), and in the west-central (0.3 acres) and southwest-central (0.1 acres) areas of the pond surrounded by shallow open water community. The total area of shrub swamp community located in Bassett Creek Park Pond is 1.2 acres.

Floodplain forest community is located at the northwest tip of Bassett Creek Park Pond and totals approximately 0.3 acres. There is moderately undulating topography throughout the floodplain forest community but steep and abrupt slopes leading into it from the east side. The North Branch of Bassett Creek extends south through floodplain forest community and then through shrub swamp community toward the shallow open water areas of Bassett Creek Park Pond.

Shallow marsh community fringes portions of Bassett Creek Park Pond on the northeast, and western sides. The two shallow marsh areas are approximately 0.1 acres each totaling 0.2 acres.

Deep marsh community is located within the shrub swamp community on the northwest side of Bassett Creek Park Pond and totals approximately 0.2 acres. This area was likely excavated based on the steep and abrupt slopes leading into it from the shrub swamp community and its regular oval shape.

3.2.4.2 Winnetka Pond East

The Winnetka Pond East project area generally has steep topography in areas leading into the pond along the delineated edges. Floodplain forest wetland has a more gradual topographic transition from upland to wetland and moderate undulations within it. Adjacent upland areas are generally flat in developed areas and hillier in greenspace areas.

Winnetka Pond East is a 3.5-acre wetland complex made up of two wetland communities: Shallow Open Water (Type 5) and Floodplain Forest (Type 1L).Shallow open water community is the dominant wetland type within Winnetka Pond East and totals approximately 3.2 acres. Topography is generally steep and abrupt along the wetland boundary leading into the pond.

Floodplain forest community is located along the eastern fringe of Winnetka Pond East and totals approximately 0.3 acres. Topography is mostly flat throughout the floodplain forest community but is steep and abrupt leading into it from upland areas on the east side.

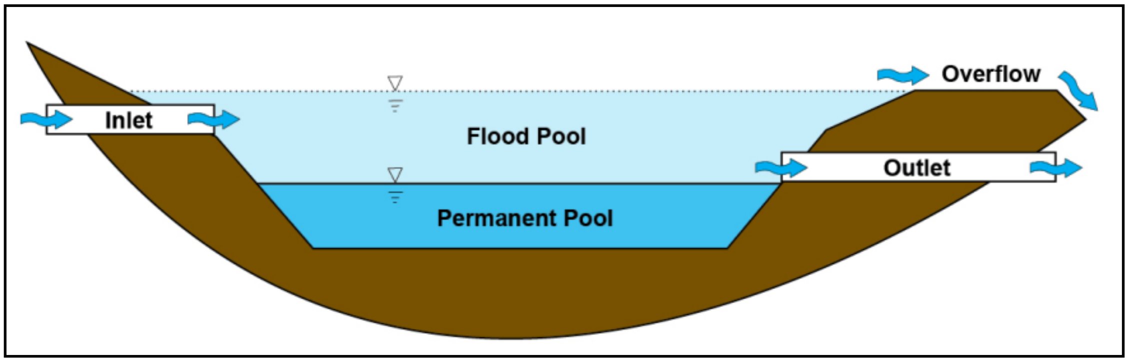
3.2.5 Bathymetric survey results

The BCWMC Engineer performed a field survey of Bassett Creek Park Pond and Winnetka Pond (West and East) in August 2016. The field survey generally included performing a bathymetric survey of the pond, surveying the current water level, collecting data for each pond inlet and outlet, and photographing each pond's inlet and outlet structures and banks. Appendix D shows the results of the bathymetric surveys. The bathymetric survey was performed by physically measuring the depth from the water surface to the pond bottom using a survey rod at various locations within the pond and recording the measurements using a Global Positioning System (GPS) data logger that tracks latitude and longitude. Sonar/radar was not used to characterize the pond bottom because vegetation and floating organic material has been found to, at times, introduce significant error in these types of shallow water surveys. The perimeter of each pond at its waters edge was also recorded using a GPS data logger and the water surface elevation was surveyed. The outlet control elevation was surveyed at each pond. Field technicians also photographed and recorded the type and size of the ponds' inlet(s) and outlet(s). Elevations recorded during the field surveys were referenced to a unique benchmark at each pond. These benchmarks were surveyed using GPS and all field elevations were recorded in mean sea level (NAVD 1988 datum). The horizontal coordinates were referenced to Hennepin County Coordinates, NAD83 (1996) datum.

GPS and elevation data from the stormwater pond surveys were imported into AutoCAD Civil 3D software. The geographically-referenced survey data points, including water surface, pond bottom transects, and outlet location points were used to create elevation contours, which represent the current pond bottom conditions. These contours could then be used to calculate sedimentation volumes by making a comparison to previous survey or design data.

The figure below shows a conceptual profile of a typical stormwater pond. The permanent pool, or dead storage volume, is the volume below the pond's outlet elevation. The flood pool is the volume between the outlet elevation and the flood elevation or overflow point. Using the contours created of each pond in AutoCAD Civil 3D, AutoCAD Civil 3D volume calculation tools, and the outlet elevation data, the permanent pool volume and wetted surface area of each pond were determined.

Typical Stormwater Pond Configuration



3.2.5.1 Bassett Creek Park Pond

The BCWMC Engineer compared the bathymetric survey data from August 2016 to design contours available from the 1995 BCWMC Flood Control Project. CAD data was not available for the 1995 project. A PDF copy of the design information was georeferenced to the location using ArcMap GIS software. The design contours generally reflected the current shape of the pond; however, it appears that there were some modifications made during construction of the project which resulted in a slightly larger permanent pool area in the southeastern area of the pond. Based on the comparison, approximately 13,500 cubic yards of sediment has accumulated in Bassett Creek Park Pond with the largest areas of accumulation near the inlet at the northwest corner of the pond. Little material has accumulated in the northeastern portion of the pond; this is likely due to the inflows following the deeper channel area excavated during the 1995 BCWMC Flood Control Project.

3.2.5.2 Winnetka Pond West

The BCWMC Engineer compared the bathymetric survey data from August 2016 to design contours available from the original construction of the Winnetka Village Apartment Complex in 1968. CAD data was not available for the 1968 project. A PDF copy of the design information was georeferenced to the location using ArcMap GIS software. The design contours generally reflected the current shape of the pond. Based on the comparison, it was evident that little sediment has accumulated in Winnetka Pond West. Winnetka Pond West is heavily vegetated with cattails. Due to the minimal sediment accumulation and the effort necessary to remove the cattails, it would not be cost effective to remove the small volume of sediment from Winnetka Pond West. As a result, no additional site investigation was performed at Winnetka Pond West.

3.2.5.3 Winnetka Pond East

The BCWMC Engineer compared the bathymetric survey data from August 2016 to design contours available from the original construction of the Winnetka Village Apartment Complex in 1968. CAD data was not available for the 1968 project. A PDF copy of the design information was georeferenced to the location using ArcMap GIS software. The design contours generally reflected the current shape of the pond; however, it appears that there were some modifications made during construction of the project which resulted in a slightly smaller permanent pool area in the southwestern area of the pond where an existing hill was not removed during construction. Based on the comparison, approximately 4,100 cubic yards of sediment has accumulated in Winnetka Pond East. There is general sedimentation throughout the pond with larger sediment deltas identified at the northern and southern storm sewer inlets.

4.0 Stakeholder input

4.1 Public stakeholder meeting

A public stakeholder open house was held at the Heathers Manor in Crystal on February 16, 2017, from 5:30 p.m. to 7:30 p.m. Approximately 19 residents attended the open house, where preliminary design concepts were presented to the attendees. The open house was held in conjunction with a City of Crystal parks master planning open house for Bassett Creek Park. The attendees asked questions and provided some of their observations of the ponds. There were no significant concerns raised about the projects. Some attendees did indicate concern about the duration of project construction and that the public trail in Bassett Creek Park would require closure during construction. Some attendees expressed concern about the height of native vegetated buffer plants around Bassett Creek Park Pond and concerns that trees would grow in the buffer, obstructing the view of the pond. Some residents commented on the changes to Winnetka Pond over the years including degradation over time, the increasing shallowness of the pond, loss of trees and riparian plants around the banks, debris (branches, etc.) clogging the pond outlet with each rain event, and the creek downstream of the pond appearing very muddy and turbid with every rain event.

4.2 Technical stakeholder meeting

A technical stakeholder meeting was held at Crystal City Hall on January 17, 2017. Attendees included representatives from the City of Crystal, Bassett Creek Watershed Management Commission, USACE, MDNR, MPCA, and the BCWMC Engineer. The attendees reviewed the design concepts for each of the two locations and provided technical feedback and permitting input. Items discussed included:

1. Review of the project schedule and meeting objectives.
2. Review of the site investigation work completed.
3. Review and discussion of the design concepts.
4. Discussion of permit requirements.
5. Discussion of additional alternatives to consider.

The meeting provided an opportunity to review the two project sites and discuss options, considering both ideal project design and permitting limitations. The USACE, MDNR, and MPCA expressed their preference for including pre-treatment (preferably off-line treatment) that would reduce the frequency and scope of future projects in the ponds. The MDNR and USACE indicated that maintenance activities to restore Bassett Creek Park Pond to the extent of the 1995 Flood Control Project should be considered maintenance of an existing project and would require the least amount of permitting. Although there was no previous permit for the work at Winnetka Pond East (work pre-dates permitting), the USACE may consider the pond a "previously-authorized structure," which would simplify permitting. The MPCA indicated that if the ponds were constructed water bodies, then they would not be considered a regulated feature by the MPCA (i.e., a "water of the state"). Additional specific outcomes of the discussion are incorporated into the appropriate sections below.

4.3 BCWMC stakeholder comments

A draft version of the April 2017 draft report was provided to the BCWMC administrator, Commissioner Mueller, and City of Crystal staff. The draft feasibility study was revised in response to the comments received. Additional review of the technical comments is recommended during final design.

5.0 Potential improvements

This section provides a summary of the alternatives for dredging accumulated sediment and other improvements at Bassett Creek Park Pond (Section 5.1) and Winnetka Pond East (Section 5.2).

Each pond dredging location includes a baseline alternative and a second alternative for additional dredging, along with "add-ons." In determining the final scope of the project, either the baseline alternative or the second alternative would be selected. The add-ons are all independent and any or all of them could be added to the final project scope. Table 5-1 in the BCWMC Plan lists project costs eligible for BCWMC reimbursement and other project costs that will be considered for whole or partial reimbursement on a project-by-project basis. The BCWMC may consider some of the add-ons as "other project costs," which means those add-ons could involve contributions from the city, other stakeholders and/or MDNR to fund the work.

5.1 Analyzed alternatives at Bassett Creek Park Pond

When selecting alternatives for detailed design and construction, the BCWMC and the City of Crystal may select one of the alternatives, and any number of the add-ons, to best meet the overall project budget and goals. Furthermore, detailed design efforts may identify and include additional improvements that are not specifically included in this feasibility study. Figure 5-1 shows the location and a brief summary of each alternative and add-on.

5.1.1 Baseline alternative—remove accumulated sediment

The baseline alternative includes removal of the accumulated sediment in the main channel area of Bassett Creek Park Pond (the portion that was excavated during the 1995 Flood Control Project). This alternative would restore the permanent pool volume and water quality benefits to what was previously in place. This alternative would have the fewest permitting considerations because it would be considered a maintenance activity to restore the pond to an excavation that was already permitted by the MDNR and USACE. The project would also maintain the pond's flood control benefits by providing sediment storage (see discussion in Section 8.0).

5.1.2 Alternative 2—deepen southeast section

Alternative 2 would deepen the southeastern section of the pond to a maximum ten-foot depth. This area was approximately seven feet deep following the construction of the 1995 Flood Control Project. Increasing the depth would provide additional water quality treatment volume; it would also create a deeper section of the pond to promote fish habitat and increase the potential for fish to over-winter in the pond. City of Crystal staff have been in contact with the MDNR about the possibility of a partnership where the MDNR would install a new fishing pier and provide an aerator for the pond, if this deeper section is created. The project would also maintain the pond's flood control benefits by providing sediment storage (see discussion in Section 8.0).

This alternative would have additional permitting requirements because it would require excavating into native material in a MDNR public water wetland, which is also under jurisdiction of the USACE. Because the original depth in this area was seven feet, the additional excavation would not likely change the wetland type in that area (areas are typically not considered wetland if they are deeper than six feet). However, there may still be permitting challenges with this alternative compared to the baseline alternative.

5.1.3 Add-on 1—create sediment forebay in northern section of pond

A method to improve the water quality treatment and reduce on-going maintenance costs is to create a sediment forebay. A sediment forebay is a small pool, separated from the main pond by a barrier such as a berm, where initial settling of heavier particulates can occur. Construction of a sediment forebay would allow the city to perform more frequent, smaller maintenance projects to remove sediment from only the forebay area and would prevent the larger scale sedimentation that has occurred over the past 20 years.

The BCWMC Engineer reviewed the Minnesota Stormwater Manual recommendations for sizing a sediment forebay. These recommendations are based on the watershed area tributary to the pond. Based on the drainage area to Bassett Creek Park Pond downstream of Winnetka Pond, a sediment forebay with a surface area of 0.85 acres with a depth of four to six feet is recommended.

Construction of an off-line sediment forebay is preferred so that maintenance projects do not impact wetlands or the MDNR public water. At this location, the primary inflows to the pond are not storm sewer pipes; it is flow from the North Branch of Bassett Creek. The creek elevation is low compared to the elevation of the surrounding park areas. Significant excavation would be required to construct a four to six foot deep sediment forebay. Due to the location of pedestrian trails surrounding the pond, two potential areas were identified for constructing an off-line sediment forebay: the peninsula at the north side of the pond and the volleyball court area. The peninsula area is not large enough to provide the recommended footprint for the sediment forebay and construction of the forebay would likely result in steep slopes adjacent to the pedestrian trail, posing a safety concern for residents and making future maintenance difficult. The volleyball courts are heavily used and cannot be moved or removed to facilitate construction of a sediment forebay. Due to site grades and site considerations, there are no feasible areas for construction of an off-line sediment forebay.

A sediment forebay within Bassett Creek Park Pond could be achieved by constructing an earthen berm or using rock gabion baskets to create a berm. The top of the berm would be located below the normal water level and would force water to slow and pool in the forebay area before spreading over the berm and into the remainder of the pond. Because the berm would be below the normal water level, it would not be visible above the water surface. This would increase sedimentation in the forebay and would trap more of the sediment in a smaller area that could be accessed relatively easily from the banks of the pond. The main area of the pond has sufficient space to construct an appropriately sized sediment forebay. Construction of the sediment forebay would involve a small increase in depth in the northern portion of the pond, and would require access to be provided for construction. This add-on would involve additional permitting considerations because it is work not previously permitted and would impact flows within the MDNR public water.

Two versions of this add-on are represented in the cost section. The first assumes that construction of the forebay will occur with either removing all accumulated sediment from the pond or with removing accumulated sediment and deepening the southeastern section of the pond. This version includes a small volume of additional excavation to achieve the ideal depth for a forebay and construction of a berm to separate the forebay from the pond. No additional erosion control or restoration is needed with this add-on. The second version assumes that only the forebay will be constructed. This version includes an excavation volume to achieve the ideal depth for a forebay (which includes excavation of accumulated sediment in the proposed forebay area), construction of a berm, erosion control, restoration, and mobilization.

5.1.4 Add-on 2—create native vegetation buffer around pond

Section 4.2.6 of the BCWMC Plan outlines the BCWMC policies related to wetland buffers. The policies include a requirement that cities develop buffer requirements for new or redevelopment projects installing more than 1 acre of new or reconstructed impervious surface. While this project will have relatively little impervious surface impact, it does involve a public water wetland. Therefore, an add-on to the project would be to designate and improve the vegetated buffer around the wetland. The width of the wetland buffer is typically based on the wetland classification, which is determined using a Minnesota Rapid Assessment Method (MNRAM) analysis. A MNRAM analysis was not performed as part of this feasibility study. However, based on general observations made during the wetland delineation and general knowledge of the site, it is expected that the wetland would be considered a Manage 1 wetland. If this were a redevelopment project, a 50-foot wide average, 30-foot wide minimum buffer width would be required. The buffer would be designated around the entire pond and would be improved and managed to promote growth of native plants.

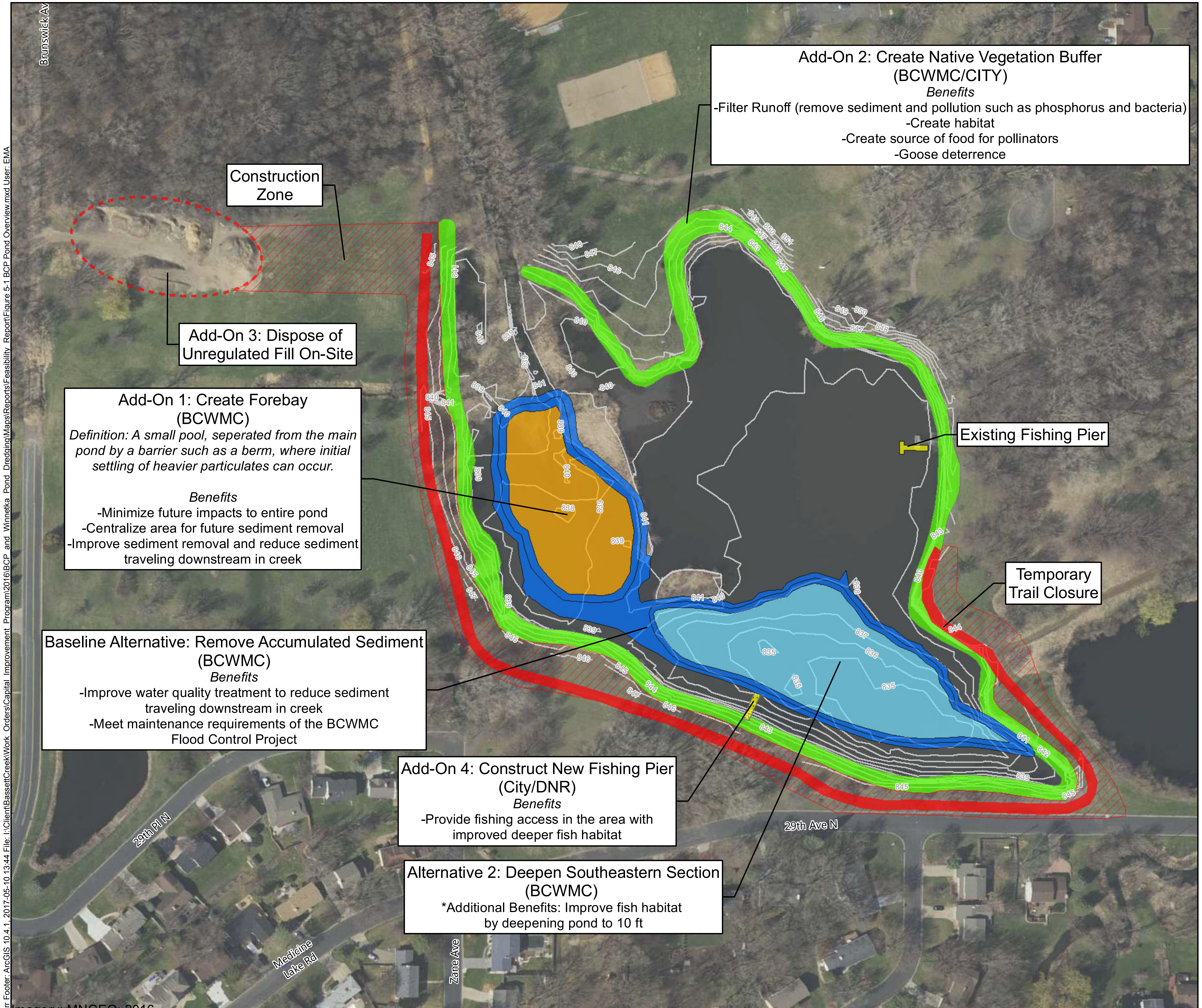
The presence of a native vegetated buffer would filter pollutants such as phosphorus, sediment, and bacteria from stormwater runoff from park areas, preventing these pollutants from reaching the pond, thus improving the water quality of the pond. It would also provide habitat for wildlife, provide food for pollinators, and deter geese.

5.1.5 Add-on 3—dispose of Unregulated Fill material on-site

The City indicated that there may be potential to dispose of some of the Unregulated Fill material (material excavated from the southeastern portion of the pond) on-site. There is an area near Brunswick Avenue where the City is investigating restoring a natural hillside that had been cut to provide a road access which is no longer used. On-site disposal would reduce hauling and disposal costs by approximately $5 to $10/cubic yard of excavated material. The City estimates 1,200 cubic yards of excavated material from Bassett Creek Park Pond or Winnetka Pond could be disposed of at the site. This could reduce construction costs by $6,000 to $12,000. A more detailed analysis will need to be completed during final design to determine the amount of material that could be reused on-site and the dewatering requirements to provide fill for this area.

5.1.6 Add-on 4—construct new fishing pier at deepened southeast section (City/MDNR responsibility)

The City and the MDNR have been in discussions about the MDNR providing a new fishing pier at the southeastern portion of the pond, if this portion of the pond is deepened to ten feet (alternative 2). This would allow increased recreational use of the pond by local residents. Construction of this add-on may need to be funded entirely or in part by the city and/or MDNR, based on Table 5-1 in the BCWMC Plan. If so, construction of the fishing pier would be considered a city improvement associated with the project but not directly tied to the goals of the BCWMC (e.g. trails, pedestrian bridges, signage).



Bassett Creek Survey Contours
Potential Sediment Disposal Location
Construction Zone
Temporary Trail Closure
Potential Forebay (BCWMC)
Base Alternative (BCWMC)
Alternative 2 (BCWMC)
Potential Native Buffer (BCWMC/CITY)
Existing Fishing Pier
Potential New Fishing Pier (City/DNR)

N

Feet
75 0 75 150

Meters
20 0 20 40

Figure 5-1

BASSETT CREEK PARK POND ALTERNATIVES
Feasibility Report for Bassett Creek Park Pond and Winnetka Pond East Dredging
Bassett Creek Watershed Management Commission

5.2 Analyzed alternatives at Winnetka Pond East

When selecting alternatives for detailed design and construction, the BCWMC and the City of Crystal may select one of the alternatives and one or more add-ons to best meet the overall project goals. Furthermore, detailed design efforts may identify and include additional improvements that are not specifically included in this feasibility study. Figure 5-2 shows the location and a brief summary of each alternative. For the baseline alternative, alternative 2, and alternative 3, the option is also available to dispose of some of the Unregulated Fill material at Bassett Creek Park (add-on 3), for a potential cost savings of $6,000-$12,000 (see Section 5.1.5 for more information).

5.2.1 Baseline alternative—remove accumulated sediment

The baseline alternative includes removal of the accumulated sediment in the entire pond. This alternative would restore the permanent pool volume and water quality benefits to what was previously in place. The project would also maintain the pond's flood control benefits by providing sediment storage (see discussion in Section 8.0). MDNR or USACE permits were not issued for Winnetka Pond East (project pre-dates permitting); therefore, any project at this location would require a new permitting effort. However, as noted in Section 4.2, the USACE may consider the pond a "previously-authorized structure," which would simplify permitting. Typically, removal of accumulated sediment is permitted with some documentation, such as the available original construction drawings for the site.

5.2.2 Alternative 2—deepen entire pond to 4.2 feet

Alternative 2 would deepen the entire pond to 4.2 feet. This is an alternative in-between the baseline alternative and alternative 3 (maximum depth alternative). Increasing the depth to 4.2 feet should preserve the wetland characteristics of the current site—water depths greater than 6.6 feet change the wetland type from a shallow-water to a deep-water habitat (per the Minnesota Wetland Conservation Act). Deepening the pond to 4.2 feet would provide additional permanent pool volume and associated water quality improvements for additional sedimentation. The project would also maintain the pond's flood control benefits by providing sediment storage (see discussion in Section 8.0). This alternative would involve additional permitting considerations because it would require excavating into native material in a MDNR public water wetland, which is also under jurisdiction of the USACE.

5.2.3 Alternative 3—deepen entire pond to 6.0 feet

Alternative 3 would deepen the entire pond to 6.0 feet. This is the maximum possible depth that can be achieved while keeping the cost of the construction project and other associated fees within the $1,000,000 currently budgeted in the BCWMC CIP. Increasing the depth to 6.0 feet should also preserve the wetland characteristics of the current site (see Section 5.2.2). Deepening the pond to 6.0 feet would provide further additional permanent pool volume and associated water quality improvements for additional sedimentation. The project would also maintain the pond's flood control benefits by providing sediment storage (see discussion in Section 8.0). As for alternative 2, this alternative would involve additional permitting considerations because it would require excavating into native material in a MDNR public water wetland, which is also under jurisdiction of the USACE.

5.2.4 Add-on 1—create native vegetation buffer around pond

Section 4.2.6 of the BCWMC Plan outlines the BCWMC policies related to wetland buffers. The policies include a requirement that cities develop buffer requirements for new or redevelopment projects installing more than 1 acre of new or reconstructed impervious surface. While this project will have relatively little impervious surface impact, it does involve a public water wetland. Therefore, an add-on to the project would be to designate and improve the vegetated buffer around the wetland. The width of the wetland buffer is typically based on the wetland classification, which is determined using a MNRAM analysis. A MNRAM analysis was not performed as part of this feasibility study. However, based on general observations made during the wetland delineation and general knowledge of the site, it is expected that the wetland would be considered a Manage 1 wetland. If this were a redevelopment project, a 50-foot wide average, 30-foot wide minimum buffer width would be required around the entire pond

For this project, the proposed native vegetation buffer would cover the land adjacent to the pond that is not currently covered by heavy tree/shrub growth, rather than around the entire pond. The buffer would be designated, improved and managed to promote growth of native plants.

The presence of a native vegetated buffer would filter pollutants such as phosphorus, sediment, and bacteria from stormwater runoff from land adjacent to the pond, preventing these pollutants from reaching the pond, thus improving the water quality of the pond. It would also provide habitat for wildlife, provide food for pollinators, and deter geese.

The City of Crystal has limited property rights over the area of the pond—the pond spans two parcels, one owned by the City and one not owned by the City does not (the pond is located at the Winnetka Village Apartments complex, not in a park or larger city parcel). Therefore, the city can maintain the pond but cannot make changes outside the pond footprint. The apartment property owner would need to agree to the creation of the native buffer. Further, either the City (through an agreement with the apartment property owner) or the apartment property owner would need to agree to maintain the buffer (estimated at approximately $1,700/year). City staff are reaching out to the apartment property owner regarding their willingness to maintain the buffer, as buffer maintenance costs could be offset by cost savings due to reduced mowing.

5.2.5 Add-on 2—goose management

The MPCA lists the North Branch of Bassett Creek as impaired for aquatic recreation due to E.coli (bacteria). The MPCA's resulting 2014 Upper Mississippi River Bacteria TMDL Study & Protection Plan (TMDL Study), and 2016 Upper Mississippi River Bacteria TMDL Implementation Plan (TMDL Implementation Plan) includes the North Branch of Bassett Creek. The TMDL Study identified pets are the most likely largest source of E. coli, but wildlife, such as deer, ducks and geese, was also identified as one of the bacteria sources. In addition to bacteria, Canada goose excrement contains high levels of phosphorus.

Managing goose populations could help to reduce the bacteria (and phosphorus) loading to Winnetka Pond/North Branch of Bassett Creek. Goose management measures, beyond the native vegetated buffer in Section 5.2.4, include physical barriers (such as fences), redistribution methods (such as harassing geese with dogs), and population reduction (such as nesting management, trapping and removal, and harvesting/shooting). The population reduction methods would have the largest impact on reducing bacteria (and phosphorus) loadings from geese. Contractors provide nesting management services, such as egg removal, and trapping and removal of geese (round-ups). According to Three Rivers Park District (TRPD) staff, goose roundups cost approximately $1,500 per lake, but there should be more than 40 geese on the lake for the roundup to be cost effective ($50/bird). Crystal staff observed 10 adult geese and 5 goslings on April 25th on Winnetka Pond.

TRPD staff also noted that a DNR permit is required to remove geese; the DNR also requires a written goose management plan. The BCWMC or the City of Crystal would need to develop a goose management plan before geese could be removed.

For $5,000, some amount of goose management could be implemented on Winnetka Pond.

Winnetka Pond Survey Contours
Base Alternative & Alternative 2
Construction Zone
Native Vegetation Buffer 50ft

N

Feet
40 0 40 80

Meters
10 0 10 20

Figure 5-2

WINNETKA POND EAST ALTERNATIVES
Feasibility Report for Bassett Creek Park Pond and Winnetka Pond East Dredging
Bassett Creek Watershed Management Commission

6.0 Project impacts

This section discusses the impacts of the dredging project, including the land ownership and permitting requirements and the estimated pollutant reduction resulting from each alternative.

6.1 Easement acquisition

Nearly all of the proposed work is located on City of Crystal property, or within existing easements. Temporary construction easements are not included in the opinion of cost and are not expected to have significant effect on cost along the City property. Temporary construction easements would potentially be necessary at Winnetka Pond East to facilitate access to the site, construction staging, and material dewatering.

6.2 Permits required for the project

The proposed projects may require 1) a Clean Water Act Section 404 permit from the USACE, or Letter of Permission under a General Permit, and Section 401 certification from the Minnesota Pollution Control Agency (MPCA), 2) compliance with the Minnesota Wetland Conservation Act, 3) a Construction Stormwater General Permit from the MPCA and compliance with the MPCA's guidance for managing dredged materials and 4) a Public Waters Work Permit from the MDNR.

Section 404 Permit and Section 401 Certification

According to Section 404 of the Clean Water Act (CWA), the USACE regulates the placement of fill into wetlands if they are hydrologically connected to a Water of the United States. In addition, the USACE may regulate all proposed wetland alterations if any wetland fill is proposed. The MPCA may be involved in wetland mitigation requirements as part of the CWA Section 401 water quality certification process for the 404 Permit, which means the MPCA's antidegradation rules (MN Rules 7050) could be applied to the projects. However, as noted in Section 4.2, it is likely both ponds would be considered constructed water bodies, not waters of the state, so the rules would not apply.

As discussed in Section 2.0, the BCWMC developed its Resource Management Plan (RMP) with the goal of completing a conceptual-level USACE permitting process for proposed projects. The RMP was submitted to the USACE in April 2009 and revised in July 2009. This feasibility study follows the protocols for projects within the BCWMC RMP.

Minnesota Wetland Conservation Act

The Minnesota Wetland Conservation Act (WCA) regulates the filling and draining of wetlands and excavation within Type 3, 4, and 5 wetlands—and may regulate any other wetland type if fill is proposed. The WCA is administered by local government units (LGU), which include cities, counties, watershed management organizations, soil and water conservation districts, and townships. The City of Crystal is the LGU for both project locations. The Minnesota Board of Water and Soil Resources (BWSR) oversees administration of the WCA statewide.

The WCA may be applicable depending on the alternative and add-ons selected and the associated types of wetland impacts that will be a part of each project. A permit related to wetland impacts will likely be required; however the LGU will have the final determination.

The MDNR will likely determine that each project area qualifies as a public waters wetland and require permitting. Each of the proposed projects will involve excavation in a wetland and access to the site through wetland areas.

Minnesota Pollution Control Agency (MPCA) Permits

Construction of the proposed project may require a National Pollutant Discharge Elimination System/ State Disposal System Construction Stormwater (CSW) General Permit issued by the MPCA. The CSW permit requires the preparation of a stormwater pollution prevention plan that explains how stormwater will be controlled within the project area during construction. This permit is required if the project will disturb 1 acre or more of soil; a permit will likely be needed only if material is disposed of at Bassett Creek Park Pond.

Both projects will need to comply with the MPCA's guidance for managing dredged materials (see Section 3.2.3 for more information).

MDNR Public Waters Work Permit

The MDNR regulates projects constructed below the ordinary high water level of public waters, watercourses, or wetlands, which alter the course, current, or cross section of the water body. Public waters regulated by the MDNR are identified on published public waters inventory maps. Bassett Creek Park Pond and Winnetka Pond East are public waters wetlands, so the proposed work will require a MDNR public waters work permit for each project. Typically, the MDNR public waters work permit includes a condition that "no activity affecting the bed of the protected water may be conducted between April 1 and June 1, to minimize impacts on fish spawning and migration. If work during this time is essential, it shall be done only upon written approval of the Area Fisheries Manager." Without such approval, work on these projects would need to occur outside the fish spawning and migration dates.

6.3 Other project impacts

Temporary Closure of Park Trail

Bassett Creek Park Pond is located within Bassett Creek Park and is surrounded by a trail. The likely construction access for the site would be to use the park trail to access the pond from 29th Avenue North. Because the trail is in close proximity to the pond, it will be necessary to close the trail during construction activities. Using the trail for a construction access will minimize restoration needed as part of the project. During final design, the trail section and access routes will be evaluated to determine if the trail should be reconstructed with a more robust section to support the large truck and equipment traffic necessary to construct the project. The extents of the trail closure will depend on if material disposal occurs on-site. Trail closure signs and barricades will be installed and a pedestrian detour route will be determined during final construction. Every effort will be made to minimize the duration of the trail closure, including considering winter construction to minimize impacts to park users.

Impacts to Bats

Preservation of bat species in Minnesota has recently become an important issue. White Nose Syndrome (WNS) has been attributed to the deaths of millions of bats in recent years across the United States, and all four species that hibernate in Minnesota are susceptible to the disease (Reference (4)). Bats typically hibernate in sheltered areas such as caves, but some bats nest in trees during summer months. Extensive tree removals are to be avoided when bats are not hibernating to avoid inadvertently destroying nests. During final design, there should be additional consultation with the US Fish and Wildlife Service or MDNR regarding the timing of any tree removals and the potential impacts to bats.

Impacts to Bassett Creek Park

Due to the location of Bassett Creek Park Pond within the park, some areas of the park may need to be temporarily closed during construction to facilitate construction staging and/or material dewatering. During final design, the City may identify areas that need to remain functional and accessible and areas that could be used for access, staging, and dewatering. Impacts to park users may be minimized by scheduling the construction work over the winter.

6.4 Anticipated pollutant removal

The pollutant (total phosphorus and total suspended solids) removals at Bassett Creek Park Pond and Winnetka Pond East for each alternative were estimated using the BCWMC P8 model. The model was first updated to reflect existing conditions, using the bathymetric survey data collected during this study. The model was then updated to reflect the additional permanent pool volume provided by each of the alternatives. Because Bassett Creek Park Pond is downstream from Winnetka Pond East, and its pollutant removal is therefore affected by changes to Winnetka Pond East, scenarios were run for completion of each individual project and for completing both projects.

6.4.1 Bassett Creek Park Pond

6.4.1.1 Remove Accumulated Sediment at Bassett Creek Park Pond—No Winnetka Pond East Improvement

The baseline alternative at Bassett Creek Park Pond involves removing accumulated sediment from the portion of the pond where the flood control project was constructed in 1996. This will restore the permanent pool volume in the pond and provide more water quality treatment volume. The permanent pool (area below the normal water level) is where water slows as it enters the pond, which allows for sediment particles to settle from the water, removing the pollutants associated with the sediment from the water conveyed downstream to the Main Stem of Bassett Creek. By providing a larger permanent pool volume, the water is stored in the pond longer which allows for increased sedimentation. Over time, as sediment accumulates in the pond, the permanent pool volume is reduced.

The MPCA Minnesota Stormwater Manual recommends a permanent pool volume of 1,800 cubic feet per acre of watershed area tributary to a pond. The direct drainage area to Bassett Creek Park Pond is approximately 137 acres. This results in a recommended permanent pool volume of 5.7 acre-feet. The permanent pool volume in Bassett Creek Park Pond after the construction of the baseline alternative would be 24.2 acre-feet. However, because Bassett Creek Park Pond is on the North Branch of Bassett Creek, there is additional watershed area tributary to the pond. The entire drainage area for the North Branch of Bassett Creek between Winnetka Pond East (the next upstream storage area) and Bassett Creek Park Pond is approximately 847 acres. This results in a recommended permanent pool volume of 35.0 acre-feet. This larger volume is more consistent with the permanent pool volume provided by constructing alternative 2; see the discussion in Section 6.4.2 below.

Under current conditions, the P8 model estimates that Bassett Creek Park Pond removes 70,508 pounds of total suspended solids per year and 151.3 pounds of total phosphorus per year. Upon construction of the baseline alternative, the P8 model estimates that Bassett Creek Park Pond would remove 71,735 pounds of total suspended solids per year (TSS) (1.7% increase to 67.5% removal efficiency) and 156.1 pounds of total phosphorus (TP) per year (3.2% increase to 23.6% removal efficiency). Based on the MPCA Minnesota Stormwater Manual, the expected average performance for a stormwater pond is 84% TSS removal and 50% TP removal. This system is not the typical stormwater pond configuration because the inflows are not limited to stormwater runoff from a parking lot or roadway, they are inflows from the entire North Branch of Bassett Creek; therefore, the anticipated pollutant removals may not be achievable even with typical sizing guidance.

6.4.1.2 Deepen Bassett Creek Park Pond—No Winnetka Pond East Improvement

Alternative 2 at Bassett Creek Park Pond involves deepening the southeastern portion of the pond to 10 feet to provide additional permanent pool volume and create a deeper habitat area to promote fish habitat and over-wintering of fish in the pond.

The permanent pool volume in Bassett Creek Park Pond after the construction of alternative 2 would be 29.6 acre-feet. This is an additional excavation of 5.4 acre-feet of material from the pond, when compared to the baseline alternative. This alternative is 5.4 acre-feet short of the MPCA recommended volume for the pond based on the entire contributing drainage area between Winnetka Pond East and Bassett Creek Park Pond. It would be challenging to perform additional excavation in other, shallower areas of the pond, as there could be wetland impacts if excavation were to result in depths greater than six feet. This additional impact would likely involve costly wetland mitigation and permitting for a large portion of the pond and may not be approved by the regulators. Therefore additional excavation was not pursued based on the additional costs and the incremental pollutant removal observed from the baseline alternative to alternative 2.

Under current conditions, the P8 model estimates that Bassett Creek Park Pond removes 70,508 pounds of TSS per year and 151.3 pounds of TP per year. Upon construction of alternative 2, the P8 model estimates that Bassett Creek Park Pond would remove 72,300 pounds of TSS per year (2.5% increase to 68.1% removal efficiency) and 158.3 pounds of TP per year (4.6% increase to 23.9% removal efficiency). Based on the MPCA Minnesota Stormwater Manual, the expected average performance for a stormwater pond is

84% TSS removal and 50% TP removal. This system is not the typical stormwater pond configuration because the inflows are not limited to stormwater runoff from a parking lot or roadway, they are inflows from the entire North Branch of Bassett Creek; therefore, the anticipated pollutant removals may not be achievable even with typical sizing guidance.

6.4.1.3 Sediment Forebay Add-on at Bassett Creek Park Pond

Construction of a forebay within Bassett Creek Park Pond will not significantly affect the pollutant removal of Bassett Creek Park Pond because it does not change the permanent pool volume of the pond. However, construction of a forebay will provide increased pollutant removals (sedimentation) within the forebay area, which will prevent sediment from migrating downstream into the larger pond area. This will allow for smaller, more frequent, and more cost-effective maintenance projects in the future, which will improve the long-term cost of providing water quality treatment at Bassett Creek Park Pond. The primary goal of constructing a forebay would be to improve the ease of maintenance such that the City could perform smaller, more frequent maintenance projects as is required because Bassett Creek Park Pond is part of the BCWMC Flood Control Project. The expectation would be that the City would take over the smaller, frequent maintenance projects, therefore reducing the maintenance burden on the BCWMC. Because Bassett Creek Park Pond is a MDNR public water, there would likely be permitting requirements each time maintenance is performed. The BCWMC may need to assist the City with applying for the MDNR and/or USACE permit on an annual basis to facilitate the City's maintenance. The anticipated long-term benefits cannot be reasonably estimated at this time because they are based on the rate of sediment accumulation, future construction costs, and future cost of material disposal, all of which are likely largely variable and likely to increase over time.

6.4.1.4 Remove Accumulated Sediment at Bassett Creek Park Pond—With Winnetka Pond East Improvement

Because Winnetka Pond East is upstream of Bassett Creek Park Pond on the North Branch of Bassett Creek, improvements to Winnetka Pond East may have impacts on the pollutant load reaching Bassett Creek Park Pond and the pollutant removal efficiency of Bassett Creek Park Pond.

Under current conditions, the P8 model estimates that Bassett Creek Park Pond removes 70,508 pounds of TSS per year and 151.3 pounds of TP per year. Upon construction of the baseline alternative in both Winnetka Pond East and Bassett Creek Park Pond, the P8 model estimates that Bassett Creek Park Pond would remove 71,595 pounds of TSS per year (1.5% increase to 67.7% removal efficiency) and 155.5 pounds of TP per year (2.8% increase to 23.6% removal efficiency).

6.4.1.5 Deepen Bassett Creek Park Pond—With Winnetka Pond East Improvement

Because Winnetka Pond East is upstream of Bassett Creek Park Pond on the North Branch of Bassett Creek, improvements to Winnetka Pond East may have impacts on the pollutant load reaching Bassett Creek Park Pond and the pollutant removal efficiency of Bassett Creek Park Pond.

Under current conditions, the P8 model estimates that Bassett Creek Park Pond removes 70,508 pounds of TSS per year and 151.3 pounds of TP per year. Upon construction of alternative 2 in both Winnetka Pond

East and Bassett Creek Park Pond, the P8 model estimates that Bassett Creek Park Pond would remove 71,725 pounds of TSS per year (1.7% increase to 68.6% removal efficiency) and 156.0 pounds of TP per year (3.1% increase to 23.8% removal efficiency).

6.4.1.6 Create native vegetation buffer around pond

A native buffer would filter pollutants such as phosphorus, sediment, and bacteria from stormwater runoff, improving the water quality of the pond. Although a native buffer would provide these water quality benefits, the amount of the load reductions cannot be quantified without more study.

6.4.2 Winnetka Pond East

6.4.2.1 Remove Accumulated Sediment at Winnetka Pond East

The baseline alternative at Winnetka Pond East involves removing accumulated sediment from the entire pond to the same depth as the original construction contours (2.1 feet). This will restore the permanent pool volume in the pond and provide more water quality treatment volume. The permanent pool (area below the normal water level) is where water slows as it enters the pond, which allows for sediment particles to settle from the water, removing the pollutants associated with the sediment from the water conveyed downstream to the North Branch of Bassett Creek. By providing a larger permanent pool volume, the water is stored in the pond longer which allows for increased sedimentation. Over time as sediment accumulates in the pond, the permanent pool volume is reduced.

The MPCA Minnesota Stormwater Manual recommends a permanent pool volume of 1,800 cubic feet per acre of watershed area tributary to a pond. The direct drainage area to Winnetka Pond East is approximately 20 acres. This results in a recommended permanent pool volume of 0.8 acre-feet. The permanent pool volume in Winnetka Pond East after the construction of the baseline alternative would be 5.7 acre-feet. However, because Winnetka Pond East is on the North Branch of Bassett Creek, there is additional watershed area tributary to the pond. The entire drainage area for the North Branch of Bassett Creek between Northwood Lake (the next upstream storage area) and Winnetka Pond East is approximately 243 acres. This results in a recommended permanent pool volume of 10.0 acre-feet. This larger volume is more consistent with the permanent pool volume provided by constructing alternative 2; see the discussion in Section 6.4.7 below.

Under current conditions, the P8 model estimates that Winnetka Pond East removes 19,286 pounds of TSS per year and 55.7 pounds of TP per year. Upon construction of the baseline alternative, the P8 model estimates that Winnetka Pond East would remove 19,724 pounds of TSS per year (1.0% increase to 43.6% removal efficiency) and 57.4 pounds of TP per year (0.4% increase to 13.9% removal efficiency). Based on the MPCA Minnesota Stormwater Manual, the expected average performance for a stormwater pond is 84% TSS removal and 50% TP removal. This system is not the typical stormwater pond configuration because the inflows are not limited to stormwater runoff from a parking lot or roadway, they are inflows from the entire North Branch of Bassett Creek; therefore, the anticipated pollutant removals may not be achievable even with typical sizing guidance.

6.4.2.2 Deepen Winnetka Pond East to 4.2 feet

Alternative 2 at Winnetka Pond East involves deepening the entire pond section to 4.2 feet to provide additional permanent pool volume.

The permanent pool volume in Winnetka Pond East after the construction of alternative 2 would be 10.7 acre-feet. This is an additional excavation of 5.0 acre-feet of material from the pond, when compared to the baseline alternative. This alternative slightly exceeds the MPCA recommended volume for the pond based on the entire contributing drainage area between Northwood Lake and Winnetka Pond East. However, the modeled pollutant removal efficiencies with the additional volume do not provide the average expected pollutant removal for a stormwater pond based on the contributing drainage area. This is likely due to other upstream storage areas and BMPs being undersized for the contributing drainage area, and the P8 model not taking this into account.

Under current conditions, the P8 model estimates that Winnetka Pond East removes 19,286 pounds of TSS per year and 55.7 pounds of TP per year. Upon construction of alternative 2, the P8 model estimates that Winnetka Pond East would remove 20,557 pounds of TSS per year (2.8 percentage point increase to 45.4% removal efficiency) and 60.8 pounds of TP per year (1.2 percentage point increase to 14.6% removal efficiency). Based on the MPCA Minnesota Stormwater Manual, the expected average performance for a stormwater pond is 84% TSS removal and 50% TP removal. This system is not the typical stormwater pond configuration because the inflows are not limited to stormwater runoff from a parking lot or roadway, they are inflows from the entire North Branch of Bassett Creek upstream of Winnetka Pond; therefore, the anticipated pollutant removals may not be achievable even with typical sizing guidance.

6.4.2.3 Deepen Winnetka Pond East to 6.0 feet

Alternative 3 at Winnetka Pond East involves deepening the entire pond section to 6.0 feet to provide additional permanent pool volume.

The permanent pool volume in Winnetka Pond East after the construction of alternative 2 would be 14.6 acre-feet. This is an additional excavation of 8.9 acre-feet of material from the pond, when compared to the baseline alternative. This alternative exceeds the MPCA recommended volume for the pond based on the entire contributing drainage area between Northwood Lake and Winnetka Pond East. However, the modeled pollutant removal efficiencies with the additional volume do not provide the average expected pollutant removal for a stormwater pond based on the contributing drainage area. This is likely due to other upstream storage areas and BMPs being undersized for the contributing drainage area, and the P8 model not taking this into account.

Under current conditions, the P8 model estimates that Winnetka Pond East removes 19,286 pounds of TSS per year and 55.7 pounds of TP per year. Upon construction of alternative 3, the P8 model estimates that Winnetka Pond East would remove 21,109 pounds of TSS per year (4.1 percentage point increase to 46.7% removal efficiency) and 62.8 pounds of TP per year (1.8 percentage point increase to 15.2% removal efficiency). Based on the MPCA Minnesota Stormwater Manual, the expected average performance for a stormwater pond is 84% TSS removal and 50% TP removal. This system is not the typical stormwater pond configuration because the inflows are not limited to stormwater runoff from a parking lot or roadway, they are inflows from the entire North Branch of Bassett Creek upstream of Winnetka Pond; therefore, the anticipated pollutant removals may not be achievable even with typical sizing guidance.

6.4.2.4 Create native vegetation buffer around Winnetka Pond East

A native buffer would filter pollutants such as phosphorus, sediment, and bacteria from stormwater runoff, improving the water quality of the pond. Although a native buffer would provide these water quality benefits, the amount of the load reductions cannot be quantified without more study.

6.4.2.5 Goose management at Winnetka Pond East

Managing goose populations could help to reduce the bacteria (and phosphorus) loading to Winnetka Pond/North Branch of Bassett Creek. Although goose management measures could provide these water quality benefits, the amount of the load reductions cannot be quantified without more study.

7.0 Project cost considerations

This section presents a feasibility-level opinion of cost of the evaluated alternatives, discusses potential funding sources, and provides an approximate project schedule.

7.1 Opinion of Cost

The opinion of cost is a Class 4 feasibility-level cost estimate as defined by the American Association of Cost Engineers International (AACI International) and uses the assumptions listed below and detailed in the following sections.

1. The cost estimate assumes a 30% construction contingency.
2. Costs associated with design, permitting, and construction observation (collectively "engineering") is assumed to be 30% of the estimated construction costs (excluding contingency).
3. Construction easements may be necessary to construct the project; however, the cost is expected to be negligible.
4. Additional work may be required to determine if cultural and/or historical resources are present at any project site.

The total construction and 30-year cost estimates for each recommended alternative are summarized in Table 7-1. Detailed cost-estimate tables for all alternatives considered are provided in Appendix E.

The Class 4 level cost estimates have an acceptable range of between -15% to -30% on the low range and +20% to +50% on the high range. Based on the development of concepts and initial vetting of the concepts by the City of Crystal, it is not necessary to utilize the full range of the acceptable range for the cost estimate; and we assume the final costs of construction may be between -20% and +30% of the estimated construction budget. The assumed contingency for the project (30%) incorporates the potential high end of the cost estimate range.

An opinion of cost was prepared for each considered alternative and add-on discussed in the sections above. The details of the cost estimate are presented in Table 7-1.

Bassett Creek Park Pond Opinion of Cost:

- The total capital cost for construction of removing accumulated sediment at Bassett Creek Park Pond (baseline alternative) is $1,167,000, which includes estimated construction costs of $730,000, plus $219,000 for construction contingency and $219,000 for engineering (all costs rounded to the nearest $1,000).
- The total capital cost for construction of deepening Bassett Creek Park Pond (alternative 2) is $1,550,000, which includes estimated construction costs of $969,000, plus $291,000 for construction contingency and $291,000 for engineering.

- The total additional capital cost for construction of the forebay at Bassett Creek Park Pond (add-on 1) is $183,000, which includes estimated construction costs of $115,000, plus $35,000 for construction contingency and $35,000 for engineering.

- The total capital cost for construction of the forebay at Bassett Creek Park Pond as a stand-alone project (add-on 1a) is $956,000, which includes estimated construction costs of $598,000, plus $180,000 for construction contingency and $180,000 for engineering.

- The total capital cost for construction of a native vegetation buffer at Bassett Creek Park Pond (add-on 2) is $85,000, which includes estimated construction costs of $53,000, plus $16,000 for construction contingency and $16,000 for engineering.

- Reusing Level 1 material at Bassett Creek Park (add-on 3) will reduce the construction cost of removing accumulated sediment or deepening the pond by $6,000 to $12,000, based on the City's use of 1,200 cubic yards of excavated material at the park. Additional analysis will be needed during final design to determine the volume of material that could be reused, and if the excavated material is suitable for reuse and could be sufficiently dewatered onsite to be used as fill.

- A cost for construction of a fishing pier at Bassett Creek Park Pond (add-on 4) was not determined because this would likely be funded by the City of Crystal with cooperation from the MDNR and the possible use of grant funds.

Winnetka Pond East Opinion of Cost:

- The total capital cost for construction of removing accumulated sediment at Winnetka Pond East (baseline alternative) is $259,000, which includes estimated construction costs of $162,000, plus $49,000 for construction contingency and $49,000 for engineering.

- The total capital cost for construction of deepening Winnetka Pond East to 4.2 feet (alternative 2) is $617,000, which includes estimated construction costs of $386,000, plus $116,000 for construction contingency and $116,000 for engineering.

- The total capital cost for construction of deepening Winnetka Pond East to 6.0 feet (alternative 3) is $888,000, which includes estimated construction costs of $555,000, plus $167,000 for construction contingency and $167,000 for engineering.

- The total capital cost for construction of a native vegetation buffer at Winnetka Pond East (add-on 1) is $17,000, which includes estimated construction costs of $11,000, plus $4,000 for construction contingency and $4,000 for engineering.

- The total capital cost for goose management at Winnetka Pond East (add-on 2) is $8,000, which includes estimated construction costs of $5,000, plus $2,000 for construction contingency and $2,000 for engineering.

- Reusing Level 1 material at Bassett Creek Park will reduce the construction cost of removing accumulated sediment or deepening the pond by $6,000 to $12,000, based on the City's use of 1,200 cubic yards of excavated material at the park. Additional analysis will be needed during final design to determine the volume of material that could be reused, and if the excavated material is suitable for reuse and could be sufficiently dewatered onsite to be used as fill.

7.1.1 Temporary easements

Most of the project is located on property owned by the City of Crystal or in areas where the City has access easements. The costs associated with temporary construction easements, if required, are typically negligible; no costs for temporary construction easements are included in this estimate.

7.1.2 Off-site sediment disposal

Most alternatives assume off-site disposal of excavated sediment. Based on the sediment sampling and investigation conducted during this study, it is assumed that sediment disposed off-site will not require additional testing. As such, these costs are not included in this estimate. If the projects are not constructed in 2018, additional testing should be considered to determine if the level of contaminants present in the material has increased such that the material would require different material management and disposal considerations.

7.1.3 Wetland mitigation

The wetland delineation for both Winnetka Pond East and Bassett Creek Park Pond identified wetlands around the perimeter of the pond and in the pond. The goal of the proposed alternatives is to minimize the amount of wetland impacts and to limit impacts to areas where the work would not change the wetland type from what is in place now or was in place following the original construction or previous work in the ponds. Therefore, it is not anticipated that the projects will require additional costs for wetland mitigation. The project alternatives were selected to minimize wetland impacts to preserve existing wetlands and minimize additional project cost.

7.1.4 30-year cost

The 30-year cost for each alternative is based on anticipated maintenance and replacement costs. For alternatives with an estimated life span less than 30 years, significant maintenance is assumed to occur at the end of the estimated life span shown in Table 7-1. The 30-year cost for each alternative is calculated as the future worth of the initial capital cost (including contingency and engineering costs) plus the future worth of annual maintenance and significant maintenance at the end of the alternative's life span. A 3% rate of inflation is assumed. The annualized cost for each alternative is calculated as the value of 30 equal, annual payments of the same future worth as the 30-year cost.

Bassett Creek Park Pond 30-year cost:

- The estimated total 30-year cost for removing accumulated sediment at Bassett Creek Park Pond (baseline alternative) is $3,455,000; the equivalent annualized cost is $72,600.

- The estimated total 30-year cost for deepening Bassett Creek Park Pond (alternative 1) is $4,384,000; the equivalent annualized cost is $92,100.
- The estimated total additional 30-year cost for construction of a forebay at Bassett Creek Park Pond (add-on 1) is $963,000; the equivalent annualized cost is $20,200.
- The estimated total 30-year cost for construction of a forebay at Bassett Creek Park Pond as a stand-alone project (add-on 1a) is $2,839,000; the equivalent annualized cost is $59,700.
- The estimated total 30-year cost for construction of a native vegetation buffer at Bassett Creek Park Pond (add-on 2) is $659,000; the equivalent annualized cost is $13,900.

Winnetka Pond East 30-year cost:

- The estimated total 30-year cost for removing accumulated sediment at Winnetka Pond East (baseline alternative) is $823,000; the equivalent annualized cost is $17,300.
- The estimated total 30-year cost for deepening Winnetka Pond East to 4.2 feet (alternative 2) is $1,693,000; the equivalent annualized cost is $35,600.
- The estimated total 30-year cost for deepening Winnetka Pond East to 6.0 feet (alternative 3) is $2,350,000; the equivalent annualized cost is $49,400.
- The estimated total 30-year cost for construction of a native vegetation buffer at Winnetka Pond East (add-on 1) is $130,000; the equivalent annualized cost is $2,700.
- The estimated total 30-year cost for goose management at Winnetka Pond East (add-on 2) is $238,000; the equivalent annualized cost is $5,000.

7.1.5 Annualized pollutant reduction cost

Estimated annual loading reductions for TSS and TP are included for each recommended alternative in Table 7-1. The BCWMC Engineer computed the loading reductions by modifying the BCWMC P8 model to include the proposed alternatives. The annualized pollutant-reduction cost for each alternative is the annualized 30-year cost divided by the annual load reduction.

Bassett Creek Park Pond annualized pollutant reduction cost:

- The estimated total annualized pollutant reduction costs for removing accumulated sediment at Bassett Creek Park Pond without improvements at Winnetka Pond East (baseline alternative) are $15,130 per pound TP and $59 per pound TSS. The estimated total annualized pollutant reduction costs for deepening Bassett Creek Park Pond without improvements at Winnetka Pond East (alternative 2) are $13,160 per pound TP and $51 per pound TSS.
- The estimated total annualized pollutant reduction costs for removing accumulated sediment at Bassett Creek Park Pond with improvements at Winnetka Pond East (baseline alternative) are $17,290 per pound TP and $67 per pound TSS. The estimated total annualized pollutant reduction

costs for deepening Bassett Creek Park Pond with improvements at Winnetka Pond East (alternative 2) are $19,600 per pound TP and $76 per pound TSS.

- Annualized pollutant reduction costs were not determined for the add-ons at Bassett Creek Park Pond because the add-ons will facilitate more cost-effective long term maintenance, but not provide additional pollutant removal (construction of a forebay—add-on 1), will provide habitat and unquantified water quality benefits (native vegetation buffer—add-on 2), will provide recreational benefit (fishing pier—add-on 4), or will reduce the construction cost (disposal of material on-site—add-on 3).

Winnetka Pond East annualized pollutant reduction cost:

- The estimated total annualized pollutant reduction costs for removing accumulated sediment at Winnetka Pond East (baseline alternative) are from $370 to $10,180 per pound TP (load reductions based on professional judgment and P8 model results, respectively), and $39 per pound TSS.
- The estimated total annualized pollutant reduction costs for deepening Winnetka Pond East to 4.2 feet (alternative 2) are from $720 to $6,980 per pound TP (load reductions based on professional judgment and P8 model results, respectively), and $28 per pound TSS.
- The estimated total annualized pollutant reduction costs for deepening Winnetka Pond East to 6.0 feet (alternative 3) are from $960 to $6,960 per pound TP (load reductions based on professional judgment and P8 model results, respectively), and $27 per pound TSS.
- Annualized pollutant reduction costs were not determined for the native vegetation buffer (add-on 1) and goose management (add-on 2) at Winnetka Pond East because the add-ons will provide habitat and unquantified water quality benefits.

The cost per pound of phosphorus removed for these dredging projects using the current P8 model analysis is very high compared to other BCWMC CIP projects—for example, the previous highest cost per pound of phosphorus removed for a BCWMC CIP project was $5,900 for the Northwood Lake Improvement Project (project NL-1). The high cost per pound of phosphorus removed for this project is likely due to several factors. The P8 model was developed at the watershed scale; this means that many of the watersheds are relatively large and the model may not be accurately reflecting the time it takes runoff to reach the ponds. This could be causing the model to over-predict flows and thus under-predict pollutant removals because the model is flushing more pollutants downstream and not allowing them to settle in the ponds. The P8 model does not account for pollutant load from the creek upstream of the ponds. For example, there are sections of the North Branch of Bassett Creek, upstream of Bassett Creek Park Pond, which have eroded banks that are contributing sediment and pollutants to the creek. This additional pollutant load is not included in the P8 model and the ponds are likely removing some of this additional load, providing a pollutant removal benefit that is not reflected in the modeling. This creek bank erosion could contribute an additional phosphorus load estimated between 3 and 92 pounds per year to the North Branch of Bassett Creek upstream of Bassett Creek Park Pond, depending on the severity of the erosion. This additional potential phosphorus load represents 15 percent—450 percent of the P8 modeled phosphorus inflow to Bassett Creek Park Pond.

The P8 model also does not account for resuspension of the sediment accumulated in the ponds. Once sediment (and the associated pollutants) has settled in the pond, the P8 model assumes they remain trapped. Calculations to determine the velocity of water through the ponds indicate that in Winnetka Pond East under current conditions, the velocities are high enough to resuspend sediment particles up to medium silt size and carry them downstream. This means that the model is over-estimating the current performance of the pond. Based on the scour/resuspension analysis, the BCWMC Engineer's professional judgment is that Winnetka Pond East under current conditions is removing only 20% of the total phosphorus predicted by the P8 model. Under current conditions, the P8 model estimates that the pond removes 55.7 pounds of total phosphorus per year. Applying the 20% effectiveness to the 55.7 pounds of phosphorus removal per year results in an estimate of 11.1 pounds of phosphorus removal per year under current conditions at Winnetka Pond East. The P8 model estimates for the Winnetka Pond East alternatives reasonably predict the total phosphorus removal provided by the pond. Therefore, another way to analyze the annual pollutant removal costs for total phosphorus is to compare the predicted phosphorus removals for the alternatives to the professional judgment phosphorus removal under current conditions. This results in lower costs per pound of phosphorus removal (see Table 7-2).

Constructing the Winnetka Pond East project to remove the accumulated sediment and deepen the pond would reduce the velocities through the pond, reducing the potential for resuspension and increasing the actual pollutant removal efficiency of the ponds.

For Bassett Creek Park Pond under current conditions, the calculations showed that the pond was not experiencing any scour or resuspension. However, approximately half of the pond surface area is located in an ineffective flow or shallow backwater area (north/northeast side of pond). As a result, the BCWMC Engineer's professional judgment is that the model may be overestimating by 50% the TP removal provided by the pond. Under current conditions, the P8 model estimates that Bassett Creek Park Pond removes 151.3 pounds of total phosphorus per year. Applying the 50% effectiveness to the 151.3 pounds of phosphorus removal per year results in an estimate of 75.7 pounds of phosphorus removal per year under current conditions. As none of the proposed alternatives address the ineffective flow area in the north of the pond, the predicted phosphorus removals for the Bassett Creek Park Pond alternatives would also be only 50% effective. The proposed conditions total phosphorus removals predicted by the P8 ranged from 155.5-158.3 pounds per year; applying the 50% effectiveness results in 77.8-79.2 pounds per year of phosphorus removal. This results in higher costs per pound of phosphorus removal (see Table 7-2).

7.1.6 Miscellaneous costs

Most site costs include erosion control and other miscellaneous items needed during construction (e.g., a rock construction entrance, silt fence or biologs, and restoration of access paths). Based on previous project experience, the estimate for each alternative includes some costs that could be applied to these miscellaneous items.

7.2 Funding sources

The BCWMC proposes to use its CIP funds to pay for the Bassett Creek Park Pond and/or the Winnetka Pond dredging project. The source of these funds is an ad valorem tax levied by Hennepin County over the entire Bassett Creek watershed. The City may pursue grants related to the recreation components of the project, such as deepening the southeastern portion of Bassett Creek Park Pond and installing a new fishing pier and aerator. The sediment removal portion of the project is typically considered standard maintenance by grantors and is usually not eligible for grant funding.

7.3 Project schedule

For project construction to occur in 2018, project design would be scheduled to begin in winter 2017. The construction work would likely be completed during the fall/winter of 2018 and into 2019. This would require the BCWMC to hold a public hearing and order the project in time to submit its ad valorem tax levy request to Hennepin County. If project construction is scheduled for fall or winter, spring or summer 2018 bidding is recommended. This will allow contractors to schedule to complete the project at a reasonable price. In the intervening time, the City would gather public input, prepare the final design, and obtain permits.

Table 7-1. Bassett Creek Park Pond and Winnetka Pond East feasibility study alternatives cost estimates - TP load reductions based on P8 model results

												Total Phosphorus (TP) Loading		Total Suspended Sediment (TSS)	
Site	Alternative	Alternative Description	Construction Cost Estimate (1)	Construction Contingency (2)	Engineering (3)	Capital Cost Estimate (4)(5)	Estimated Life Span(6) (years)	Annual Maintenance Cost Estimate	Major Maintenance Cost Estimate (7)	30-Year Future Worth Cost Estimate(8)(9)	Annualized Cost(9)(10)	Load Reduction Improvement (lb/yr)(11)	Cost/lb TP Reduction (12)	Load Reduction Improvement (lb/yr)	Cost/lb TSS Reduction(12)
Bassett Creek Park Pond (No Winnetka Pond Improvement)	Baseline Alternative	Remove accumulated sediment	$ 730,000	$ 219,000	$ 219,000	$ 1,167,000	30	$ -	$ 256,400	$ 3,455,000	$ 72,600	4.8	$ 15,130	1,227	$ 59
Bassett Creek Park Pond (No Winnetka Pond Improvement)	Alternative 2	Deepen SE section to 10 feet	$ 969,000	$ 291,000	$ 291,000	$ 1,550,000	30	$ -	$ 256,000	$ 4,384,000	$ 92,100	7.0	$ 13,160	1,792	$ 51
Bassett Creek Park Pond	Baseline Alternative	Remove accumulated sediment	$ 730,000	$ 219,000	$ 219,000	$ 1,167,000	30	$ -	$ 256,400	$ 3,455,000	$ 72,600	4.2	$ 17,290	1,087	$ 67
Bassett Creek Park Pond	Alternative 2	Deepen SE section to 10 feet	$ 969,000	$ 291,000	$ 291,000	$ 1,550,000	30	$ -	$ 256,000	$ 4,384,000	$ 92,100	4.7	$ 19,600	1,217	$ 76
Bassett Creek Park Pond	Add-on 1	Construct sediment forebay in northwest section (forebay in addition to baseline alternative or alternative 2)	$ 115,000	$ 35,000	$ 35,000	$ 183,000	30	$ 10,900	$ -	$ 963,000	$ 20,200	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 1a	Construct sediment forebay in northwest section (forebay only, no other pond construction)	$ 598,000	$ 180,000	$ 180,000	$ 956,000	30	$ 10,900	$ -	$ 2,839,000	$ 59,700	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 2	Create native vegetation buffer around pond	$ 53,000	$ 16,000	$ 16,000	$ 85,000	30	$ 8,800	$ 21,120	$ 659,000	$ 13,900	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 3 (13)	Dispose of Level 1 material onsite	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 4 (14)	Construct new fishing pier at deepened southeast section	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	0.0	$ -	0	$ -
Winnetka Pond East	Baseline Alternative	Remove accumulated sediment	$ 162,000	$ 49,000	$ 49,000	$ 259,000	30	$ -	$ 80,000	$ 823,000	$ 17,300	1.7	$ 10,180	438	$ 39
Winnetka Pond East	Alternative 2	Deepen entire pond to 4.2 feet	$ 386,000	$ 116,000	$ 116,000	$ 617,000	30	$ -	$ 80,000	$ 1,693,000	$ 35,600	5.1	$ 6,980	1,271	$ 28
Winnetka Pond East	Alternative 3	Deepen entire pond to 6.0 feet	$ 555,000	$ 167,000	$ 167,000	$ 888,000	30	$ -	$ 80,000	$ 2,350,000	$ 49,400	7.1	$ 6,960	1,823	$ 27
Winnetka Pond East	Add-on 1	Create Native Vegetation Buffer Around Pond (50-foot buffer)	$ 11,000	$ 4,000	$ 4,000	$ 17,000	30	$ 1,700	$ 4,200	$ 130,000	$ 2,700	0.0	$ -	0	$ -
Winnetka Pond East	Add-on 2	Goose Management	$ 5,000	$ 2,000	$ 2,000	$ 8,000	30	$ 5,000	$ -	$ 238,000	$ 5,000	0.0	$ -	0	$ -

(1) A Class 4 screening-level opinion of probable cost, as defined by the American Association of Cost Engineers International (AACI International), has been prepared for these alternatives. The opinion of probable construction cost provided in this table is made based on Barr's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to Barr at this time and includes a conceptual-level design of the project.

(2) Assumed 30% contingency on construction costs.

(3) Assumed 30% of construction costs for design, permitting, and adminstration.

(4) Includes estimated initial construction cost (with 30% contingency) and design, permitting, and adminstration costs (30% of construction cost).

(5) Many of the alternatives in this table are mutually exclusive. The total project cost will not be a sum of each of these alternatives, rather a sum of a unique combination of a portion of these alternatives.

(6) Estimated life span until significant maintenance is required.

(7) Future value of significant maintenance at the end of the lifespan of the project (i.e. future cost at 20 years for a project with a 20 year life span)

(8) Future value of initial capital cost, annual maintenance cost, and major maintenance cost at end of expected life span.

(9) Assumes 3% inflation rate.

(10) Annualized 30-year future worth.

(11) TP load reductions based on P8 model results

(12) Annualized cost divided by estimated annual pollution load reduction.

(13) This alternative would provide no additional pollutant removal, but would reduce the construction cost associated with the Bassett Creek Park Pond Baseline Alternative and Alternative 2 and the Winnetka Pond Baseline Alternative, Alternative 2, and Alternative 3 by $6,000 - $12,00.

(14) This alternative would likely be funded by the City of Crystal/MDNR/Grant Funds, not the BCWMC.

Table 7-2. Bassett Creek Park Pond and Winnetka Pond East feasibility study alternatives cost estimates - TP load reductions based on professional judgement

Site	Alternative	Alternative Description	Construction Cost Estimate (1)	Construction Contingency (2)	Engineering (3)	Capital Cost Estimate (4)(5)	Estimated Life Span(6) (years)	Annual Maintenance Cost Estimate	Major Maintenance Cost Estimate (7)	30-Year Future Worth Cost Estimate(8)(9)	Annualized Cost(9)(10)	Total Phosphorus (TP) Loading		Total Suspended Sediment (TSS)	
												Load Reduction Improvement (lb/yr)(11)	Cost/lb TP Reduction (12)	Load Reduction Improvement (lb/yr)	Cost/lb TSS Reduction(12)
Bassett Creek Park Pond (No Winnetka Pond Improvement)	Baseline Alternative	Remove accumulated sediment	$ 730,000	$ 219,000	$ 219,000	$ 1,167,000	30	$ -	$ 256,400	$ 3,455,000	$ 72,600	2.4	$ 30,250	1,227	$ 59
Bassett Creek Park Pond (No Winnetka Pond Improvement)	Alternative 2	Deepen SE section to 10 feet	$ 969,000	$ 291,000	$ 291,000	$ 1,550,000	30	$ -	$ 256,000	$ 4,384,000	$ 92,100	3.5	$ 26,310	1,792	$ 51
Bassett Creek Park Pond	Baseline Alternative	Remove accumulated sediment	$ 730,000	$ 219,000	$ 219,000	$ 1,167,000	30	$ -	$ 256,400	$ 3,455,000	$ 72,600	2.1	$ 34,570	1,087	$ 67
Bassett Creek Park Pond	Alternative 2	Deepen SE section to 10 feet	$ 969,000	$ 291,000	$ 291,000	$ 1,550,000	30	$ -	$ 256,000	$ 4,384,000	$ 92,100	2.3	$ 40,040	1,217	$ 76
Bassett Creek Park Pond	Add-on 1	Construct sediment forebay in northwest section (forebay in addition to baseline alternative or alternative 2)	$ 115,000	$ 35,000	$ 35,000	$ 183,000	30	$ 10,900	$ -	$ 963,000	$ 20,200	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 1a	Construct sediment forebay in northwest section (forebay only, no other pond construction)	$ 598,000	$ 180,000	$ 180,000	$ 956,000	30	$ 10,900	$ -	$ 2,839,000	$ 59,700	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 2	Create native vegetation buffer around pond	$ 53,000	$ 16,000	$ 16,000	$ 85,000	30	$ 8,800	$ 21,120	$ 659,000	$ 13,900	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 3 (13)	Dispose of Level 1 material onsite	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	0.0	$ -	0	$ -
Bassett Creek Park Pond	Add-on 4 (14)	Construct new fishing pier at deepened southeast section	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	0.0	$ -	0	$ -
Winnetka Pond East	Baseline Alternative	Remove accumulated sediment	$ 162,000	$ 49,000	$ 49,000	$ 259,000	30	$ -	$ 80,000	$ 823,000	$ 17,300	46.3	$ 370	438	$ 39
Winnetka Pond East	Alternative 2	Deepen entire pond to 4.2 feet	$ 386,000	$ 116,000	$ 116,000	$ 617,000	30	$ -	$ 80,000	$ 1,693,000	$ 35,600	49.7	$ 720	1,271	$ 28
Winnetka Pond East	Alternative 3	Deepen entire pond to 6.0 feet	$ 555,000	$ 167,000	$ 167,000	$ 888,000	30	$ -	$ 80,000	$ 2,350,000	$ 49,400	51.7	$ 960	1,823	$ 27
Winnetka Pond East	Add-on 1	Create Native Vegetation Buffer Around Pond (50-foot buffer)	$ 11,000	$ 4,000	$ 4,000	$ 17,000	30	$ 1,700	$ 4,200	$ 130,000	$ 2,700	0.0	$ -	0	$ -
Winnetka Pond East	Add-on 2	Goose Management	$ 5,000	$ 2,000	$ 2,000	$ 8,000	30	$ 5,000	$ -	$ 238,000	$ 5,000	0.0	$ -	0	$ -

(1) A Class 4 screening-level opinion of probable cost, as defined by the American Association of Cost Engineers International (AACI International), has been prepared for these alternatives. The opinion of probable construction cost provided in this table is made based on Barr's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to Barr at this time and includes a conceptual-level design of the project.

(2) Assumed 30% contingency on construction costs.

(3) Assumed 30% of construction costs for design, permitting, and adminstration.

(4) Includes estimated initial construction cost (with 30% contingency) and design, permitting, and adminstration costs (30% of construction cost).

(5) Many of the alternatives in this table are mutually exclusive. The total project cost will not be a sum of each of these alternatives, rather a sum of a unique combination of a portion of these alternatives.

(6) Estimated life span until significant maintenance is required.

(7) Future value of significant maintenance at the end of the lifespan of the project (i.e. future cost at 20 years for a project with a 20 year life span)

(8) Future value of initial capital cost, annual maintenance cost, and major maintenance cost at end of expected life span.

(9) Assumes 3% inflation rate.

(10) Annualized 30-year future worth.

(11) TP load reductions based on professional judgment. For **Bassett Creek Park Pond**, equivalent to 50% of the removal predicted by P8 model under existing and proposed conditions; lower estimated removal based on approximately half of the pond surface area in the existing conditions model is located in an ineffective flow or shallow backwater area. P8 model predicted 151.3 lbs of TP removal under existing conditions; 50% of 151.3 is 75.7 lbs/yr. The proposed conditions TP removals predicted by P8 ranged from 155.5 - 158.3 lbs/yr; 50% is 77.8 - 79.2 lbs/yr. Result: approximately doubles the $/lb/yr TP removed. For **Winnetka Pond East**, equivalent to 20% of the removal predicted by P8 model under existing conditions; lower estimated removal based on scour/resuspension analysis finding almost all sediment particles subject to resuspension. P8 model predicted 55.7 lbs of TP removal under existing conditions; 20% of 55.7 is 11.1 lbs/yr.

(12) Annualized cost divided by estimated annual pollution load reduction.

(13) This alternative would provide no additional pollutant removal, but would reduce the construction cost associated with the Bassett Creek Park Pond Baseline Alternative and Alternative 2 and the Winnetka Pond Baseline Alternative, Alternative 2, and Alternative 3 by $6,000 - $12,00.

(14) This alternative would likely be funded by the City of Crystal/MDNR/Grant Funds, not the BCWMC.

8.0 Alternatives assessment and recommendations

The final project will consist of a combination of the alternatives discussed below. The costs of the alternatives recommended for the final design are summarized in Table 8-1 (TP load reductions based on the P8 model) and Table 8-2 (TP load reductions based on professional judgment). Alternatives that could be implemented in combination were chosen if they presented cost-effective TP and TSS loading reductions and appear feasible to permit for construction. The ability of alternatives to improve habitat and recreation (identified as priorities in stakeholder meetings and goals of the BCWMC) was also taken into consideration in choosing the final alternatives.

The final design process for the Bassett Creek Park Pond project should include continuing to work closely with the City of Crystal Parks and Recreation Department to develop a plan to successfully combine efforts to improve Bassett Creek Park Pond with the Bassett Creek Park System Master Plan.

The annualized pollutant reduction costs indicate that the improvements at Winnetka Pond East are the most cost effective and that improvements at Bassett Creek Park Pond are more cost effective when work at Winnetka Pond East is not completed. Because Bassett Creek Park Pond is in a prominent park in the City of Crystal, completion of a project at this location would provide the opportunity to complete additional work such as the creation of a native vegetation buffer and enhancements to fish habitat and recreational use of the pond.

Because the modeling results do not show the expected pollutant removals from completing the projects, the BCWMC Engineer recommends completing first the Winnetka Pond East alternative 3 project (deepening to 6.0 feet), along with add-on 1 (native buffer) and add-on 2 (goose management), completing further investigation on Bassett Creek Park Pond, and ordering a project at this location in the future if it is determined to be feasible. This additional analysis on Bassett Creek Park Pond would allow time for the City of Crystal to complete its parks planning process at this location, which may result in identifying other feasible options for improvements at Bassett Creek Park Pond. These additional options may include options for increasing flood storage in the park to reduce the flood elevation of Bassett Creek Park Pond and reduce flooding downstream or identify other locations and alternatives for other water quality treatment alternatives at the site. The P8 model could be calibrated using City of Plymouth/Three Rivers Park District information and using BCWMC information that will be collected as part of a proposed monitoring program on the North Branch of Bassett Creek. After calibrating the model, the pollutant removal efficiencies for this project could be updated to more accurately predict the pollutant removals provided by the proposed project (updated model results would likely show more pollutant removal provided by completing the project).

In addition to providing pollutant removal benefits, removing accumulated sediment from Bassett Creek Park Pond and Winnetka Pond East is necessary to continue to provide flood storage in these areas along the trunk line of the North Branch of Bassett Creek. An area near the center of Winnetka Pond East just downstream of two inlets to the pond is becoming very shallow. As additional sediment accumulates, the sediment will form an island near the center of the pond. Once the island forms above the normal water level, the sediment island reduces the flood storage available in the area, which could lead to additional flooding in other areas that would normally not be inundated. The sediment islands may also cause flow restrictions and therefore additional flooding during smaller storm events where flooding may not normally occur. A similar situation will eventually occur at Bassett Creek Park Pond, though the island formation is not as dramatic at this time. Eventually, some sediment removal will need to be performed to maintain flood storage capacity, regardless of the water quality benefit provided. Furthermore, when the flood control project at Bassett Creek Park Pond was designed and constructed, it assumed some additional excavation volume to allow for sediment storage that would not interfere with providing the designed flood control benefits. Maintenance removal of the accumulated sediment is necessary to maintain functionality of the flood control project.

Removing accumulated sediment and deepening the permanent pool to 6.0 feet at Winnetka Pond East (alternative 3), creating a native buffer (add-on 1), and implementing goose management methods (add-on 2) will provide water quality improvement by 1) providing additional permanent pool storage for increased sedimentation, 2) minimizing downstream transport of sediment, 3) filtering pollutants such as phosphorus, sediment, and bacteria from stormwater runoff, and 4) reducing phosphorus and bacteria loads from geese. If the BCWMC decides to support the Winnetka Pond East project, we recommend completing it in 2018, which fits into the City's CIP schedule and the BCWMC CIP schedule. The total estimated project capital cost to implement the Winnetka Pond East project is $913,000, which includes $888,000 to deepen Winnetka Pond East to 6.0 feet, $17,000 to construct a native buffer, and $8,000 for goose management. We recommend that the opinions of cost identified in this study be used to develop a levy request for the selected project and that the Winnetka Pond East project proceeds to the design and construction phase.

Table 8-1. Bassett Creek Park Pond and Winnetka Pond East recommended alternatives cost summary - TP load reductions based on P8 model results

Alternative	Construction Cost Estimate (1)	Construction Contingency (2)	Engineering (3)	Capital Cost Estimate (4)	Annualized Cost(5)	TP Loading		TSS Loading	
						Load Reduction (lb/yr)	Cost/lb Reduced(6)	Load Reduction (lb/yr)	Cost/lb Reduced(6)
Bassett Creek Park Pond Alternative 2 (No Winnetka Pond)	$ 969,000	$ 291,000	$ 291,000	$ 1,550,000	$ 92,100	7.0	$ 13,160	1,792	$ 51
Bassett Creek Park Pond Add-on 1 (forebay)	$ 115,000	$ 35,000	$ 35,000	$ 183,000	$ 20,200	0.0	$ -	0	$ -
Bassett Creek Park Pond Add-on 2 (buffer)	$ 53,000	$ 16,000	$ 16,000	$ 85,000	$ 13,900	0.0	$ -	0	$ -
Winnetka Pond East Baseline Alternative	$ 162,000	$ 49,000	$ 49,000	$ 259,000	$ 17,300	1.7	$ 10,180	438	$ 39
Winnetka Pond East Alternative 3 (deepen to 6.0 ft)	$ 555,000	$ 167,000	$ 167,000	$ 888,000	$ 49,400	7.1	$ 6,960	1,823	$ 27
Winnetka Pond East Add-on 1 (buffer)	$ 11,000	$ 4,000	$ 4,000	$ 17,000	$ 2,700	0.0	$ -	0	$ -
Winnetka Pond East Add-on 2 (goose management)	$ 5,000	$ 2,000	$ 2,000	$ 8,000	$ 5,000	0.0	$ -	0	$ -

(1) A Class 4 screening-level opinion of probable cost, as defined by the American Association of Cost Engineers International (AACI International), has been prepared for these alternatives. The opinion of probable construction cost provided in this table is made based on Barr's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to Barr at this time and includes a conceptual-level design of the project.

(2) Assumed 30% contingency on construction costs.

(3) Assumed 30% of construction costs for design, permitting, and adminstration.

(4) Includes estimated initial construction cost (with 30% contingency) and design, permitting, and adminstration costs (30% of construction cost).

(5) Future value of capital cost, annual maintenance cost, and major maintenance cost at end of expected life span, annualized to 30-year value assuming 3% inflation rate.

(6) Annualized cost divided by estimated annual pollution load reduction.

Table 8-2. Bassett Creek Park Pond and Winnetka Pond East recommended alternatives cost summary - TP load reductions based on professional judgement

Alternative	Construction Cost Estimate (1)	Construction Contingency (2)	Engineering (3)	Capital Cost Estimate (4)	Annualized Cost(5)	TP Loading: Load Reduction (lb/yr)(6)	TP Loading: Cost/lb Reduced(7)	TSS Loading: Load Reduction (lb/yr)	TSS Loading: Cost/lb Reduced(7)
Bassett Creek Park Pond Alternative 2 (No Winnetka Pond)	$ 969,000	$ 291,000	$ 291,000	$ 1,550,000	$ 92,100	75.7	$ 30,250	1,792	$ 51
Bassett Creek Park Pond Add-on 1 (forebay)	$ 115,000	$ 35,000	$ 35,000	$ 183,000	$ 20,200	0.0	$ -	0	$ -
Bassett Creek Park Pond Add-on 2 (buffer)	$ 53,000	$ 16,000	$ 16,000	$ 85,000	$ 13,900	0.0	$ -	0	$ -
Winnetka Pond East Alternative 3	$ 555,000	$ 167,000	$ 167,000	$ 888,000	$ 49,400	51.7	$ 956	1,823	$ 27
Winnetka Pond East Add-on 1 (buffer)	$ 11,000	$ 4,000	$ 4,000	$ 17,000	$ 2,700	0.0	$ -	0	$ -
Winnetka Pond East Add-on 2 (goose management)	$ 5,000	$ 2,000	$ 2,000	$ 8,000	$ 5,000	0.0	$ -	0	$ -

(1) A Class 4 screening-level opinion of probable cost, as defined by the American Association of Cost Engineers International (AACI International), has been prepared for these alternatives. The opinion of probable construction cost provided in this table is made based on Barr's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to Barr at this time and includes a conceptual-level design of the project.

(2) Assumed 30% contingency on construction costs.

(3) Assumed 30% of construction costs for design, permitting, and adminstration.

(4) Includes estimated initial construction cost (with 30% contingency) and design, permitting, and adminstration costs (30% of construction cost).

(5) Future value of capital cost, annual maintenance cost, and major maintenance cost at end of expected life span, annualized to 30-year value assuming 3% inflation rate.

(6) TP load reductions based on professional judgment. For **Bassett Creek Park Pond**, equivalent to 50% of the removal predicted by P8 model under existing and proposed conditions; lower estimated removal based on approximately half of the pond surface area in the existing conditions model is located in an ineffective flow or shallow backwater area. P8 model predicted 151.3 lbs of TP removal under existing conditions; 50% of 151.3 is 75.7 lbs/yr. The proposed conditions TP removals predicted by P8 ranged from 155.5 - 158.3 lbs/yr; 50% is 77.8 - 79.2 lbs/yr. Result: approximately doubles the $/lb/yr TP removed.

For **Winnetka Pond East**, equivalent to 20% of the removal predicted by P8 model under existing conditions; lower estimated removal based on scour/resuspension analysis finding almost all sediment particles subject to resuspension. P8 model predicted 55.7 lbs of TP removal under existing conditions; 20% of 55.7 is 11.1 lbs/yr.

(7) Annualized cost divided by estimated annual pollution load reduction.

9.0 References

1. **Bassett Creek Watershed Management Commission.** 2015 Watershed Management Plan. September 2015.

2. **Minnesota Department of Natural Resources.** White-nose Syndrome and Minnesota's bats. [http://www.dnr.state.mn.us/wns/index.html]. 2015.

3. **Minnesota Pollution Control Agency.** Managing Stormwater Sediment Best Management Practice Guidance. June 2015. [https://www.pca.state.mn.us/sites/default/files/wq-strm4-16.pdf].

4. **Minnesota Department of Natural Resources.** White-nose Syndrome and Minnesota's bats. [http://www.dnr.state.mn.us/wns/index.html]. 2015.

Appendices

(in stand-alone PDF)

Appendix A	Sediment Sampling Memo—Bassett Creek Park Pond
Appendix B	Sediment Sampling Memo—Winnetka Pond East
Appendix C	Wetland Delineation Report
Appendix D	Bathymetric Survey Figures
Appendix E	Detailed Cost Estimates