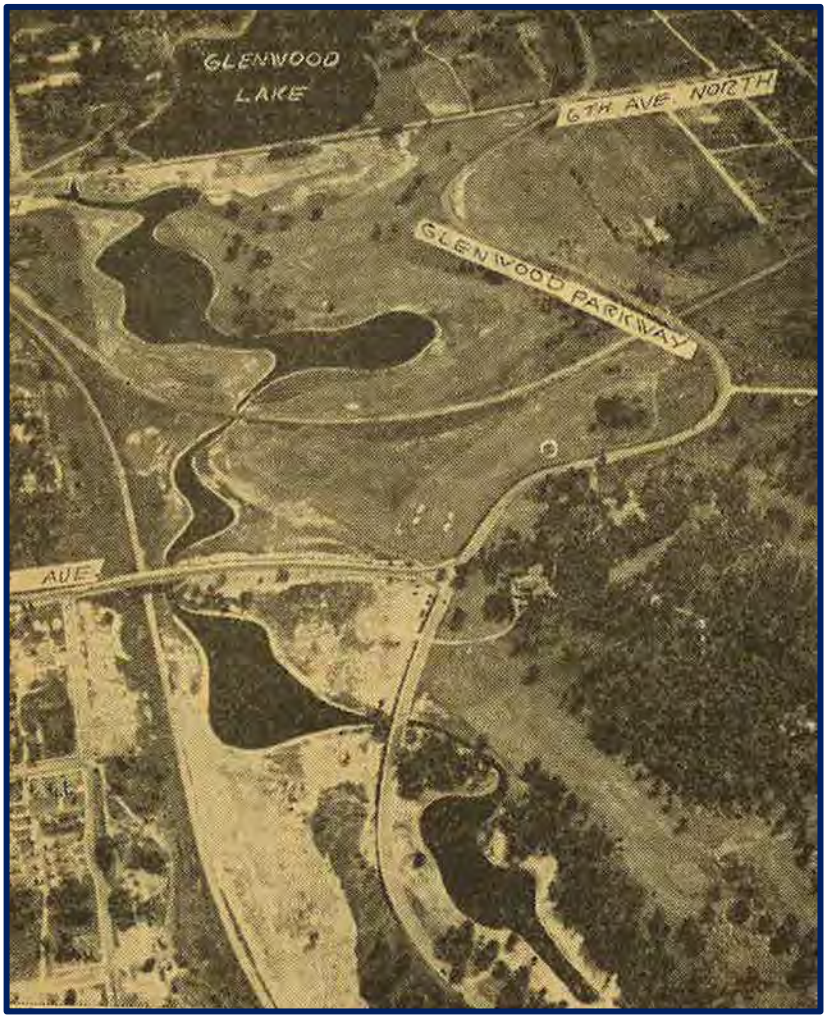
Item 5F.
BCWMC 4-16-20

Main Stem Lagoon Dredging Project Feasibility Study

Golden Valley, Minnesota

April 2020



Prepared for
Bassett Creek Watershed Management Commission

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Main Stem Lagoon Dredging Project Feasibility Study

April 2020

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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.

Patrick Brockamp, PE
PE #: 54931

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 BC-7 "dredging of accumulated sediment in Main Stem of Bassett Creek just north of Highway 55, Theodore Wirth Regional Park" (Main Stem Lagoon Dredging Project).

This study examines the feasibility of dredging accumulated sediment from three of seven lagoons (D, E, and F) (see Figure 1-1). The project will remove accumulated sediment from the lagoons to re-establish an aesthetic and function similar to the original design. The project will also provide other benefits. If ordered, the project is anticipated to be implemented in 2021 and 2022. Funding for the project is proposed to come from an ad valorem tax levied by Hennepin County on behalf of the BCWMC.

1.2 Site Conditions

The lagoons are located in the City of Golden Valley within the Minneapolis Park and Recreation Board (MPRB) Theodore Wirth Regional Park, and along the Main Stem of Bassett Creek, which is a Minnesota Department of Natural Resources (MDNR) public watercourse. Lagoon E, also named Ski Jump Pond, is a public water basin (MDNR #27065100P). Lagoons D and F are not listed as public water basins. Lagoons E and F are located north of Plymouth Ave. N, and Lagoon D to the south (see Figure 1-1).

Land adjacent to the lagoons consists of open grassy areas used for golf and other recreation, wooded uplands, and various wetland communities. The lagoons are bordered along the western edge by a recreational trail, which runs alongside the BNSF railroad.

A desktop wetland delineation was completed in December 2019 to identify the wetland extent of each lagoon. The delineation report is included as Appendix C. Wetlands delineated at the three lagoons totaled approximately 9.9 acres and were made up of five wetland communities: Riverine, Type 5; Floodplain Forest, Type 1; Shrub-carr, Type 6; Shallow Marsh, Type 3; and Wet Meadow, Type 2.

Based on concentrations of PAHs (as BaP equivalents) and DRO, sediment in all three lagoons does not meet MPCA guidelines for Unregulated Fill (MPCA, 2012), indicating it is not suitable for unrestricted offsite reuse. In addition, BaP equivalents are above the MPCA Industrial SRV, indicating the sediments are not suitable for reuse at other commercial or industrial properties. Based on the sediment sampling results and MPCA guidelines, the dredged material will require landfill disposal.

1.3 Project Alternatives

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

- Removing accumulated sediment from Lagoons D, E, and F to restore the original design aesthetic and function, flood conveyance, and water quality treatment capability (multiple depths)
- Alternatives for phasing the dredging – complete all lagoons together or separately
- Improving the pond buffer by removing undesirable tree species such as buckthorn and planting new trees

The recommended alternatives are discussed in Section 8.0.

1.4 Relationship to Watershed Management Plan

The Bassett Creek Watershed Management Commission (BCWMC) included the Main Stem Lagoon Dredging Project in its Capital Improvement Plan (CIP), based on the following "gatekeeper" policy from the BCWMC Plan. Items in bold italics represent those that directly apply to the Main Stem Lagoon Dredging Project.

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 of the report)***
- ***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.

The Main Stem Lagoon Dredging Project meets several gatekeeper criteria: improving water quality by reducing the amount of sediment and pollutants that would otherwise travel downstream in Bassett Creek, reducing flood risk during smaller and more frequent events, and improving wildlife habitat.

Project Area

Theodore Wirth Regional Park

N

0 250 500

Feet

Bassett Creek Watershed Management Commission

SITE LOCATION MAP

Golden Valley, Minnesota

FIGURE 1-1

1.5 Project Impacts and Estimated Costs

Potential impacts from the dredging project are discussed in Section 6.0 and include permit requirements (e.g., MDNR public waters work permit), temporary impacts to wetlands, temporary trail closures and park impacts, and impacts to aquatic species. Of these, the most significant consideration for the project is the need to manage trail usage to maintain pedestrian safety and park use during the project. Continued coordination with the Minneapolis Park and Recreation Board (MPRB) will be required during design of the Main Stem Lagoon Dredging project to address and mitigate this issue.

Overall, the proposed project will result in increased permanent pool volume and sediment storage volume in the three lagoons, resulting in a reduction of sediment and phosphorus loading to Bassett Creek and all downstream water bodies, including the Mississippi River.

The feasibility-level opinion of costs for implementing each alternative, as well as the cost per pound of total phosphorus (TP) removed and total suspended solids (TSS) removed are shown in Table 1-1. The capital cost estimate includes estimated construction costs, construction contingency, and engineering costs (all costs rounded to the nearest $1,000).

Table 1-1 Feasibility Level Cost Estimates Summary

Alternative	Lagoon	Dredged Volume (cy) (1)	Capital Cost Estimate (2)	TP Load Reduction (lb/yr) (3)	TP Reduction ($/lb/yr) (4)	TSS Load Reduction (lb/yr) (3)	TSS Reduction ($/lb/yr) (4)
1 4 Foot Max Depth	F	9,100	$823,000	150	$280	39,000	$1.10
	E	12,600	$1,123,000	200	$290	52,000	$1.20
	D	6,100	$581,000	38	$1,370	9,900	$5.30
	ALL	27,800	$2,247,000	390	$300	101,000	$1.20
2 6 Foot Max Depth	F	12,200	$1,084,000	210	$270	55,000	$1.10
	E	19,300	$1,690,000	320	$270	83,000	$1.10
	D	8,100	$750,000	75	$970	19,000	$3.90
	ALL	39,600	$3,145,000	600	$270	156,000	$1.10

(1) Sediment from all lagoons is considered contaminated and any dredged material will require landfill disposal.

(2) Includes estimated initial construction cost (with 30% contingency) and design/permitting/ admin costs (30% of construction cost).

(3) Based on estimated removal from Walker (1987) (2) relationship applied to average annual TP load from MCES WOMP monitoring.

(4) Pollutant reduction cost/lb based on 30-year annualized cost, annualized cost divided by estimated annual pollution load reduction.

In addition to providing pollutant removal benefits, removing accumulated sediment from the lagoons is necessary to continue to provide flood storage and conveyance in these areas along the Main Stem of Bassett Creek. All three lagoons have filled in significantly since their construction, becoming shallower and narrower. Sediment islands have formed in Lagoon E, which restricts flow and reduces the flood storage available in the area, resulting in an increase in flooding during smaller storm events. This could lead to additional flooding in other areas that would normally not be inundated. The sediment islands may also deflect flow and create erosion along the banks. Eventually sediment will need to be removed to maintain flood storage capacity, regardless of the water quality benefit provided. 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.

1.6 Recommendations

The BCWMC Engineer recommends completing one or more of the lagoons from Alternative 2, 6-foot dredging depth, and ordering a project. As compared to the 4-foot dredging depth alternative, dredging to 6-feet provides increased benefits for all project goals, the most significant being project longevity.

To aid in the selection of an option within Alternative 2, the BCWMC Engineer recommends a combined funding and merit-based approach. The options listed below are presented for consideration.

For the selected option, the BCWMC Engineer recommends that the BCWMC use the opinions of cost identified in this study to develop a levy request for the selected project and that the project proceed to design and construction. Due to the high cost of all options within this alternative, we anticipate that the BCWMC would likely need to spread the CIP funding over more than one year to construct the project.

Option 1 - All Lagoons

Under this option (the highest cost option), all three lagoons (D, E, and F) would be dredged to 6 feet. The annualized pollutant reduction costs indicate that this option is the most cost effective; it also has the longest lifespan. Completing the lagoons as a single project offers several advantages:

- Reduces duration of impacts to Theodore Wirth Regional Park roads, trails, and park users
- Reduces duration of impacts to aquatic species and other wildlife
- Reduces overall cost when compared to dredging all three lagoons individually (due to economies of scale, reduced mobilization/demobilization, reduced permitting and engineering, and redundant work)
- Returns the aesthetics of the three lagoons closest to the original design intent

Option 2 - Lagoon E Only

Under this option, Lagoon E would be dredged to 6 feet. This lagoon is the largest and has experienced the most significant changes over its lifetime as compared to Lagoons D and F. In addition to having the longest lifespan (time until the lagoon re-fills with sediment), dredging Lagoon E has the largest anticipated benefit for flood reduction.

Option 3 - Lagoon D Only

This option would dredge Lagoon D to 6 feet. This is the smallest of the three lagoons and represents the most economical option from Alternative 2. This option is most closely aligned with the funding that the BCWMC has currently allocated toward the project.

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 BC-7 "dredging of accumulated sediment in Main Stem of Bassett Creek just north of Highway 55, Theodore Wirth Regional Park" (Main Stem Lagoon Dredging Project). The BCWMC approved the 5-year (working) CIP at their April 18, 2019 meeting, which included implementation of the project in 2021-2022.

The BCWMC completed a Resource Management Plan (RMP) in 2009 (5) through which the United States Army Corps Engineers (USACE) and the BCWMC agreed on a series of steps, work items, deliverables (called "protocols") that must be accomplished and submitted to complete the RMP process and USACE review/approval process. Although this project was not included in the RMP, the USACE has allowed the RMP protocols to be applied to other projects not specifically included in the RMP. With the completion of the protocols, we expect the USACE application process to move more quickly than it would otherwise. Most of the protocols must be addressed as part of the feasibility study, in addition to the usual tasks that would be performed as part of a feasibility study under the criteria adopted by the BCWMC in October 2013. In general, the protocols require compliance with Section 106 of the National Historic Preservation Act, compliance with Section 404 of the Clean Water Act, and Clean Water Act Section 401 Water Quality Certification. Compliance with Section 106 can require some level of cultural resources inventory.

2.1 Project Area Description

The lagoons are located in the City of Golden Valley, within the MPRB's Theodore Wirth Regional Park, along the Main Stem of Bassett Creek. The Civilian Conservation Corps (CCC) constructed the lagoons in 1937. In total, approximately 405,000 cubic yards (CY) of soil was excavated to create seven lagoons. The project created 27 acres of open water and 36 acres of usable land for recreation.

Since their creation in 1937, significant development has occurred throughout the watershed. A study performed by Barr in 2015 found that the lagoons remained relatively unchanged until the early to mid-1990s when dramatic changes started to occur. The study concluded that a sediment pulse in the early 1990's was the main contributor to rapid sedimentation in the lagoons. Through comparison of historical aerial imagery, it was apparent the lagoons were filling in, becoming noticeably shallower with sediment deposits forming along the banks and creating multiple sediment islands in Lagoon E.

The MPRB owns and manages the lagoons and surrounding park property, which includes traditional and disc golf courses; and numerous trails for hiking, biking, and cross-country skiing. Due to their proximity to the park, the lagoons are considered part of the Minneapolis Grand Rounds System, which has been deemed eligible by the U.S. Department of the Interior under the Historic Preservation Act for listing on the National Register of Historic Places (once a site is deemed eligible it is treated as being on the list).

The Minnesota Pollution Control Agency (MPCA) lists the Main Stem of Bassett Creek as impaired (on the 303d list) for chloride, fecal coliform bacteria, and fish bioassessments. The United States Environmental Protection Agency (EPA) approved total maximum daily load studies (TMDLs) for chloride (Twin Cities Metro Area Chloride TMDL, 2016) and fecal coliform (Upper Mississippi River Bacteria TMDL Study and Protection Plan, 2014). There is no TMDL completed for the fish bioassessment impairment.

2.2 Goals and Objectives

The goals and objectives of the feasibility study are to:

1. Review the feasibility of removing accumulated sediment from Lagoons D, E, and F, 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 Main Stem of Bassett Creek and improve downstream water quality by restoring permanent pool storage in the three lagoons.
2. Remove accumulated sediment that is contaminated with polycyclic aromatic hydrocarbons (PAHs), elevated lead, and petroleum associated with diesel range organics (DRO).
3. Restore the intended design aesthetics and function of the original lagoon project.
4. Preserve natural beauty along the Main Stem of Bassett Creek and contribute to natural habitat quality and species diversification by improving the vegetated buffer around the lagoons.
5. Restore flood conveyance through this section of Bassett Creek.
6. Improve fish habitat by deepening the lagoons.

2.3 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 Lagoons D, E, and F, including water quality, flood control (including local flooding of parkway and parking lot), 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.

3.0 Site Conditions

3.1 Main Stem Bassett Creek Watershed

The Main Stem of Bassett Creek watershed area tributary to the lagoons encompasses nearly the entire 40 square mile watershed including portions of nine cities. 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 lagoons are located in the City of Golden Valley within Theodore Wirth Regional Park along the Main Stem of Bassett Creek (see Figure 1-1).

3.2.1 Site Access

Construction access will be straightforward as relatively few obstacles or infrastructure elements block access to the proposed work areas. In addition, the project is located on public property (Theodore Wirth Regional Park). The figures in Section 5.0 present the potential site access locations.

Access to the site is via Theodore Wirth Parkway, which has weight restrictions year-round; this will need to be considered in bidding and construction.

3.2.2 Topographic, Bathymetric, and Utility Surveys

The BCWMC Engineer completed topographic, bathymetric, and utility surveys in fall 2019 to develop the existing conditions base map and to use in the development and evaluation of the concepts.

A Topcon GR5 VRS, base/receiver, and Topcon PS Total Station were used to gather topographic and utility information within the project extents. Topographic information was collected in Hennepin County NAD83 horizontal datum and NAVD88 vertical datum. The utility survey included a detailed survey of the storm sewer entering the lagoons. Topographic survey information was imported into AutoCAD Civil 3D to create an existing conditions base map for this feasibility study.

The existing conditions topographic, bathymetric, and storm sewer/culvert survey results can be found in Appendix C.

3.2.3 Environmental and Land Use History

The BCWMC Engineer performed a review of the MPCA's "What's in my Neighborhood?" database to assess whether historical land use or contamination releases may have impacted the sediments, and to identify relevant analytical parameters for sediment testing. The MPCA database files for MPCA Leak Site #4162 were identified and reviewed. The leak involved a historical release during removal of an underground fuel oil tank in 1991. The tank was located east of the Theodore Wirth golf course clubhouse, west of the current parking lot. Contaminated soil was removed shortly after identification of

the release. Groundwater monitoring from 1991 through 1996 identified petroleum contamination primarily near the former tank basin location, including diesel range organics (DRO) and petroleum-related volatile organic compounds (VOC). In 1996, groundwater monitoring indicated the contamination was limited to an area immediately around the former tank. Groundwater flow direction was reported to the northeast, toward Lagoon E. The MPCA closed the leak site in 1997.

Based on the historical fuel oil release and documented impacts to groundwater, DRO and VOC analyses in the sediment characterization are described below.

In addition, due to the use of the surrounding property functioning as a golf course for several decades, pesticides and RCRA metals analyses of sediment samples were included in the sediment characterization scope.

3.2.4 Sediment Sampling

The purpose of sediment sampling and characterization is to evaluate whether the sediment in a pond can potentially be reused, or if other management methods such as landfill disposal are required. The tested samples from Lagoons D, E, and F all had concentrations above the MPCA criteria and will require landfill disposal.

The MPCA uses the term "Unregulated Fill" to characterize sediments or soil (dredged or excavated) that can be reused. Excavated sediment and soils that do not exhibit field screening impacts and do not exceed MPCA Residential Soil Reference Values (SRV) or applicable Soil Leaching Values (SLVs) may be considered Unregulated Fill that is suitable for off-site reuse according to the MPCA document *Best Management Practices (BMPs) for the Off-Site Reuse of Unregulated Fill (MPCA, 2012)*. Sediment or soil excavated from stormwater ponds that does not meet MPCA BMPs for Unregulated Fill are often disposed at an industrial solid waste landfill. If the soil meets MPCA Industrial SRVs, other options for managing sediments at publicly-owned property could be considered if suitable locations and uses are available.

The BCWMC Engineer conducted sediment sampling in Lagoons D, E, and F in accordance with the MPCA's *Managing Stormwater Sediment, Best Management Practice Guidance* (MPCA, 2017), as described in detail in Appendix A. Sediments were analyzed for baseline parameters listed in the MCPA stormwater sediment guidance. These parameters include arsenic, copper and PAHs, as well as VOCs, DRO, RCRA Metals and pesticides, based on documented environmental releases and historical land uses described in Section 3.2.3.

The sediment sampling results were compared to MPCA Residential SRVs and/or SLVs (Appendix A, Table 1). Carcinogenic PAHs are evaluated in terms of their cumulative equivalency to benzo(a)pyrene (BaP equivalents). Based on concentrations of PAHs as BaP equivalents and DRO, sediment in all three lagoons does not meet MPCA guidelines for Unregulated Fill (MPCA, 2012), indicating it is not suitable for unrestricted offsite reuse. In addition, BaP equivalents are above the MPCA Industrial SRV, indicating the sediments are not suitable for reuse at other commercial or industrial properties. Based on the sediment sampling results and MPCA guidelines, the dredged material will require landfill disposal.

3.2.5 Wetland Delineations

A desktop wetland delineation was completed within the project area on December 9, 2019. Previously, the project area was partially delineated in 2011 by Barr and in 2016 by the Blue Line Light Rail Transit Extension Project. Barr used these field wetland delineation reports to aid in the desktop wetland boundary determination. In addition, we delineated the wetland boundaries by evaluating the topography, soil type, and previously mapped waterbodies and wetlands within the project area. Wetlands were classified using the U.S. Fish and Wildlife Service (USFWS) Cowardin System (Cowardin et al., 1979), the USFWS Circular 39 system (Shaw and Fredine, 1956), and the Eggers and Reed Wetland Classification System (Eggers and Reed, 1977).

One 9.9-acre wetland was delineated within the project area, along Bassett Creek. The local government unit (LGU) and technical evaluation panel (TEP) approved the desktop wetland delineation report and wetland boundary determination on January 29, 2020. The complete wetland delineation report and figures are included as Appendix B.

3.2.6 Threatened and Endangered Species

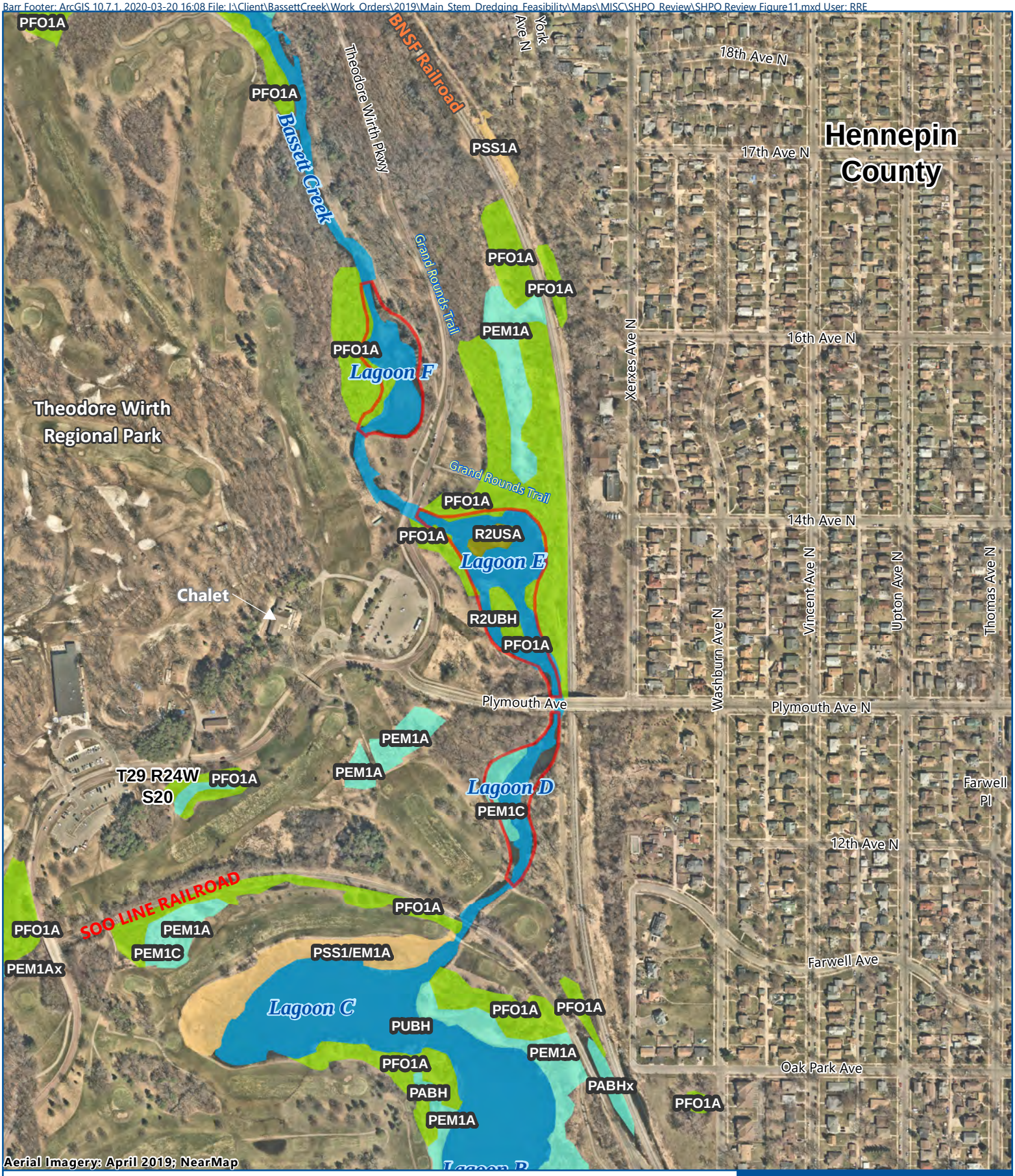
Barr has a license agreement (LA-898) with the MDNR for access to the Natural Heritage Information System (NHIS) database, which was queried in December 2019 to determine if any rare species could potentially be affected by the proposed project. The NHIS database identified three sensitive species and one sensitive plant community within one mile of the project area.

Table 3-1 Rare Species Documented within One Mile of Proposed Project Area According to MNDNR NHIS

Common Name	Scientific Name	Federal Status	State Status
Dwarf trout lily	*Erythronium propullans*	Endangered	Endangered
Rusty patched bumble bee	*Bombus affinis*	Endangered	Watchlist
Blanding's turtle	*Emydoidea blandingii*	None	Threatened
Tamarack Swamp	N/A	None	None

The US Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (IPaC) website identified two federally listed species potentially occurring in the project area: the northern long-eared bat (*Myotis septentrionalis;* threatened) and the rusty patched bumble bee (*Bombus affinis*; endangered). No designated critical habitat for any federally listed species is located within the project area.

According to GIS data obtained from the MDNR, there are no Minnesota County Biological Survey (MCBS) Sites located within one mile of the proposed project site. Additionally, no state-owned wildlife management areas (WMA), Scientific Natural Areas (SNA), or native plant communities are present within one mile of the proposed project site.



Project Area
Emergent
Forested
Scrub-Shrub
Open Water
Unconsolidated Shore

N

0 250 500
Feet

Bassett Creek Watershed Management Commission

National Wetland Inventory Map

Golden Valley, Minnesota

FIGURE 3-1

Impact Analysis

The northern long-eared bat hibernates in caves during the winter and uses forested areas for roosting and foraging during the bat's active season of April through October. Suitable roost trees for this species have trunks greater than three inches diameter at breast height (DBH) with loose, peeling bark or crevices. Numerous trees exceeding three inches DBH exist in the project area. Removal of undesirable trees surrounding the project area may occur. The dredging project work will occur within the stream channel of Bassett Creek where no suitable habitat for the species is present. According to the MDNR, the nearest hibernacula is about 11 miles southeast of the proposed project area and no maternity roost trees have been identified within one mile of the proposed project area. The project may affect, but is not likely to adversely affect, the federally threatened northern long-eared bat and is not expected to cause a prohibited take of this species.

Rusty patched bumble bees are typically found in grasslands with flowering plants from April through October. They typically nest in underground and abandoned rodent cavities or clumps of grasses above ground in uplands. During the winter months, queens typically overwinter in underground cavities in upland forests dominated by maple-basswood or oak-hickory trees. The project area is located within USFWS designated High Potential Zone for the rusty patched bumble bee; however, the proposed project is located within the Bassett Creek stream channel and adjacent upland areas. Upland areas will be utilized for site access. No impacts to the rusty patched bumble bee are anticipated as a result of the proposed project.

The dwarf trout lily occurs in wooded floodplains or river terraces, typically on north-facing slopes above or near a stream, preferring densely shaded habitat during the summer. One community of the dwarf trout lily was identified within one mile of the project area. The dwarf trout lily species is federally listed as endangered; however, it is not listed as occurring in Hennepin County. The identified dwarf trout lily population was transplanted to the Eloise Butler Wildflower Garden at Theodore Wirth Park (located approximately 1 mile south of the project site). The full extents of the population are known and would not be impacted by the proposed project. No additional dwarf trout lilies would be impacted by the project, as the scope of work would be limited to the stream channel and adjacent grassland areas for access. No wooded floodplain communities will be disturbed.

The Blanding's turtle uses a variety of aquatic habitats, including marshes, bays of lakes, slow-moving waters with areas of submergent and emergent vegetation, and wet meadows near these habitats. There is suitable Blanding's turtle habitat in the immediate vicinity of the project and Blanding's turtles have been recorded within one mile of the project area. During the active season (considered March–November), this species spends a large majority of its time on land. Nesting typically occurs May–June and their nesting sites are in sandy soil within 300 meters (984 feet) of a wetland. The primary measure to avoid direct impacts to this species is to install exclusion fencing around the entire work area during the turtle's non-nesting period (November–March). Fencing should be installed during the non-nesting period because Blanding's turtles have not yet traveled to and settled in their nesting locations. Blanding's turtles would be excluded from the project area prior to carrying out construction. Work can then be conducted any time of year as long as fencing is maintained. If a Blanding's turtle is observed in the work area, work

would cease and the MDNR notified. It is expected that work could resume once the turtle is removed from the construction area.

A tamarack swamp (FPs63), a Minnesota native plant community, is known to occur within one mile of the project area. Tamarack swamps occur in peat-filled basins on glacial moraines and outwash plains and appear to be associated with areas underlain by sandy substrates. Soils are well-decomposed peat of variable depth. The canopy is dominated by tamarack, typically with 25 to 75 percent cover. The project area was previously delineated in 2011 and 2016 and no tamarack species were noted during these surveys, nor were peat soils. As a result, no impacts to tamarack swamp would occur.

In summary, this project is not expected to impact the following state-listed species known to occur in the area: dwarf trout lily, or tamarack swamp. The project will not adversely affect or cause prohibited take of the federally listed rusty patched bumble bee.

It is assumed that the Blanding's turtle may be present within the project area, therefore no survey for the species is required. It is recommended that the avoidance measures identified above to minimize impacts to this state-listed species be followed. In addition, contractors should review the Blanding's turtle informational flyer (Appendix E).

3.2.7 Cultural Resources

On December 10, 2019, a file search was requested from the Minnesota State Historic Preservation Office (SHPO) Standing Structures (Historic) and Archaeology Inventories for all public land survey sections located within one mile of the project area (the evaluated area, see Figure 3-2).

SHPO responded to the data request with information indicating that there are numerous recorded historic and archaeological resources within the evaluated area. The file search identified 461 historical inventory records and 7 archaeological inventory records within the evaluated area. Recorded resources largely consisted of residential buildings located in the adjacent neighborhood east of the project site. No historical inventory records or archaeological records were identified within the project area. The proposed project would not impact any previously recorded standing structures or archaeological sites.

This review only reflects currently known cultural resources; it is possible that unidentified cultural resources may be present within the project area. Further cultural resources evaluation may be required as part of future design and permitting efforts.

Project Area
Historic Events
Archaeological Events

N

0 250 500
Feet

Bassett Creek Watershed Management Commission

CULTURAL RESOURCES
SHPO REVIEW
Golden Valley, Minnesota

FIGURE 3-2

3.2.8 Stream Stability Review

On November 11, 2019, a stream geomorphic site visit of the Bassett Creek Main Stem was conducted. The reach of stream visited included downstream of Lagoon G to downstream of Lagoon D. The purpose of the site visit was to review this section of stream for erosion and identify potential project impacts to the stream by the proposed dredging. This reach of stream was largely stabilized during a recent restoration project. Design drawings signed August 22, 2014 were reviewed in the field as part of this site visit.

Lagoon G to Lagoon F

This reach of stream is confined between steep slopes on either side and is largely straight. There is limited development of riffle, run, or pool sequences within this reach and it appears to function as a long riffle with limited habitat availability and connectivity to its floodplain. Several boulder vanes appear to have been installed to improve this variability and much of the right overbank has been stabilized with field stone. The channel is generally wide (bankfull width of approximately 40 feet) and shallow (bankfull depth of approximately 1.5 feet). No significant erosion was identified within this reach.

Figure 3-3 Confined reach from Lagoon G to Lagoon F

Lagoon F to Lagoon E

This reach of stream is less confined by topography than the upstream reach but is moderately entrenched with reduced access to the floodplain. The stream is slightly narrower (bankfull width of approximately 35 feet) and deeper (bankfull depth approximately 2.5 feet). Stabilization features installed in the right overbank include fascines and fieldstone. Fieldstone was also installed around the bridge abutment at the Theodore Wirth Parkway crossing.

A woody debris jam that spanned the entire channel width was present immediately downstream of Lagoon F. The City of Golden Valley was notified about the debris at this location and they added it to their maintenance list for removal.

Minor erosion (three to four feet high) was identified immediately downstream of the Theodore Wirth Parkway bridge riprap. The minor erosion could be repaired during the project by adding some additional riprap.

Figure 3-4 Woody debris within channel immediately downstream of Lagoon F

Figure 3-5 Erosion within right overbank of the channel downstream of the riprap (upstream of Lagoon E)

Lagoon E to Lagoon D

The hydraulics within this reach is largely controlled by the Plymouth Ave N. bridge crossing. In this section, the stream is confined between the concrete bridge abutment and the railroad embankment. Velocities through this area are very high, and it has been stabilized with riprap. Fascines (right and left overbanks) and rock vanes (left overbank) were installed along this reach to reduce the erosion potential. Upstream and downstream of the bridge crossing the stream has good access to its floodplain and is moderately entrenched. The bankfull width in this reach is approximately 30 feet with a bankfull depth of approximately 3 feet.

Minor erosion of the left overbank is present immediately upstream of Lagoon D. Installation of rootwads or other bio-stabilization along this bank to increase roughness could be completed in conjunction with this project if work was planned within this same area.

Figure 3-6 Project reach downstream of Plymouth Ave. N bridge (minor erosion in the left overbank)

Lagoon D to Golf Course Bridge

The section downstream of Lagoon D includes shallow banks and a floodplain forest where the stream has good access to its floodplain. This section has been stabilized with rootwads and fascines and is stable with no erosion.

Figure 3-7 Fascines installed in the right overbank

Stream Stability Summary and Geomorphology Discussion

The stream segments visited during this site have been stabilized in recent years through the use of fascines, rootwads, and fieldstone and has remained stable with limited erosion. The sections above identified a few areas for stabilization conjunction with the Main Stem Lagoon Dredging project. These improvements are minor enough to not require any special attention if a project in the area was not already proposed. The improvements include:

- Repair of erosion in the right overbank downstream of the Theodore Wirth Parkway bridge
- Repair of erosion in the left overbank downstream of the Plymouth Ave. N bridge

The proposed project will be excavating deposited sediment within the lagoons adjacent to these stream reaches. It is expected that this project will improve habitat through the creation of added depth that would improve survivability of fish and other aquatic species through the winter months. The Main Stem of Bassett Creek in this reach is generally confined by adjacent infrastructure and topography. Adding variability to the depth of the stream within this reach will provide additional energy dissipation and reduce stress on the channel banks.

4.0 Stakeholder Input

4.1 Project Kickoff Meeting

A project kickoff meeting was held at Golden Valley City Hall on August 21, 2019. Attendees included the BCWMC administrator and engineers, City of Minneapolis staff, and MPRB staff. The project feasibility study scope and schedule were discussed. The BCWMC engineers presented background information and preliminary concept ideas.

4.2 Technical Stakeholder Meeting

One technical stakeholder meeting was held on November 22, 2019 at the Theodore Wirth Chalet. Attendees included the BCWMC administrator and engineers, and representatives from the City of Minneapolis, MPRB, City of Golden Valley, MDNR, MPCA, and USACE. Information regarding the existing conditions, general goals, and design concepts for the project were presented, which was followed by discussion related to technical feedback and permitting input. The items discussed included:

- Review of project background and history
- Review of site information compiled to-date and completed site investigation work
- Review of potential design concepts
- Discussion of regulatory issues, potential permit requirements and other considerations
- Discussion of next steps

Section 6.5 of this feasibility study summarizes the anticipated permitting requirements, based on the discussion at the agency meeting and follow-up correspondence.

4.3 Public Stakeholder Meeting

A public stakeholder open house meeting was held on February 27, 2020 at University of Minnesota Robert J. Jones Urban Research and Outreach-Engagement Center in Minneapolis. The BCWMC administrator and BCWMC engineers attended the meeting, along with MPRB staff and Commissioner Welch. The BCWMC display included a watershed map, a brief project description, possible design concepts, project history, and information about the BCWMC. Only two members of the public attended the meeting and they were supportive of the project. No other comments from the public were received.

4.4 BCWMC Stakeholder Comments

A draft version of the April 2020 draft feasibility report was provided to the BCWMC administrator, City of Golden Valley, City of Minneapolis, and MPRB staff, and presented at the BCWMC meeting. The draft feasibility study was revised in response to the comments received. The revised draft was presented to the Commission at their April 2020 meeting. Action at that meeting resulted in [*pending meeting outcome*].

5.0 Project Concepts

This section provides a summary of the two conceptual designs developed and evaluated for the Main Stem Lagoon Dredging project feasibility study.

5.1 Alternative 1 - deepen lagoons to 4 feet

Alternative 1 would deepen the lagoons to a depth of 4 feet below the estimated normal water level. Increasing the depth to 4 feet should preserve the wetland characteristics of the current site—water depths greater than 6 feet change the wetland type from a shallow-water to a deep-water habitat (per the Minnesota Wetland Conservation Act). Deepening the lagoons to 4 feet would provide additional permanent pool volume and associated water quality improvement through additional sedimentation. The project would improve the flood conveyance through the lagoons by removing sediment islands and vegetation. This alternative (and Alternative 2) would involve multiple permitting considerations because it includes excavation within Bassett Creek, which is a MDNR public water wetland, and under USACE jurisdiction.

5.2 Alternative 2 - deepen lagoons to 6 feet

Alternative 2 would deepen the lagoons to a depth of 6 feet below the estimated normal water level. Increasing the depth to 6.0 feet should also preserve the wetland characteristics of the current site (see Section 5.1). Deepening the lagoons to 6 feet would provide further additional permanent pool volume and associated water quality improvement through additional sedimentation. The project would also improve the flood conveyance as in Alternative 1 and involve similar permitting considerations.

Because this alternative removes more accumulated sediment than Alternative 1, the construction costs would be higher. However, the longevity of the dredging would be improved due to the additional volume created.

5.3 Phasing Alternatives

Both alternatives 1 and 2 offer the possibility to pick and choose which lagoons are dredged, in combination with dredging order (if phased over multiple years) and depth. For example, the BCWMC may elect to fund the dredging of a single lagoon (D, E, or F) and could then choose the depth of dredging (4 or 6 feet). If the BCWMC chooses to move forward with dredging of all three lagoons, we expect that bidding these as a single project would offer efficiencies from a design and permitting perspective, as well as an anticipated cost savings due to economies of scale (e.g., lower mobilization costs).

5.4 Buffer improvements

Most of the area surrounding the lagoons is well-established wooded vegetation. There is limited overland flow from the adjacent area, meaning that there is not a significant opportunity to filter pollutants through an improved native vegetation buffer. However, improving the vegetated buffer would improve aesthetics and improve wildlife habitat. During a fall 2019 site visit, it was noted that significant

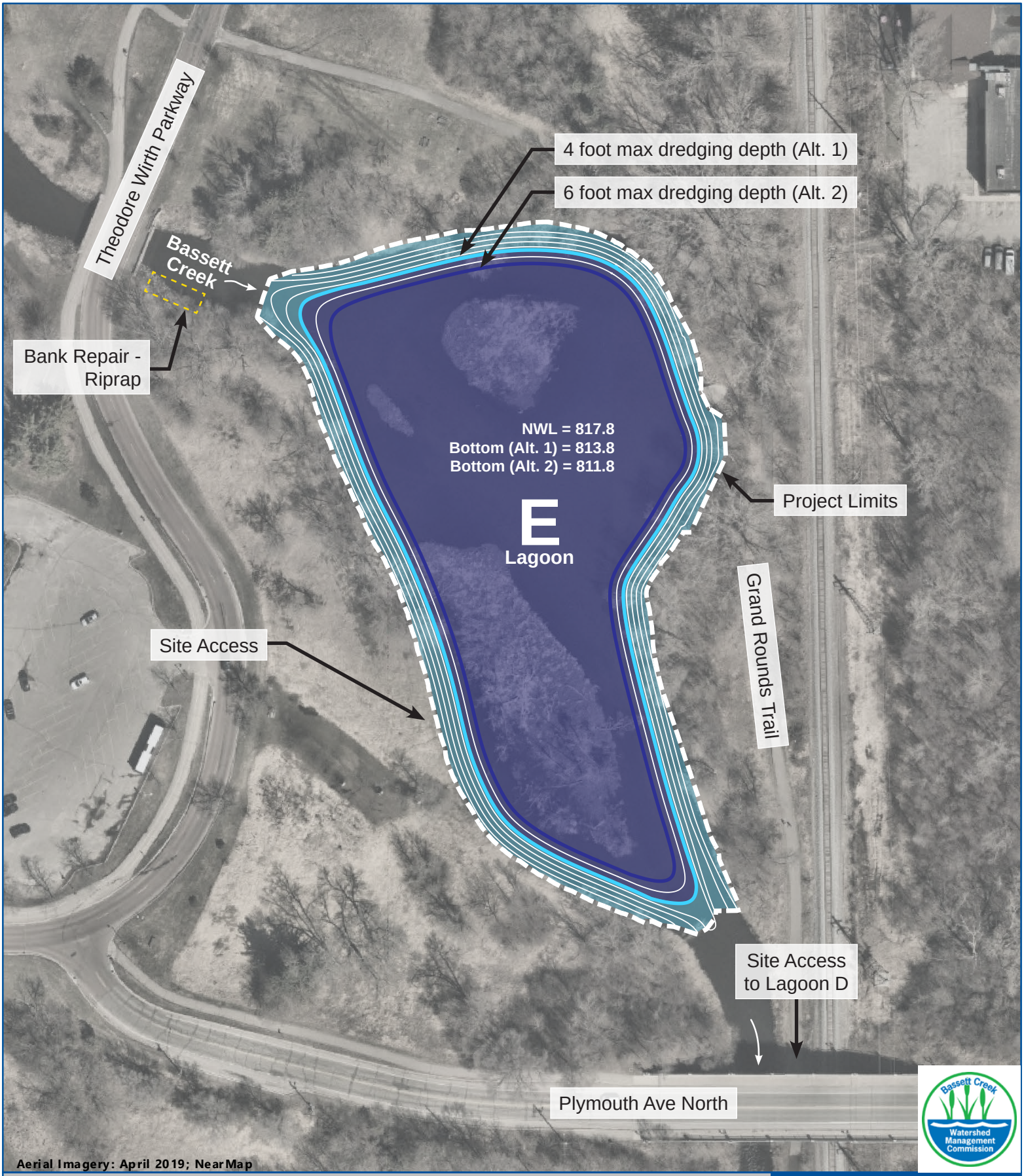
buckthorn growth was limiting visibility of the lagoons, in particular along the trail east of Lagoon E. Additionally the MPRB indicated that there are a large number of undesirable volunteer trees in the area (siberian elm and green ash).

Buffer improvements are not included in the estimated costs for this feasibility study. Further coordination with MPRB during design may identify opportunities to improve the buffer through volunteer efforts or other funding sources (such as through a MDNR Conservation Legacy Grant).

5.5 Bank Erosion Repairs

The minor erosion on the banks identified in Section 3.2.8 at the upstream end of Lagoon E and along the left bank of Lagoon D are relatively small and easily repaired as part of the larger dredging project. Repair of these two locations and associated costs are included with all alternatives that include Lagoon D or E.


Bassett Creek
Grand Rounds Trail
4 foot max dredging depth (Alt. 1)
6 foot max dredging depth (Alt. 2)
NWL = 817.9
Bottom (Alt. 1) = 813.9
Bottom (Alt. 2) = 811.9
F
Lagoon
Project Limits
Site Access
Theodore Wirth Parkway
Aerial Imagery: April 2019; NearMap
Project Area
Proposed 1' Contour
4 foot Dredging Depth (Alt. 1)
6 foot Dredging Depth (Alt. 2)
N
0
50
100
200
Feet
Conceptual Design:
Lagoon F (upstream)
Golden Valley, Minnesota
Figure 5-1



Project Area
Proposed 1' Contour
4 foot Dredging Depth (Alt. 1)
6 foot Dredging Depth (Alt. 2)

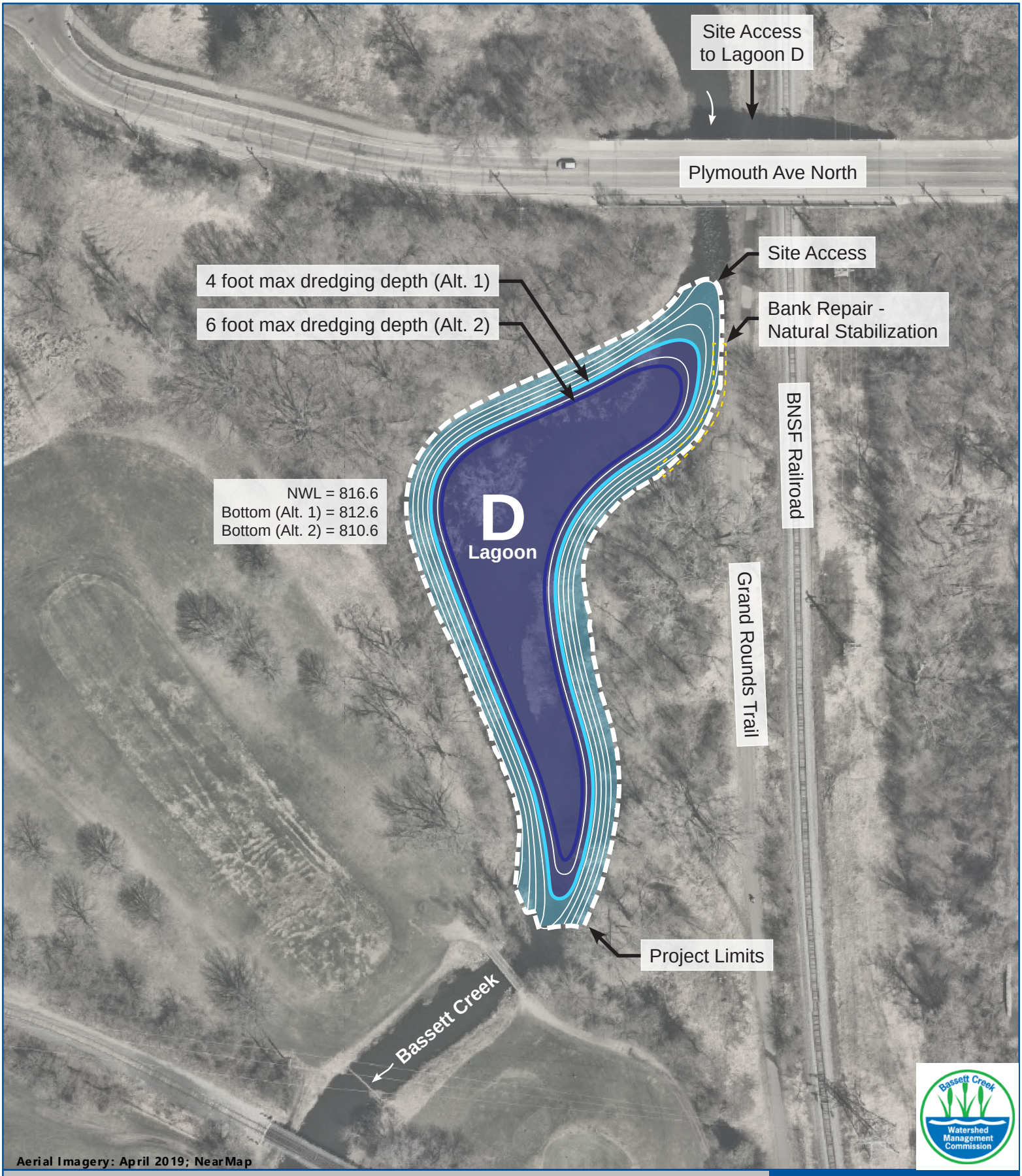
N

0 50 100 200
Feet

Conceptual Design:
Lagoon E (middle)

Golden Valley, Minnesota

Figure 5-2


Site Access to Lagoon D
Plymouth Ave North
Site Access
4 foot max dredging depth (Alt. 1)
6 foot max dredging depth (Alt. 2)
Bank Repair - Natural Stabilization
BNSF Railroad
NWL = 816.6
Bottom (Alt. 1) = 812.6
Bottom (Alt. 2) = 810.6
D
Lagoon
Grand Rounds Trail
Project Limits
Bassett Creek
Aerial Imagery: April 2019; NearMap
Project Area
Proposed 1' Contour
4 foot Dredging Depth (Alt. 1)
6 foot Dredging Depth (Alt. 2)
N
0
50
100
200
Feet
Conceptual Design:
Lagoon D (downstream)
Golden Valley, Minnesota
Figure 5-3

6.0 Project Modeling Results and Potential Impacts

This section discusses the results of the hydrologic, hydraulic, and water quality modeling and provides information on potential project impacts of each concept, including permitting requirements.

6.1 Hydrologic, Hydraulic, and Water Quality Modeling

The purpose of the analyses was to analyze the potential flood reduction impact (restore flood conveyance) and to estimate the water quality benefits from dredging the lagoons to remove sediment islands and vegetation from the floodplain.

Hydrologic and hydraulic information for the project area is available in the form of an XP-SWMM hydrologic and hydraulic model. The BCWMC completed the Phase 2 XP-SWMM model in 2017 for Bassett Creek and its contributing watersheds. This model was used to evaluate the impact of each concept.

Water quality information is available for the project area in the form of water quality monitoring data from the Metropolitan Council Environmental Services (MCES) Watershed Outlet Monitoring Program (WOMP) station. The MCES WOMP station data for Bassett Creek provides total suspended solids (TSS), total phosphorus (TP) and flow data in addition to other water quality monitoring parameters. MCES routinely uses the available monitoring data to calculate pollutant loadings that are reported on monthly and yearly basis.

Final design efforts should include additional refinements to the XP-SWMM and water quality evaluations. Water quality evaluations were based on estimated removal from a Walker (1987) (2) relationship applied to average annual TP load from MCES WOMP monitoring, as it allowed us to account for actual (flow and water quality) monitoring data and the treatment efficiency differences associated with in-line lagoon volumes more accurately than the P8 watershed modeling. Any constructed improvements should be incorporated into the BCWMC XP-SWMM model upon project completion.

6.1.1 Hydrologic & Hydraulic Modeling Results

The existing BCWMC Phase 2 XP-SWMM model cross sections (Figure 6-1) were updated with surveyed data collected in September 2019 to reflect the current conditions as existing conditions. The updated existing conditions BCWMC Phase 2 XP-SWMM model was hydraulically modified to model two design alternatives (1-All and 2-All) within the study area. Storage was modeled as natural cross-sections. The cross-sections were revised based on the proposed design to represent the proposed bathymetric contours for the two alternatives. Maximum flood elevations for the Atlas 14 1-, 2-, 10-, and 100-year recurrence intervals were analyzed and compared for alternatives 1-All and 2-All. As the design alternatives are different only below the normal water level (dead storage), the results are identical for both alternatives (i.e., flood storage occurs above the normal water level).

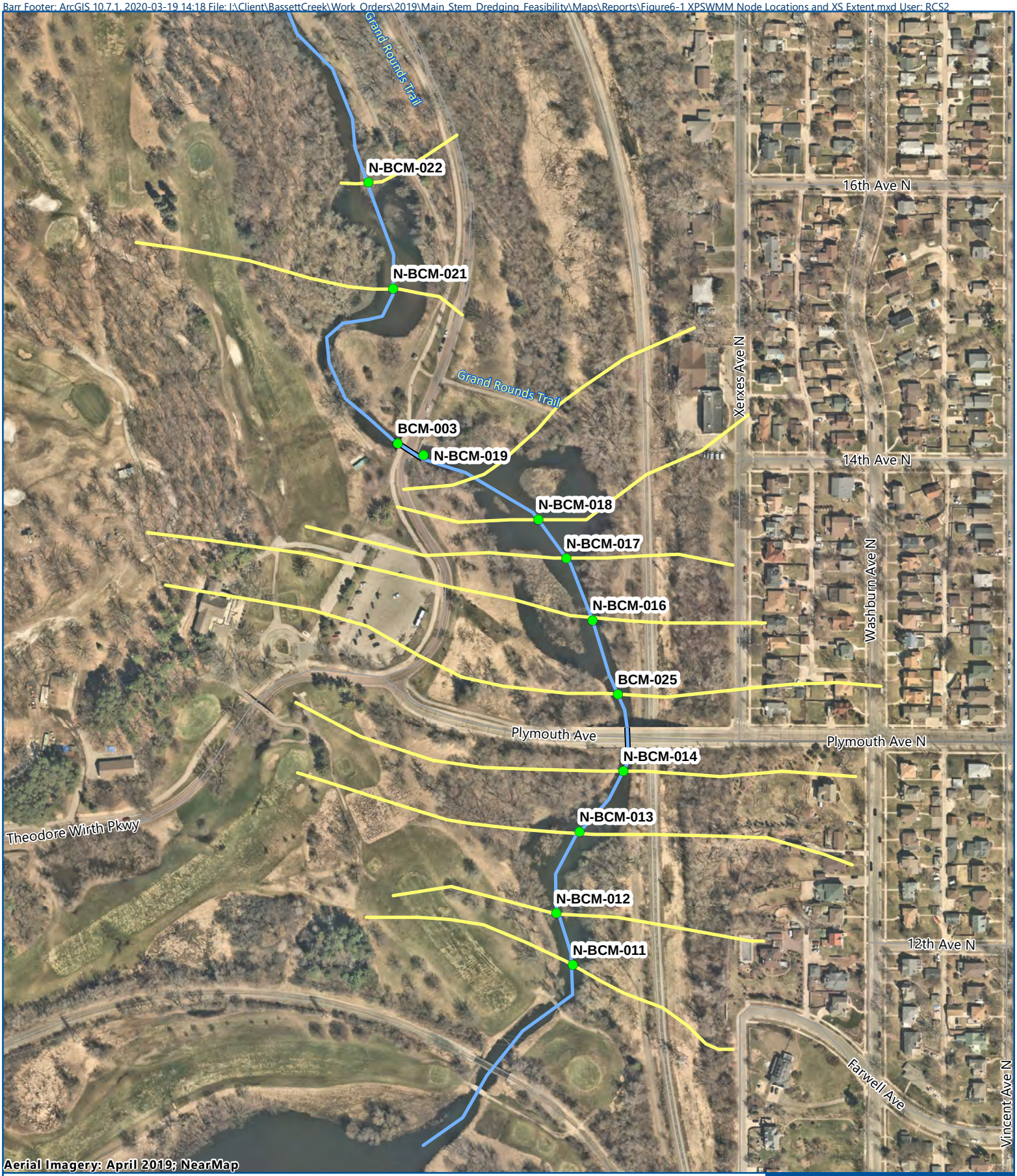
Table 6-1 (the comparative matrix) provides the maximum 1-, 2-, 10-, and 100-year flood elevations for existing and proposed conditions. The results show reductions for all events of up to 0.15 feet

(approximately 2 inches) in peak water surface elevation (WSE) for the 1-year event, and smaller reductions for all other events. The model suggests that the magnitude of the reduction resulting from dredging all three lagoons is small enough that it would be difficult to observe or measure. Modeling of individual lagoon dredging alternatives was not performed due primarily to the small overall magnitude of the change in water surface elevation. With that in mind, dredging Lagoon E has the largest relative increase in cross-sectional area and should represent a larger portion of the reduction contribution when compared to Lagoons D and F.

Table 6-1 Maximum 1-, 2-, 10-year and 100-year flood elevations for existing conditions and the two conceptual designs for alternatives 1-All and 2-All

	1-year maximum flood elevations (1)			2-year maximum flood elevations (1)		
Node Name	Existing	Proposed	WSE Change (ft)	Existing	Proposed	WSE Change (ft)
N-BCM-022	821.78	821.63	-0.15	822.41	822.28	-0.13
N-BCM-021	821.75	821.63	-0.13	822.39	822.28	-0.11
BCM-003	821.72	821.63	-0.09	822.36	822.28	-0.08
N-BCM-019	821.61	821.52	-0.09	822.23	822.15	-0.08
N-BCM-018	821.61	821.52	-0.09	822.23	822.15	-0.08
N-BCM-017	821.61	821.52	-0.09	822.23	822.15	-0.08
N-BCM-016	821.60	821.52	-0.08	822.22	822.15	-0.07
BCM-025	821.59	821.52	-0.08	822.21	822.15	-0.07
N-BCM-014	821.56	821.48	-0.08	822.18	822.11	-0.07
N-BCM-013	821.52	821.48	-0.05	822.15	822.11	-0.04
N-BCM-012	821.52	821.48	-0.04	822.15	822.11	-0.04
N-BCM-011	821.51	821.47	-0.03	822.14	822.11	-0.03
	10-year maximum flood elevations (1)			**100-year maximum flood elevations** (1)		
Node Name	Existing	Proposed	WSE Change (ft)	Existing	Proposed	WSE Change (ft)
N-BCM-022	824.25	824.15	-0.10	826.81	826.73	-0.08
N-BCM-021	824.23	824.15	-0.09	826.78	826.73	-0.05
BCM-003	824.21	824.14	-0.07	826.76	826.72	-0.03
N-BCM-019	823.99	823.92	-0.07	826.67	826.61	-0.05
N-BCM-018	823.99	823.92	-0.07	826.66	826.61	-0.05
N-BCM-017	823.99	823.92	-0.07	826.66	826.61	-0.05
N-BCM-016	823.99	823.92	-0.06	826.66	826.61	-0.05
BCM-025	823.98	823.92	-0.06	826.66	826.61	-0.05
N-BCM-014	823.95	823.89	-0.06	826.61	826.56	-0.05
N-BCM-013	823.93	823.89	-0.04	826.60	826.56	-0.03
N-BCM-012	823.92	823.89	-0.04	826.59	826.56	-0.03
N-BCM-011	823.91	823.88	-0.03	826.58	826.56	-0.02

(1) All elevations are in NAVD 88 vertical datum



XP-SWMM Node

Cross-section Extent

N

0 200 400

Feet

Bassett Creek Watershed Management Commission

XP-SWMM Node Locations and Cross-sections Extent

FIGURE 6-1

6.2 Parkway and Parking Lot Flooding

Prior to this feasibility study, the MPRB and City of Minneapolis raised a concern that sedimentation in Lagoon E was contributing to local flooding of Theodore Wirth Parkway and the adjacent Chalet parking lot. The concern was that the culvert from the parking lot to the lagoon was obstructed by the sediment island on the west-central side of the lagoon. This location was identified on the MPRB's construction plans for the 2014 Main Stem of Bassett Creek Restoration Project prepared by WSB & Associates, Inc. The construction drawings indicated removal of 1,000 CY of sediment from the storm sewer outfall area and construction of a rock vane and rootwad on the bank of the sediment island across from the outlet.

The BCWMC Engineer inspected the area near the parking lot storm sewer outlet following the November 22, 2019 technical stakeholder meeting. During the inspection, a storm sewer junction structure was identified near the lagoon bank, but due to high water levels, the pipe outlet could not be observed. There was no visible evidence that the rock vane or rootwad was constructed, but it is possible these features were obscured by either vegetation or high-water levels. It did appear that there was sufficient distance between the bank of the lagoon and the adjacent sediment island that the storm sewer should function properly.

The XP-SWMM model does not include this storm sewer outlet pipe, and the model resolution is not detailed enough to analyze the flood impacts from a possible obstructed outlet. If dredging of Lagoon E does occur, this pipe should be inspected and televised to confirm if this pipe is obstructed and contributing to local flooding of the parking lot and parkway. If Lagoon E dredging does not occur, this could be inspected and cleaned if needed as part of a storm sewer maintenance project.

6.3 Anticipated pollutant removal

The pollutant (TP and TSS) removals for each alternative were calculated based on the excavated depth, TP removal percentages as provided in a Walker (1987) (2) relationship that provides, and MCES WOMP monitoring data. To calculate the TP load reductions, we used the relative change in basin volume and the Walker (1987) (2) relationship to estimate the TP removal percentage. This removal rate was applied to the average annual TP load, which we obtained from MCES WOMP monitoring data. The relationship was first updated to reflect existing conditions, using the bathymetric survey data collected during this study. The relationship was further updated to reflect the additional permanent pool volume provided by each of the alternatives. We calculated the TSS removals for each alternative based on a NURP-published (Walker, 1990 (3)and Athayde et al., 1983 (4)) relationship, combined with the TP reduction estimates. The time to refill the sediment volume dredged from each lagoon area was calculated based on the amount of sediment removed and an assumed sediment density of 100 pounds/cubic foot.

6.3.1 Alternative 1 - Deepen lagoons to 4 feet

Alternative 1 involves deepening the lagoons to 4 feet to provide additional permanent pool volume. Table 6-2 shows that upon construction of alternative 1, the pollutant load reduction relationships estimate that the combined effect in all three lagoons would result in 101,000 pounds of TSS removal per year and 390 pounds of TP removal per year. The time to refill the sediment volume dredged from all three lagoon areas is estimated to be 91 years with this alternative (see Table 6-2).

6.3.2 Alternative 2 - Deepen lagoons to 6 feet

Alternative 2 involves deepening the lagoons to 6 feet to provide additional permanent pool volume. Table 6-2 shows that upon construction of alternative 2, the pollutant load reduction relationships estimate that the combined effect in all three lagoons would result in 156,000 pounds of TSS removal per year and 600 pounds of TP removal per year. The time to refill the sediment volume dredged from all three lagoon areas is estimated to be 129 years with this alternative (see Table 6-2). The time to refill for ALL lagoon's alternative assumes that the most upstream lagoon fills first, then the second, then the third, therefore the years to refill is the summation of the time to refill for each individual lagoon.

Table 6-2 Water quality benefits summary

Alternative	Lagoon	Dredged Volume (cy)	TSS Removal (lbs/year) (1)	Phosphorus Removal (lb/yr) (2)	Time to Refill w/ Sediment (years) (3)
1 4 Foot Max Depth	F	9,100	39,000	150	30
	E	12,600	52,000	200	41
	D	6,100	9,900	38	20
	ALL	27,800	101,000	390	91
2 6 Foot Max Depth	F	12,200	55,000	210	40
	E	19,300	83,000	320	63
	D	8,100	19,000	75	26
	ALL	39,600	156,000	600	129

(1) Long-term average based on ratio of TP load reduction

(2) Based on estimated removal from Walker (1987) (2) relationship applied to avg annual TP load from MCES WOMP monitoring

(3) Longevity equates sediment volume dredged with sediment removal, based on assumed sediment density of 100 lbs/cubic foot

6.4 Easement Acquisition

All of the proposed work is located on public property, so no additional easement acquisition is anticipated. Also, no temporary construction easements are anticipated to be needed, as all access to the site, construction staging, and grading efforts should all be possible from the roadway or park area. Therefore, the feasibility planning level opinions of cost do not include the estimated cost of permanent or temporary easement acquisition in the project area.

6.5 Permits required for the project

The proposed projects may require the following permits, approvals, and certifications:

Section 404 Permit and Section 401 Certification

Under Section 404 of the Clean Water Act (CWA), the USACE regulates the discharge of dredge or fill material into waters of the United States. The USACE will regulate the work conducted within Bassett Creek. 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. It is likely the proposed project would fall under a USACE Nationwide Permit; however, it is ultimately up to the discretion of the USACE.

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.

The lagoons are part of the Minneapolis Grand Rounds System, deemed eligible for listing on the National Register of Historic Places (once a site is deemed eligible it is treated as being on the list). Initial discussions with USACE indicated that because the lagoons are being restored to the same shape and aesthetic as the original design it is possible this project could be given a "no adverse impact" determination. Any determination by USACE would be subject to SHPO review and concurrence.

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 Golden Valley is the LGU for the project location. The Minnesota Board of Water and Soil Resources (BWSR) oversees administration of the WCA statewide. A permit related to wetland impacts will likely be required. Although it is also likely the project will be covered under WCA no-loss criteria 8420.0415 (B), the LGU will make the final determination.

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 upland soil, which is not anticipated for this project.

This project will need to comply with the MPCA's guidance for managing dredged materials (see Section 3.2.4 for more information).

MDNR Public Waters Work Permit

The MDNR regulates projects constructed below the ordinary high water (OHW) 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 is a public watercourse and Lagoon E is a public water, so the proposed work will require a MDNR public waters work permit. 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 this project would need to occur outside the fish spawning and migration dates.

Environmental Assessment Worksheet (EAW)

The Minnesota Environmental Review Program requires review of projects that could result in significant environmental impacts. The Minnesota Environmental Quality Board (EQB) administers the program, but a regional government unit (RGU) is assigned to conduct the review using a standardized public process to disclose information about environmental effects and methods to minimize or avoid them. This process is designed to help permitting authorities make better-informed decisions regarding the project and the level of environmental review required, either an EAW or an Environmental Impact Statement (EIS).

Minnesota Rules Section 4410.4300, Mandatory EAW Categories, Subp. 27A require preparation of an EAW for "projects that will change or diminish the course, current, or cross-section of one acre or more of any public water or public waters wetland." The rule further states that in this situation, "the local government unit shall be the RGU." Based on these requirements, an EAW is required for the Main Stem Lagoon Dredging project and the City of Golden Valley is the RGU for preparing the EAW.

Per the EQB, the EAW process includes the following general steps:

1. An EAW will be prepared by completing the standard EQB form. The RGU makes a completeness determination according to the EQB rules.
2. When complete, the EAW is made publicly available for a 30-day public comment period. This comment period affords the public and other governmental agencies the opportunity to review and comment on the project and any potential environmental effects.
3. Based on comments reviewed and information provided in the EAW, the RGU decides whether an EIS is required.

MPRB Construction Permit

MPRB Construction Permits are required for construction related activities on parkland and are administered by the MPRB Planning Services Division. Permits may take several days to issue, or longer, depending upon the complexity and impacts of the work. MPRB permits are considered "denied" until a permit is issued.

City of Golden Valley Stormwater Management Permit

The City of Golden Valley requires a Stormwater Management Permit for land-disturbing activities that remove soils or vegetation, including but not limited to clearing, digging, dredging, draining, or filling. Specific projects requiring a stormwater management permit include:

- Activities that disturb more than 4,000 square feet of soils or vegetation
- Cutting, filling, disposal, hauling in, or storage of more than 30 cubic yards of soil
- Construction, expansion, or modification of a stormwater quality treatment facility or stormwater best management practices (BMPs)
- Any land-disturbing activities within the 100-year floodplain or calculated high water level of any water body, or immediately adjacent to any wetland or public water body, including shoreline restoration and creek bank stabilization

7.0 Project Cost Considerations

This section presents the feasibility-level opinion of probable cost of the evaluated alternatives, discusses 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") are assumed to be 30% of the estimated construction costs.

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, it is not necessary to utilize the full range of the acceptable range for the cost estimate; and we assume the final project costs may be between -20% and +30% of the estimated project budget. Table 7-1 summarizes the feasibility-level construction cost estimates for each alternative. Appendix B provides the detailed cost-estimate tables for all concepts.

Table 7-1 Main Stem Lagoon Dredging Project Alternative Cost Summary

Alternative	Lagoon	Construction Cost Estimate (1)	Construction Contingency (2)	Engineering (3)	Capital Cost Estimate (4)
1 4 Foot Max Depth	F	$487,000	$146,000	$190,000	$823,000
	E	$664,500	$199,000	$259,000	$1,123,000
	D	$344,000	$103,000	$134,000	$581,000
	ALL	$1,478,000	$443,000	$576,000	$2,247,000
2 6 Foot Max Depth	F	$641,500	$192,000	$250,000	$1,084,000
	E	$1,000,000	$300,000	$390,000	$1,690,000
	D	$444,000	$133,000	$173,000	$750,000
	ALL	$2,068,000	$620,000	$806,000	$3,145,000

(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 administration.

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

7.1.1 Temporary Easements

The entire project is located on property owned by the MPRB and therefore, no temporary easements are anticipated for project construction.

7.1.2 30-year Cost

The 30-year cost for each concept was calculated as the future worth of the initial capital cost (including contingency and engineering costs) plus the future worth of anticipated annual maintenance and significant maintenance at the end of the concept's estimated useful life. The analysis assumed that no annual maintenance would occur, but the annualized cost does account for future dredging cost for lagoons that would completely fill before 30 years (applies to Lagoon D for both Alternatives). A 3% rate of inflation was assumed. The annualized cost for each concept was calculated as the value of 30 equal, annual payments of the same future worth as the 30-year cost. Table 7-2 presents the 30-year annualized costs and the annualized costs per pound of total phosphorus (TP) and total suspended solids (TSS) removed for each alternative.

7.1.3 Annualized Pollutant Reduction Cost

Section 6.2 provides the estimated annual total phosphorus loading reductions for each recommended conceptual design alternative. The total phosphorus load reductions were estimated by modifying the predicted phosphorus removal efficiency based on the relative change in volume, from the relationship published in Walker (1987) (2), to include the proposed alternatives. The annualized pollutant-reduction cost for each alternative is the estimated annualized 30-year project cost divided by the annual load reduction. Table 7-2 summarizes the annualized pollutant reduction cost.

Table 7-2 Pollutant Reduction Cost Summary

Alternative	Lagoon	Estimated Lifespan (years) (1)	30-Year Annualized Cost (2)	TP Load Reduction (lb/yr) (3)	TP Reduction ($/lb/yr) (4)	TSS Load Reduction (lb/yr) (3)	TSS Reduction ($/lb/yr) (4)
1 4 Foot Max Depth	F	30	$42,000	150	$280	39,000	$1.10
	E	41	$57,300	200	$290	52,000	$1.20
	D	20	$51,700	38	$1,370	9,900	$5.30
	ALL	91	$114,700	390	$300	101,000	$1.20
2 6 Foot Max Depth	F	40	$55,400	210	$270	55,000	$1.10
	E	63	$86,300	320	$270	83,000	$1.10
	D	26	$72,300	75	$970	19,000	$3.90
	ALL	129	$160,500	600	$270	156,000	$1.10

(1) Lifespan equates sediment volume dredged with sediment removal, based on assumed sediment density of 100 lbs/cubic foot
(2) Annualized 30-year future worth, assumes 3% inflation rate.
(3) TP and TSS load reductions from Table 6-2 Water quality benefits summary.
(4) Annualized cost divided by estimated annual pollution load reduction.

The cost per pound of phosphorus removed for this project is low when compared to other BCWMC CIP projects. There may also be opportunities to optimize the design during final design to reduce overall project costs.

7.2 Funding Sources

The planning level estimated costs for the recommended Alternative 2 are Option 1 - $3,145,000 (ALL), Option 2 - $1,690,000 (E only), and Option 3 - $750,000 (D only) (-20%/+30%) (see Section 7.1). The budget amount used as a "placeholder" for this project in the BCWMC CIP is $400,000, which includes administrative, feasibility study, design and construction costs. The BCWMC could consider splitting project funding over multiple levy years, choosing an option/alternative other than those recommended, seeking cost sharing with other entities, and/or moving the project to a future year (after 2026). Grant funding is unlikely for the dredging project.

7.3 Project Schedule

Following the BCWMC's typical CIP implementation schedule, for project construction to occur over winter in 2021/2022, project design should begin in fall 2020. The BCWMC will hold a public hearing on this project at the September 17, 2020 BCWMC meeting. Pending the outcome of the hearing, the BCWMC will officially order the project, the BCWMC will enter into an agreement with a city or the MPRB to design and construct the project, and the BCWMC will certify to Hennepin County a final 2021 tax levy for this project. The construction work would likely begin in the fall of 2021 with final restoration complete in 2022.

Because of northern long-eared bat concerns, tree removal (greater than 3 inches in diameter) should occur during the period from November 1 through April 15, outside of the northern long-eared bat's active season. Additionally, excavation during the winter would be appropriate to complete the major earthwork during periods with less frequent runoff events. The MDNR may require exclusionary fencing to prevent turtles from entering the lagoons. If so, it would have an impact on when bidding needed to happen so that the contractor could install the fencing.

8.0 Alternatives Assessment and Recommendations

In developing a recommendation, the BCWMC Engineer considered the implementation of Alternative 1-All and Alternative 2-All (i.e., the dredging of all three lagoons to either four or six feet, respectively) and the implementation of individual lagoon dredging projects, as a single project or in combination with other lagoon dredging. The main considerations were if the alternatives (or individual lagoon dredging projects) presented cost-effective TP and TSS loading reductions and appeared feasible to permit for construction. The ability of each alternative to improve habitat, flood conveyance, and provide water quality benefits (identified as priorities in stakeholder meetings and goals of the BCWMC) were also taken into consideration in choosing the recommended alternative.

In addition to providing pollutant removal benefits, removing accumulated sediment from the lagoons is necessary to continue to provide flood storage and conveyance along the Main Stem of Bassett Creek. As additional sediment accumulates the lagoons will continue becoming shallower and narrower, forming new islands and increasing the size of existing islands. The sediment islands and associated vegetation may also create flow restrictions and obstructions, causing additional flooding during smaller storm events where flooding may not normally occur.

8.1 Recommendation

The BCWMC Engineer recommends completing one or more of the lagoons from Alternative 2, 6-foot dredging depth, and ordering a project. As compared to the 4-foot dredging depth alternative, dredging to 6-feet provides increased benefits for all project goals, the most significant being project longevity.

To aid in the selection of an option within Alternative 2, the BCWMC Engineer recommends a combined funding and merit-based approach. The options listed below are presented for consideration.

For the selected option, the BCWMC Engineer recommends that the BCWMC use the opinions of cost identified in this study to develop a levy request for the selected project and that the project proceed to design and construction. Due to the high cost of all options within this alternative, we anticipate that the BCWMC would likely need to spread the CIP funding over more than one year to construct the project.

Option 1 - All Lagoons

Under this option (the highest cost option), all three lagoons (D, E, and F) would be dredged to 6 feet. The annualized pollutant reduction costs indicate that this option is the most cost effective; it also has the longest lifespan. Completing the lagoons as a single project offers several advantages:

- Reduces duration of impacts to Theodore Wirth Regional Park roads, trails, and park users
- Reduces duration of impacts to aquatic species and other wildlife
- Reduces overall cost when compared to dredging all three lagoons individually (due to economies of scale, reduced mobilization/demobilization, reduced permitting and engineering, and redundant work)
- Returns the aesthetics of the three lagoons closest to the original design intent

Option 2 - Lagoon E Only

Under this option, Lagoon E would be dredged to 6 feet. This lagoon is the largest and has experienced the most significant changes over its lifetime as compared to Lagoons D and F. In addition to having the longest lifespan (time until the lagoon re-fills with sediment), dredging Lagoon E has the largest anticipated benefit for flood reduction.

Option 3 - Lagoon D Only

This option would dredge Lagoon D to 6 feet. This is the smallest of the three lagoons and represents the most economical option from Alternative 2. This option is most closely aligned with the funding that the BCWMC has currently allocated toward the project.

9.0 References

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

2. **Walker, W.W., Jr.** *Phosphorus Removal by Urban Runoff Detention Basins, Lake & Reservoir Management, 3: 314-326.* 1987.

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5. **Bassett Creek Watershed Management Commission.** Resource Management Plan for Basset Creek Watershed Management Commission Proposed Water Quality Improvement Projects 2010 - 2016. 2009.

6. **Rosgen, D.L.** *Watershed Assessment of River Stability and Sediment Supply (WARSSS).* Fort Collins, CO : Wildland Hydrology Books, 2006.

7. **Minnesota Board of Water and Soil Resources (MN BWSR).** Pollution Reduction Estimator - Water Erosion - Excel Version. [http://www.bwsr.state.mn.us/elinkupdate/Pollution_Reduction_Calculator_Manual.pdf]. 2010.

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

9. **Minnesota Pollution Control Agency and Bassett Creek Watershed Management Commission.** *Medicine Lake Excess Nutrients Total Maximum Daily Load.* November 2010.

10. —. *Medicine Lake Excess Nutrients Total Maximum Daily Load Implementation Plan.* September 2010.

11. **Minnesota Pollution Control Agency.** *2014 Proposed Impaired Waters List.* [https://www.pca.state.mn.us/sites/default/files/wq-iw1-47.pdf]. April 2014.

12. **Bassett Creek Watershed Management Commission.** *2015 Biotic Index Evaluation of Plymouth Creek and Bassett Creek.* 2016.

13. **Minnesota Pollution Control Agency.** *MPCA Stream Habitat Assessment (MSHA) Protocol for Stream Monitoring Sites.* 2014.

Appendices

(in Separate PDF)