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Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Co.
Subject: Item 5A – Review Draft Feasibility Study for Crane Lake Improvement Project via Ridgedale Drive (CIP #CL-3) – Minnetonka, MN
BCWMC September 20, 2018 Meeting Agenda
Date: September 12, 2018
Project: 23270051 2018 640

5A Review Draft Feasibility Study for Crane Lake Improvement Project via Ridgedale Drive (CIP #CL-3) – Minnetonka, MN

Summary:

Proposed Work: Crane Lake Improvement Project (CIP #CL-3) as part of Ridgedale Drive Reconstruction

Basis for Review at Commission Meeting: Draft CIP Project Feasibility Study Review

Recommendation: Request additional information for the recommended BMPs, and request that the feasibility study be resubmitted to BCWMC for review and approval at a later meeting.

Background

The Bassett Creek Watershed Management Commission's (BCWMC) 2015-2025 Watershed Management Plan (Plan) addresses the need to improve the quality of stormwater runoff reaching the Mississippi River by reducing nonpoint source pollution, protecting and enhancing fish and wildlife habitat, reducing stormwater runoff volume to improve water quality, and taking into account aesthetics and recreational opportunities within the watershed. The Plan's 10-year Capital Improvement Program (CIP, Table 5-3 in the Plan, as amended) includes a project for retention of impervious area drainage in the Ridgedale Center area. The BCWMC approved the 5-year (working) CIP at their April 19, 2018 meeting, which included implementation of the Crane Lake Improvement Project (CIP #CL-3), as part of the Ridgedale Drive reconstruction project, in 2020. If approved, CIP #CL-3 will be funded by the BCWMC's ad valorem levy (via Hennepin County).

In accordance with the BCWMC Plan and Joint Powers Agreement, the City of Minnetonka prepared and provided a draft feasibility study to the BCWMC Engineer for review. The following is a summary of the draft feasibility study and the BCWMC Engineer's recommended revisions for the draft feasibility study.

Feasibility Study Summary

The City of Minnetonka's draft *Stormwater Management Feasibility Analysis* (WSB, August 13, 2018; updated September 10, 2018) examines the feasibility of several water quality improvement alternatives

for the pond south of Ridgedale Center and Ridgedale Drive (Ridgedale Pond), the pond to the northeast of Ridgedale Center (northeast pond), and runoff from Ridgedale Center and Ridgedale Drive. The water quality improvement options selected for implementation would be constructed as part of the city's Ridgedale Drive Reconstruction project, scheduled for construction in 2019.

The feasibility analysis identifies eight water quality improvement options, including:

- Option 1 – Dredge Ridgedale Pond to address future maintenance needs and improve pollutant removal efficiency
- Option 2 – Modify Ridgedale Pond outlet to provide low flow drawdown and enhanced treatment in-between rainfall events
- Option 3 – Reuse stormwater from Ridgedale Pond for irrigation
- Option 4 – Install stormwater treatment BMPs in Ridgedale shopping center parking lot upstream of Ridgedale Pond or the northeast pond
- Option 5 – Install stormwater runoff BMPs to provide treatment systems for runoff not currently receiving treatment prior to discharge to Crane Lake
- Option 6 – Periodically dose stormwater ponds with alum to improve water quality and reduce rate of internal sediment nutrient release
- Option 7 – Divert high chloride snow-melt water to reverse osmosis treatment system
- Option 8 – Divert high chloride snow-melt runoff to sanitary sewer

The feasibility study evaluated these eight options at a high level, and based on input from City of Minnetonka staff, the eight options were narrowed down to three recommended options. The feasibility study further evaluated these three recommended options (option 5, option 6, and option 8) for BCWMC consideration as part of the CIP #CL-3 project. The three options are further discussed below. Table 1 from the feasibility study, edited for clarity, is provided below and compares the three recommended options.

The study also discusses alternatives to reduce inundation depths in the Ridgedale Center parking lot during the 100-year storm event. However, these alternatives are part of the Ridgedale Drive conveyance analysis and are not part of the CIP #CL-3 project, and were therefore not reviewed by the BCWMC Engineer.

Option 5 – Stormwater Treatment for Untreated Runoff to Crane Lake

According to the feasibility analysis, stormwater runoff from 13.4 acres currently flows to Crane Lake without treatment. This option includes constructing a stormwater pond or underground treatment system in the southeast part of the study area, either in public right-of-way, the Ridgedale shopping center, or in a private parking lot at the Sheraton Minneapolis West hotel, adjacent to Crane Lake. The feasibility study indicates that, based on the type of BMP selected, treatment could be provided through sedimentation, skimming, or filtration, although details on the specific types of BMPs have not been provided. This alternative would require coordination with private property owners and an easement for the proposed stormwater utilities, especially if located in the private parking lot.

Option 6 – Alum Treatment in Ridgedale Pond

This option includes implementing alum treatment in Ridgedale Pond to reduce internal phosphorus loading and reduce total phosphorus in the water column, either through periodic dosing or regular titration of alum into the pond based on inflows.

Option 8 – High Chloride Snowmelt Runoff Diversion to Sanitary Sewer

This option includes the pumping of snowmelt runoff from the Ridgedale Pond watershed to the Metropolitan Council Environmental Services (MCES) sanitary sewer, rather than discharging to Crane Lake (which has elevated levels of chlorides). The snowmelt runoff maybe be captured in a subsurface storage tank or pumped directly from Ridgedale Pond. This option will require further evaluation of the feasibility and permitting requirements for diverting snowmelt runoff with high chloride concentrations to the sanitary sewer, and if that will be allowed by the MCES. Additionally, this option does not reduce the private application of chlorides and salts in the watershed; however, it would divert the chloride load away from Crane Lake. This diverted runoff would be sent to the MCES wastewater treatment plant (although treatment in the plant will not remove/reduce chlorides) and this water would ultimately discharge to the Mississippi River.

Table 1: Features, Costs, and Benefits of Recommended Options

Recommended Options		Watershed Area (acre)	Pollutant Addressed	Raw Loading (Pound/Year)[1]	Existing Percent Removal (%)	Proposed Percent Removal (%)	Annual Pollutant Removal (Pound/Year)	Total Project Capital Cost ($)	Annualized 30-Year Life Cycle Cost ($/Year)	Annualized Cost per Pound of Pollutant Removed ($/Pound/Year)
Option 5	Construct a pond or underground treatment system for untreated runoff to Crane Lake (CL-417B)	13.4	TSS	5,360	0	80	4,300	$390,000	$18,000[4]	$4.20
			TP	20.1	0	50	10			$1,800
Option 6	Implement alum treatment in Ridgedale Pond (CL-410)	97.9	TP	149.2	72	85	20	N/A[3]	$25,000	$1,250
Option 8	Monitor snowmelt and divert runoff with high chloride concentrations from the Ridgedale Center parking lot to the sanitary sewer[2]	97.9	TSS	40,077	94	100	3,610	$150,000	$45,000[5]	$12.50
			TP	149.2	72	100	41.8			$1,080
			Chloride	52,600	0	95	50,000			$0.90

[1] Existing information from *Crane Lake – Water Quality and Subwatershed Assessment* dated June 2017.

[2] This option will treat 24 acre-feet per year, which assumes three inches of snowmelt runoff volume for the winter months, based on monthly average precipitation data.

[3] Limited capital costs as this is a lease option.

[4] Assumes $5,000 maintenance cost per year during 30-year life cycle.

[5] Assumes $32,000 in MCES treatment charges and $8,000 maintenance per year

Recommendations

The Commission Engineer recommends the following revisions to the draft *Stormwater Management Feasibility Analysis 2019 Ridgedale Drive Reconstruction and Crane Lake Improvement Project (BCWMC CIP #CL-3)* (dated 9/10/2018):

Note: At the request of the City of Minnetonka, we focused our feasibility study review on the three recommended water quality improvement projects (Options 5, 6, and 8), and did not focus efforts on projects that were evaluated at a high level but were eliminated for consideration by the City of Minnetonka during the development of the feasibility report.

1. Two different pieces of information were provided for use in the Crane Lake Feasibility Study:
    a. The excerpt from the 2014-2016 Subwatershed Assessment Report (including the revised P8 model), dated June 2017, completed by Barr for the City of Minnetonka
    b. The 2016 Water Quality Summary for Crane Lake, developed by Barr for the BCWMC

    The references to these studies need to be revised in the Feasibility Study to reference the correct study and for whom the study was completed.
2. For the recommended options (at a minimum), the report should identify the BCWMC objectives (from the Watershed Management Plan) that are addressed by each of the alternatives.
3. Eight water quality improvement options were evaluated at a high level and summarized in the feasibility study report, but based on City input, only three options were selected by the City for further evaluation/consideration. The report should provide the pros and cons of each alternative so it is clear to the Commission why the recommended alternatives were selected/preferred.
4. All figures in the report should be titled, numbered, and referenced in the text accordingly, so it is clear what figure the reader should be reviewing as they are reading the report text.
5. Section II should include a brief summary of the existing water quality in Crane Lake, focusing at a minimum on total phosphorus and chloride concentrations in comparison with MPCA state standards/potential impairments, as these pollutants are the focus of the alternatives considered.
6. Section V, paragraph 1 references small pretreatment ponds that treat runoff from areas of Ridgedale Drive downstream of Ridgedale Pond or the pond to the northeast of Ridgedale Center. It is not clear what ponds this statement is referring to and is not clear on the figures provided. A figure should be included highlighting all of the existing ponds that are referenced in this paragraph, including Ridgedale Pond, the northeast pond, the small pretreatment ponds, and Crane Lake.
7. Section V, paragraphs 1 and 3, discusses the existing ponds that provide treatment upstream of Crane Lake. The report should include a summary of the existing pollutant removal, as a percentage and as estimated pounds per year, in the existing ponds at Ridgedale Center, for both the south and northeast ponds.
8. Section VI includes cost estimates for various stormwater treatment improvements. For the recommended options (at a minimum), the report text should clearly state the cost assumptions for construction, contingency, planning, engineering, and design to support the provided cost estimates. A similar footnote should be added to the Total Project Capital Costs heading in Table 1 to reflect these assumptions.
9. Section VI, item 1) outlines the potential dredging of Ridgedale Pond. Barr Engineering provided a P8 model for the City of Minnetonka to use in the BCWMC Crane Lake Improvement Project; this model was originally developed for the BCWMC and was updated on behalf of the city for a more recent study. The existing treatment performance of the pond noted in the text is based on

the provided P8 model. However, Barr did not complete the P8 analysis for this feasibility study as the text indicates. This should be revised and clarified in the text.

10. Section VI, item 5) (Option 5) describes the project to provide treatment of 13.4 acres of untreated watershed runoff along Ridgedale Drive. The BMP as evaluated is listed as either a pond or underground treatment system. The report should clarify this alternative, as summarized below:
    a. The report needs to clarify the details of the proposed BMP. What is the anticipated size/volume of the proposed BMP? Is this BMP intended to treat 1.1 inches of runoff from the impervious surfaces of the watershed? Assuming the watershed is approximately 70% impervious and the BMP is to provide treatment of 1.1 inches of runoff, the estimated volume would be 37,500 cubic feet. The costs can vary greatly, depending on the type of system implemented (surface versus subsurface). Additionally, using typical subsurface construction costs per volume provided, we would estimate a project construction cost of $375,000 - $750,000, which is significantly higher than the $300,000 estimate provided.
    b. As identified, this project will be primarily located on private property (at the Sheraton Minneapolis West Hotel) and will require the purchase of an easement. The estimated footprint of the BMP and the associated easement area should be summarized as part of this feasibility study, as the easement cost could be significant. The total project capital cost should also include the estimated easement cost.
    c. The report identifies public education as a potential part of this feature. The proposed cost estimate should include costs for the development of an educational experience.
    d. The report should discuss the permitting requirements for this option.
11. Section VI, item 6) (Option 6) describes the project to treat the Ridgedale stormwater ponds with alum to target internal sediment nutrient release and improve water quality. The report should clarify this alternative, as summarized below:
    a. The heading description of the project indicates treatment of multiple ponds at Ridgedale although the figure of the alternatives and Table 1 only suggest that this is alum treatment of Ridgedale Pond. The project heading/description should be clarified.
    b. Recent water quality monitoring of Ridgedale Pond is limited to one sample collected in July 2018. Typically, alum treatment is intended to manage internal loading; however, it is not clear that internal loading is an issue in this pond. A summary of the water quality from the July 2018 sample should be included in the discussion for this alternative and if this indicated elevated phosphorus levels due to internal loading.
    c. There are two approaches proposed to performing the alum treatment: 1) titration of alum into the pond based on flow rates and 2) period batch treatments based on rainfall or water quality sampling. Further discussion of these options are needed based on the questions provided below:
        i. A system that titrates into the pond based on flow rates into/out of the pond will result in the constant development and settlement of an aluminum hydroxide precipitate (floc) that will accumulate in the pond. These systems typically include a floc settlement pond that collects the settled floc, which can then be managed by removal from the pond (e.g. pumping to the sanitary sewer). As proposed, it appears that the alternative will use the existing stormwater pond for the collection of floc; however, more details on how this would be managed needs to be discussed before this approach can be further considered. What is the anticipated flow rate to be treated? Where would the temporary/permanent

dosing equipment/chemical storage be installed (the discussion suggests that this equipment would be rented)? Does the pond have the buffering capacity for the proposed dosing/frequency of alum?

ii. For a system that does batch treatment of the pond, how frequently would these applications occur? Where would the temporary/permanent dosing equipment/chemical storage be installed (the discussion suggests that this equipment would be rented)? How would this alum be evenly distributed through the pond for this approach? Does the pond have the buffering capacity for the proposed dosing/frequency of alum?

d. Based on the limited detail provided for the alum treatment concepts, the total phosphorus removal for this option as presented appears high. The report assumes that alum treatment will increase phosphorus removal to up to 85% from the existing removal by Ridgedale Pond of 72% for ALL runoff. Based on a summary for alum treatment on the Lake Management page on the MnDNR website, suggests removals of at or above 80%. (https://www.pca.state.mn.us/water/lake-protection-and-management). Monitoring of the Tanners Lake alum treatment system in the Ramsey-Washington Metro Watershed District indicated removals of 70-80% for treated runoff (https://www.rwmwd.org/projects/tanners-lake-alum-treatment-facility/); however, it is important to note that approximately 15% of flows bypass this treatment system. If 85% removals are applied for the effectiveness of the treatment for ALL runoff to Ridgedale Pond, further documentation of studies supporting these removals should be provided. The report should also summarize additional details about each of the alum concepts that support that the concept will be able to treat to that level. The report indicates that only 100 acre-ft of runoff would be treated (during non-winter months) which is approximately 70% of the annual runoff volume to the pond, which suggests that not ALL runoff would be treated, which conflicts with the pollutant removal estimates.

e. The report should discuss the permitting requirements for the two alum treatment options, including follow-up with the appropriate agencies. The conversations with agency staff will likely determine if the agencies would allow the alum application approaches for Ridgedale Pond. Ridgedale Pond is a MnDNR public water (27-735W) and the proposed option will likely trigger a MnDNR public waters work permit. Depending on the type of alum system proposed, other permits may be required, such as an MPCA NPDES permit.

f. The cost estimate does not include any upfront total project capital cost, and only includes an annual lease rate, alum cost, and operation and monitoring cost. Costs for the potential management of floc should also be considered. Based on the number of unknowns to these concepts at this time, it is not realistic to assume that there are no initial capital costs for this option. Capital costs should include estimates for further evaluation and development, monitoring, engineering and design, permitting, treatment system location and site preparation (even for installation of a temporary system), and potentially easement purchase for this space if not located on public property. The feasibility report should include additional discussion related to these costs.

12. Section VI, item 8) (Option 8) describes the project diverting high-chloride snowmelt runoff to the sanitary sewer system. The report should clarify this alternative, as summarized below:

    a. As discussed in the report, the watershed area to be diverted to the sanitary sewer reflects the entire watershed to Ridgedale Pond, which includes a portion of Ridgedale Center, as well as the watershed area to the south. Based on previous discussions with

city staff and their consultant regarding this option, our understanding is that the focus of this option would be on the Ridgedale Center runoff, especially if the runoff was collected in a subsurface storage tank, rather than being pumped directly from Ridgedale Pond. The report should clarify these two different approaches for this option.

b. The option that considers drawing down Ridgedale Pond to store snowmelt in the winter, indicates that 20 acre-ft of storage could be developed; however, this assumes that the pond is completely drawn down. Ridgedale Pond is a MnDNR public water (27-735W) and it is unlikely that the MnDNR would allow a complete drawdown as proposed. This option and the associated assumptions should be reviewed and clarified in the report, and based on the proposed pumping rates the report should summarize the volume of snowmelt storage that is needed. Pollutant removals should be revised based on the estimated fraction of snowmelt than can be intercepted based on the contributing watershed, pumping rate, and proposed storage, which should be based on modeling.
c. For the option that would consider storing snowmelt in a subsurface storage tank, what volume of snowmelt storage is proposed? Does this option only target the collection of runoff from Ridgedale Center or the entire watershed to Ridgedale Pond? This option and the associated assumptions should be reviewed and clarified in the report. Pollutant removals should be revised based on the estimated fraction of snowmelt than can be intercepted based on the contributing watershed, pumping rate, and proposed storage, which should be based on modeling.
d. The report should include a discussion of the estimated chloride concentrations in the snowmelt runoff and state the assumed chloride concentration used to quantify the estimated load reduction. The report should also include a discussion of the estimated runoff between December and April.
e. Because there are two potential collection methods for the snowmelt diversion option, separate cost estimates should be developed for each collection method as they can result in significantly different costs. For the option that includes a subsurface storage tank, the cost of the tank should be included (along with the anticipated lift station and monitoring costs) as well as any easement costs. If located on public property, this should be noted in the report. Once constructed, we would anticipate the annual operation and maintenance costs would be similar for the two collections methods, assuming they intercept similar amounts of snowmelt volume.
f. The report should discuss the permitting requirements for the option and include follow-up discussion with the appropriate agencies. For both collection options, this will include a summary of discussions with MCES to-date, if discussions indicate if MCES will consider a snowmelt diversion to the sanitary sewer, and anticipated next steps for this alternative. Additionally, for the option considering pumping from Ridgedale Pond and proposing drawdown of the pond to provide storage for snowmelt, because this pond is a MnDNR public water (27-735W), this option will likely trigger a MnDNR public waters work permit and require approval from the MnDNR.
g. The report should include discussion of sanitary sewer capacity issues that should be considered as part of this project and how the proposed alternatives could be developed to minimize impact on the existing sanitary sewer system.
h. The report discussion should also include a clear summary of how this alternative does not physically remove chlorides, but how it will remove chloride loads to Crane Lake/Bassett Creek but these loads are ultimately going to pass through the wastewater treatment system (untreated) and be discharged to the Mississippi River, etc.

13. The 30-year annualized costs and cost-benefits for recommended stormwater treatment improvement project options will likely need updating, based on the revised cost and pollutant loading estimates in response to the above comments. The report should also discuss the life span and interest rates used for the annualized costs.
14. Section VII. C heading should be more general, such as "reduce pollutant loading to Crane Lake" as one of the options also reduces chlorides.