Item 5Bi
BCWMC 4-18-13

TECHNICAL MEMORANDUM

TO: Jeff Oliver, PE – City Engineer
City of Golden Valley

FROM: Justin Klabo, PE – Water Resources Engineer

DATE: March 27, 2013
(Updated April 10, 2013)

RE: Lakeview Park Pond Preliminary Design
BCWMC Technical Advisory Committee – Project Update
SEH No. GOLDV 122415 14.00

Background

In 2004, the City of Golden Valley completed a Feasibility Report for Lakeview Park as part of the Bassett Creek Watershed Management Commission (BCWMC) CIP. The study identified water quality benefits, potential to reduce flooding throughout the park, removal and replacement of the sanitary sewer through the park, and the overall feasibility of constructing a storm water pond within the park. The proposed project was not funded in 2004; however the project has been included within the BCWMC CIP for 2013. An update to the 2004 Feasibility Study was provided to the Commission in June of 2011. The update included project information, clarification of the project scope and an updated cost estimate to be included within the CIP.

The City of Plymouth has pursued improvements to the same drainage system by constructing a storm water pond on City owned property immediately upstream of Medicine Lake. However, the Plymouth storm water pond is not adequately sized to treat all of the storm water from the trunk storm sewer system to BCWMC Level I standards. Based on previous studies, the Plymouth storm water pond removes approximately 38% of the Total Suspended Solids (TSS) and 23% of the Total Phosphorous (TP) from the runoff of the watershed. New construction requirements implemented by BCWMC require storm water ponds to remove 90% of the TSS and 60% of the TP from the contributing watershed. Therefore the Plymouth pond does improve water quality downstream but does not meet BCWMC Level I standards.

Introduction

The City of Golden Valley requested that SEH provide professional services for the construction of a storm water pond within Lakeview Park. The goal of the project is to design and develop construction documents for a storm water pond that is designed to meet BCWMC Level I standards for the contributing drainage area. A budget was set by BCWMC based on the estimate developed in the 2011 update to the commission for engineering and construction costs for the pond. The funding includes $196,000 from BCWMC and a $50,000 match by the City of Golden Valley, totaling $246,000 for engineering, construction and administration fees.

SEH is currently in the preliminary design phase of the project. Constraints to the site and other factors affecting the overall project cost that were not identified during the original drainage study completed in 2004 have arisen. Therefore it was deemed necessary to bring the project before the BCWMC Technical Advisory Commission (TAC) for discussion.

The purpose of this technical memorandum is to summarize the work that has been completed to date by the City of Golden Valley and SEH.

Lakeview Park is located approximately two blocks east of Trunk Highway 169 (T.H. 169), between Olympia Street and Winsdale Street North (see **Figure 1**). The park features include a baseball field, picnic area, shelter, soccer field, trail, and green space. Based on historical data, the area appeared to be a wetland and was hydraulically connected to Medicine Lake. When the area was developed, the wetland was filled to accommodate homes and roadways. The park is located in the center of a closed basin (i.e. a low area with no natural outlet). A trunk storm sewer line was installed during the time of the original development to drain the basin/low area into Medicine Lake. The trunk storm sewer line is the only outlet for the park and it extends west, under T.H. 169 and discharges into Medicine Lake.

Two areas in the park are prone to flooding; (1) the baseball field located in the northwest portion of the park (baseball field), and (2) the green space area located in the northeast portion of the park (green space). These two areas are separated by a berm formed by the construction of the trunk storm sewer line through the park. The trunk storm sewer line through the park is relatively shallow therefore fill material had to be placed over the pipe to provide cover over the pipe. The green space area experiences ponding for extended periods following rainfall events rendering the area unusable for park recreational activities. Under normal rainfall conditions (i.e. no extended period without rainfall), the area remains saturated. Site photos have been attached for review.

Geotechnical Investigation

A geotechnical investigation was performed by American Engineering Testing Inc. (AET) of St. Paul Minnesota and laboratory testing was performed by Soil Engineering Testing (SET) of Richfield, Minnesota. The soils investigation consisted of performing three soil borings throughout the park. Soil boring depths ranged from 30 to 60 feet.

Soil conditions at the site consisted of 2 to 4 feet of variable fill over swamp deposits. The fill consisted of a mixture of clayey sands, lean and fat clays, with some roots, organic material and gravel. The fill appeared to be placed in an uncontrolled fashion and was simply graded and not compacted. The swamp deposits below the fill consist of soft to very soft peats and organic clays that should be considered highly compressible. Below the swamp deposits layers of sandy lean clay and clayey sand till extend to layers of sandy coarse alluvium. The upper 5 feet of the till is very soft to soft and at greater depths the till is generally stiff to very stiff.

Based on the presence of swamp deposits and soft soils at the site, the outlet system will need to be placed on piling to prevent settlement from occurring. In addition, the swamp deposits have the potential to transfer vibrations from construction activities to adjacent structures. Therefore precondition surveys are recommended to be completed on the adjacent homes and vibration monitoring equipment installed to prevent structural damage.

Ground water was observed in all three borings during drilling. A piezometer was installed in one of the boreholes to get a more accurate measurement of the groundwater elevation. Based on the data obtained to date, the groundwater elevation is at an elevation of approximately 887.4 feet or approximately 7 feet below the ground surface elevation.

Hydrologic and Hydraulic Analysis

Existing Conditions
An existing conditions hydrologic and hydraulic model was developed to evaluate the current High Water Levels (HWLs) within the park. XPSWMM was used to dynamically model the system using data obtained from as-builts, 2011 LiDAR data and the previous study completed in 2004.

The model included the entire trunk storm sewer line which extends from upstream of Lakeview Park (Winsdale St. N.) to Medicine Lake. The existing conditions model determined that during the 100-year storm event, the green space area experiences just over 3 feet of ponding or a HWL of 897.2'. There are 4 homes located adjacent to the park whose rear-yards back up to the low lying area of the park. The ground elevation adjacent to each structure was surveyed (see **Table 1**). The surveyed point at each building approximately represents the finished floor elevation (FFE). Three of the four homes located along the park are within 0.4 feet of the 100-year HWL of the park. On all four parcels, the 100-year HWL extends onto each property (see **Figure 3**).

Table 1. Critical Building Elevations

Property	Approximate FFE
1529 Gettysburg Ave	902.6
1521 Gettysburg Ave	897.6
1517 Gettysburg Ave	897.3
1513 Gettysburg Ave	897.5

- 100yr HWL - 897.2'

Causes of Flooding
The cause of flooding within Lakeview Park was determined to be the result of three primary factors; (1) an undersized trunk storm sewer line downstream of the park, (2) the trunk storm sewer is relatively shallow as compared to the green space area of the park, and (3) limited live storage within the park below critical building elevations.

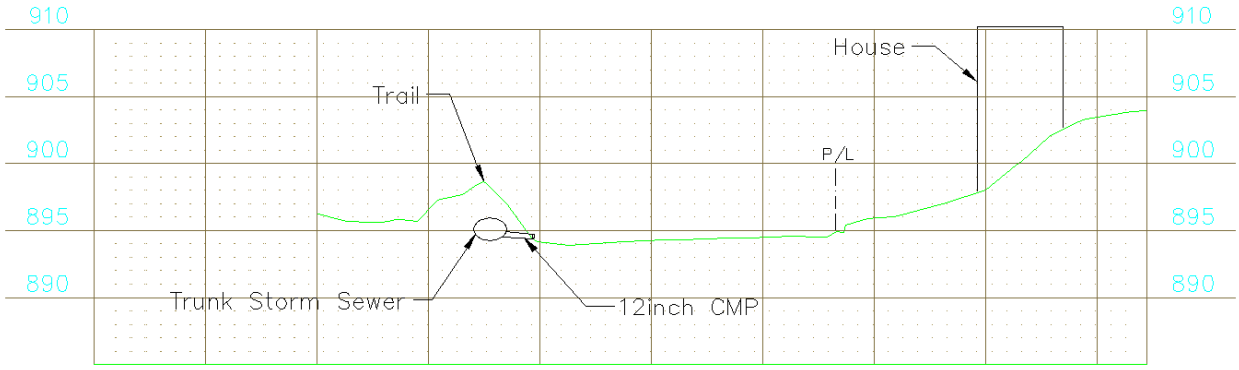
- (1) Undersized Trunk Storm Sewer Line – The trunk storm sewer line within the park surcharges as a result of the limited downstream capacity. This causes storm water to be forced out of 12inch CMP and into the green space area. Even though the purpose of the 12inch CMP is to drain the green space area, it actually serves as an outlet pipe for the trunk storm sewer system during surcharged conditions. The storm water that has entered the green space area is only able to be discharged back into the system once the water level in the downstream pipe has dropped. The trunk storm sewer line downstream of the park is made up of circular and arch reinforced concrete pipes. Sections of the system are relatively shallow as compared to the ground surface elevation therefore arch pipes were used in these locations to maintain adequate cover.

- (2) Shallow Trunk Storm Sewer Line –The second factor that causes flooding within the park is the relative elevation of the low area as compared to the invert elevation of the trunk storm sewer line. The low area within the green space is actually lower by approximately 0.2 feet than the invert of the trunk storm sewer line. The invert of the 12inch CMP on the trunk storm sewer line is 0.55 feet higher than the invert of the trunk line. Therefore storm water discharges into the

park after only building up 0.55 feet in the 50inch Span CMP-A trunk storm sewer line. If the trunk storm sewer line was lower, storm water would be conveyed downstream before discharging into the green space area under free flow conditions.

- (3) Limited Live Storage – The third cause of flooding is the limited live storage or allowable bounce in the park. The elevation at the property line of the residential parcels ranges from 0.5 feet to 1.5 feet higher than the low point in the green space area. Effectively the ponding area only has 0.5 feet of live storage before storm water is ponding on residential properties. The detail provided below illustrates the buildings, trail and property line relative to the existing topography at 1517 Gettysburg Avenue.

Section A-A (see Figure 4). Cross Section at 1517 Gettysburg Avenue



Proposed Conditions

The goal of the project, as mentioned previously, is to design a storm water pond to meet BCWMC Level I standards for the contributing drainage area to the pond. Two areas were identified to be routed into the pond for treatment (see **Figure 2**).

- South Area – South of Olympia St., including Lakeview Park
  - Subwatersheds B, C, D, E, H, I, L & O
  - Total Area – 16.8 acres
  - Volume from a 2.5" rainfall event: 1.05 acre-feet

- North Area – North of Olympia St.
  - Subwatersheds N, G & F
  - Total Area – 17.8 acres
  - Volume from a 2.5" rainfall event: 2.12 acre-feet

Several pond grading options were explored based on the treatment levels required for the contributing drainage areas. Ultimately one footprint was selected with varying depths based on the contributing drainage area to the pond. The two pond options are Partial Build and Full Build. **Figure 4** attached details the footprint used for both pond options and depicts the depth for the Full Build option.

- Partial Build (Option 2A) – Pond would be graded to a depth of 3 feet and be designed with a permanent pool volume equal to Level I standards for the South Area.
  - Divert only the South Area into the pond for treatment

- Permanent Pool Volume: 1.41 acre-feet

- Full Build (Option 2B) – Pond would be graded to a depth of approximately 7 feet. The pond permanent pool volume would be designed to Level I standards for the North Area and South Area.
  - Divert both the South Area and North Area into the pond for treatment
  - Permanent Pool Volume: 2.354 acre-feet

A P8 model was developed to analyze the pollutant removal efficiencies of each pond. **Table 2** below summarizes the pollutant loading and removal efficiency for each pond.

Table 2. P8 Results

Storm Water Pond	Partial Build - Option 2A		Full Build - Option 2B	
	TSS	TP	TSS	TP
Inflows	5855	18.7	11856	37.9
Trapped	5329	11.8	10214	22.1
% Removed	91.0%	63.1%	86.2%	58.3%

The removal efficiencies for Lakeview Pond identified in the 2004 feasibility study were 83% for TSS and 52% for TP.

A proposed conditions model was developed to analyze the addition of a pond to the park. The XPSWMM analysis determined that the HWL of the park could not be significantly reduced with the addition of a pond. This is because there is limited live storage created by excavating a pond since the elevation of the low area is at or near the proposed NWL of the pond.

The two areas proposed to be routed into the pond for treatment were analyzed in XPSWMM to determine the change in HWL in the park. The option to route storm water from only the area south of Lakeview Park was found to maintain the HWL. However routing both the areas (north of Olympia and South of Lakeview Park) to the pond were found to cause an increase in the HWL. As a result of the flooding and inability to reduce flood levels within the park options to improve the flooding situation within the park were reviewed.

- Option 1 - The downstream trunk storm sewer system was evaluated to determine if there was a specific section of pipe that could be replaced to increase capacity and thereby reducing flood levels within the park. MnDOT is currently in the process of developing plans and specifications for improvements to T.H. 169 and based on discussions with the MnDOT project manager, an improvement to the crossing at T.H. 169 would be possible as part of their project. Ultimately through an iterative analysis of the downstream trunk storm sewer system, it was found that a parallel storm sewer line, approximately 30inch RC pipe would be the most feasible improvement. However the parallel line would need to extend from Lakeview Park to Medicine Lake and was not pursued further based on impacts and overall cost.

- Option 2A Partial Build, Option 2B Full Build – Construct a berm along the property line, separating the pond and rear yards. The berm would be constructed such that the top of the berm was above the 100-year HWL of the pond. In addition a culvert with a flap gate would need to be

installed to provide a gravity outlet for any storm water that collects in the rear yards while preventing backflow from the pond.

- Option 3 – Buyout the four homes located along the park. This would allow a pond to be constructed without flooding the residential dwellings since they would be removed.

A summary of the cost estimates for each option have attached including the cost per pound of phosphorus removed for each option. The pond construction costs provided in the table are based on diverting the storm water from both the area to the north along Olympia St. and the area south of Lakeview Park.

Findings

The option that had the least overall cost and is the most feasible to construct is Option 2. This option will require monitoring of the berm but it presents the least amount of impacts to infrastructure and reduces flooding to the rear yards without buyouts.

Detailed costs estimates were developed for two pond grading options. In both grading plan options, a berm (see Option #2 above) was included in the estimate.

- Partial Build (Option 2A) – Pond would be graded to a depth of 3 feet and be designed with a permanent pool volume equal to Level I standards for only diverting the drainage area south of Lakeview Park.

- Full Build (Option 2B) – Pond would be graded to a depth of approximately 7 feet. The pond permanent pool volume would be designed to Level I standards for diverting both the area to the north and south of Lakeview Park for treatment.

The annualized costs for each option, including the original project cost from the 2011 update are summarized in **Table 3** below. A project life of 50 years was used and included $7,500 for maintenance costs which would be incurred every 12 years. A range of annual costs per lb of TP removed was provided in **Table 3** based on a 3% and 4% interest rate.

Table 3. Cost per Pound of TP removed

Project	Project Cost [(1)]	TP Removal, lbs/year	Annual Cost of TP Removal, $/lb
2004 Feasibility Study	$ 196,000.00	15.0	$570 - $660
Option 2A - Partial Build	$ 361,100.00	11.8	$1,270 - $1,500
Option 2B - Full Build	$ 411,800.00	22.1	$770 - $910

[(1)] Includes Construction Cost, Engineering, Administration and Contingency

Conclusion

Overall total project costs were found to increase as a result of site issues that were not originally anticipated in the 2004 study. The additional project components include constructing a berm along the park to prevent the pond from inundating private property, installing piling for the outlet system to

prevent settlement, conducting precondition structure surveys and installing vibratory monitoring equipment to monitor construction activities.

Attachments

- Figure 1 – Project Location
- Figure 2 – Drainage Areas
- Figure 3 – Existing Condition 100-Year HWL
- Figure 4 – Pond Grading Plan (Full Build Scenario)
- Opinion of Probable Costs for Improvements
- Site Photos

c: Dan Erickson | SEH
Sue Mason | SEH
Ron Leaf | SEH

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SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (888) 908-8166
TF: (800) 325-2055
www.sehinc.com

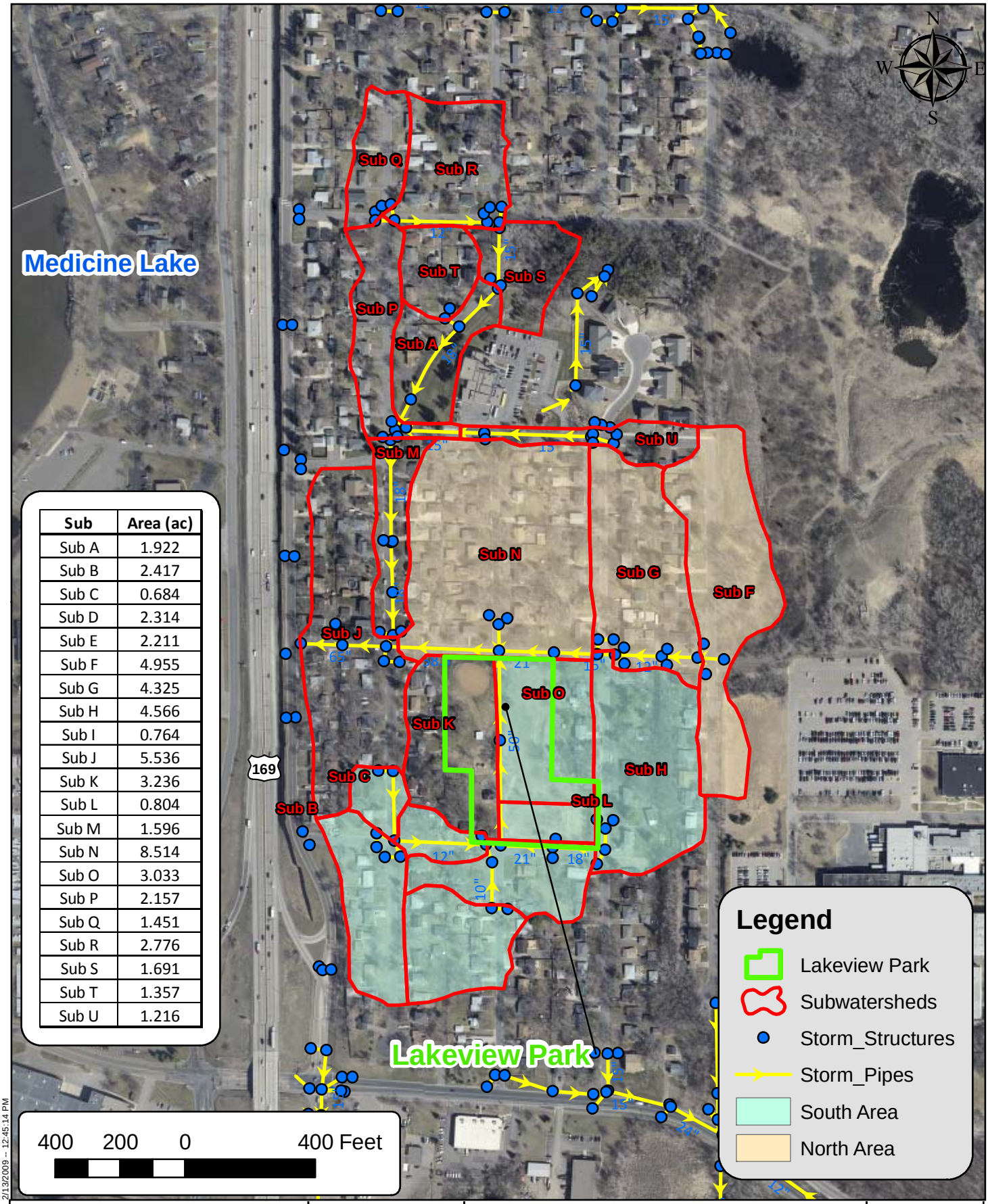
Project: GOLDV 122415
Print Date: 4.10.13

Map by: jtk
Projection: UTM Zone 15
Source: MnGeoSpatial, SEH, MnDOT, City of Golden Valley

Project Location

Lakeview Park Pond
City of Golden Valley

Figure 1



Sub	Area (ac)
Sub A	1.922
Sub B	2.417
Sub C	0.684
Sub D	2.314
Sub E	2.211
Sub F	4.955
Sub G	4.325
Sub H	4.566
Sub I	0.764
Sub J	5.536
Sub K	3.236
Sub L	0.804
Sub M	1.596
Sub N	8.514
Sub O	3.033
Sub P	2.157
Sub Q	1.451
Sub R	2.776
Sub S	1.691
Sub T	1.357
Sub U	1.216

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ST. PAUL, MN 55110
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Drainage Areas

Lakeview Park Pond
City of Golden Valley

Figure 2

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SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
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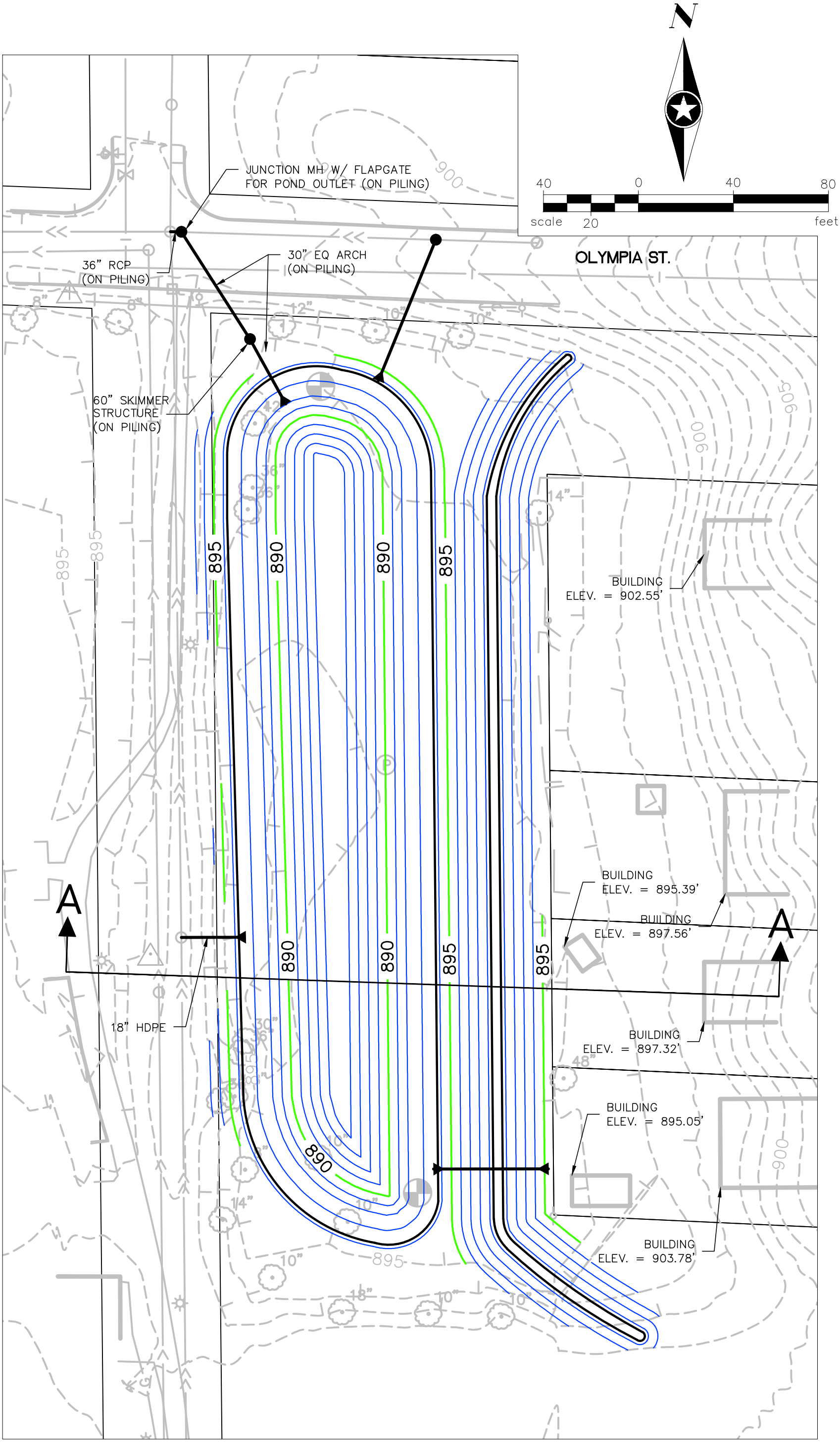
Existing Conditions - 100 Yr HWL

Lakeview Park Pond
City of Golden Valley

Figure 3



POND NWL = 893.60'

SEH
PHONE: 651.490.2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110-5196
www.sehinc.com

FILE NO.
122415

DATE:
02/20/2013

LAKEVIEW PARK
FULL BUILD
GOLDEN VALLEY, MINNESOTA

FIGURE NO. 4

City of Golden Valley
Lakeview Park Pond
Opinion of Probable Cost for Improvements
4.10.13

Option	Description	Estimated Cost
Option #1 - Parallel Trunk Storm Sewer System	- Install a parallel system from Park to Medicine Lake	
	- Existing system would remain online	
	- New parallel system would be at 0.1%, lowering the upstream invert at the Park by ~3.5 feet.	$ 281,900.00
	- 30" RCP Parallel Pipe $90/lf	
	- Storm Water Pond Construction	$ 215,600.00
	- Roadway Costs $175/lf (does not include utilities)	$ 316,800.00
	Subtotal (Construction Cost w/ 20% Contingency) -	$ 814,300.00
	Engineering and Admin (30%) -	$ 244,300.00
	Total Estimated Project Cost -	**$ 1,058,600.00**
	Cost per LB of Phosphorus Removed (22.1 lbs/yr Removed) -	**$ 48,000.00**
Option #2A - Pond (Partial Build) with Berm	- Construct a storm water pond and berm	
	- The berm is located along the east edge of the park	
	- Berm would provide over 1 foot of freeboard from the 100-year HWL	$ 277,700.00
	- Cost includes 20% Contingency	
	Engineering and Admin (30%) -	$ 83,400.00
	Total Estimated Project Cost -	**$ 361,100.00**
	Cost per LB of Phosphorus Removed (11.8 lbs/yr Removed) -	**$ 30,700.00**
Option #2B - Pond (Full Build) with Berm	- Construct a storm water pond and berm	
	- The berm is located along the east edge of the park	
	- Berm would provide over 1 foot of freeboard from the 100-year HWL	$ 316,700.00
	- Cost includes 20% Contingency	
	Engineering and Admin (30%) -	$ 95,100.00
	Total Estimated Project Cost -	**$ 411,800.00**
	Cost per LB of Phosphorus Removed (22.1 lbs/yr Removed) -	**$ 18,700.00**
Option #3 - Home Buyouts	- Purchase the 4 homes along the eastern edge of the park	
	- Home costs include: purchase, relocation, demolition, legal and administrative fees	$ 1,500,000.00
	- Storm Water Pond Construction (Includes 20% Contingency, 30% Engineering and Administrative fees)	$ 336,300.00
	Total Estimated Project Cost -	**$ 1,836,300.00**
	Cost per LB of Phosphorus Removed (22.1 lbs/yr Removed) -	**$ 83,100.00**