Feasibility Report For

Northwood Lake
Storm Water Improvements

Prepared for:

City of New Hope, Minnesota

City Project No. 938

Stantec

November 2014

Stantec Project No. 193802816

Stantec Consulting Services Inc.
2335 Highway 36 West
St. Paul, MN 55113
651.636.4600

November 12, 2014

Mr. Bob Paschke
Director of Public Works
City of New Hope
5500 International Parkway
New Hope, MN 55428

Re: Northwood Lake Storm Water Improvements – **Final Feasibility Report**
City Project No. 938
Stantec Project No. 193802816

Dear Mr. Paschke:

We are pleased to present our Final Feasibility Report for the Northwood Lake Storm Water Improvements project. The general location of the work includes the improvement area at the north east part of Northwood Lake, west of Boone Avenue, as well as an improvement area to the west of the lake adjacent to Jordan Avenue.

The improvements included in this report are identified in the Bassett Creek Watershed Management Commission's Capital Improvement Program (BCWMC's CIP), which is scheduled to begin construction in 2016.

We recommend this report be presented and discussed at the November 10, 2014, City Council meeting. Following City Council review, the report can be presented and discussed at the November 19, 2014, BCWMC meeting.

Respectfully submitted,

STANTEC CONSULTING SERVICES INC.

Christopher W. Long, P.E.

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.

Christopher W. Long, P.E.

Date: November 12, 2014 Reg. No. 47106

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Appendix A – Preliminary Cost Estimate

Appendix B – Soil Boring Report

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Introduction

The City of New Hope has chosen to investigate the feasibility of performing storm water improvements at Northwood Lake. The project areas identified at Northwood Lake are shown on Figure 1.

HISTORY

In 1996 Barr Engineering prepared the Northwood Lake Watershed and Lake Management Plan which identified several Best Management Practices (BMP's) to help improve water quality. The plan identified the Northeast Drainage District, which is the current area of proposed improvements, as an area to implement BMP's, and reduce phosphorous loading. In efforts to enhance the water quality of the lake and downstream water bodies, cost effective BMP's were recommended to be implemented to prevent degradation of the lake's water quality and mitigate any effects urbanization has on the lake.

Northwood Lake is an identified DNR Public Water and is also on the State Impaired Waters List for excess nutrients. A Total Maximum Daily Load (TMDL) study has not been completed, but is anticipated in the future.

The City of New Hope has completed several storm water improvement projects at Northwood Lake over the past 40 years (see Appendix D). As identified in the City's Local Water Management Plan, past and future water quality projects are further identified (see LWMP excerpts in Appendix E).

The Bassett Creek Watershed Management Commission (BCWMC) has identified a project to complete storm water improvements at Northwood Lake in their Capital Improvements Program (CIP) for funding in 2016 and 2017. According to the BCWMC CIP process and timeline, a feasibility report must be completed in order for funding to be provided.

SCOPE OF STUDY

The purpose of this report is to provide the feasibility to construct storm water improvements at Northwood Lake. The type of improvements, storm water benefits, cost of the improvements, and how the improvements will be funded will be evaluated.

As funding may be provided from the BCWMC, the report will follow the Feasibility Study Criteria, as approved by the BCWMC on October 17, 2013. The feasibility of three alternative concept options for storm water improvements will be reviewed.

Proposed storm water improvements will be coordinated with future park improvements at Northwood Lake. The City currently has identified park and playground improvements in their CIP for 2016. This report generally identifies future park improvements along with the storm water improvement options to ensure all improvements are harmonious with future City visions.

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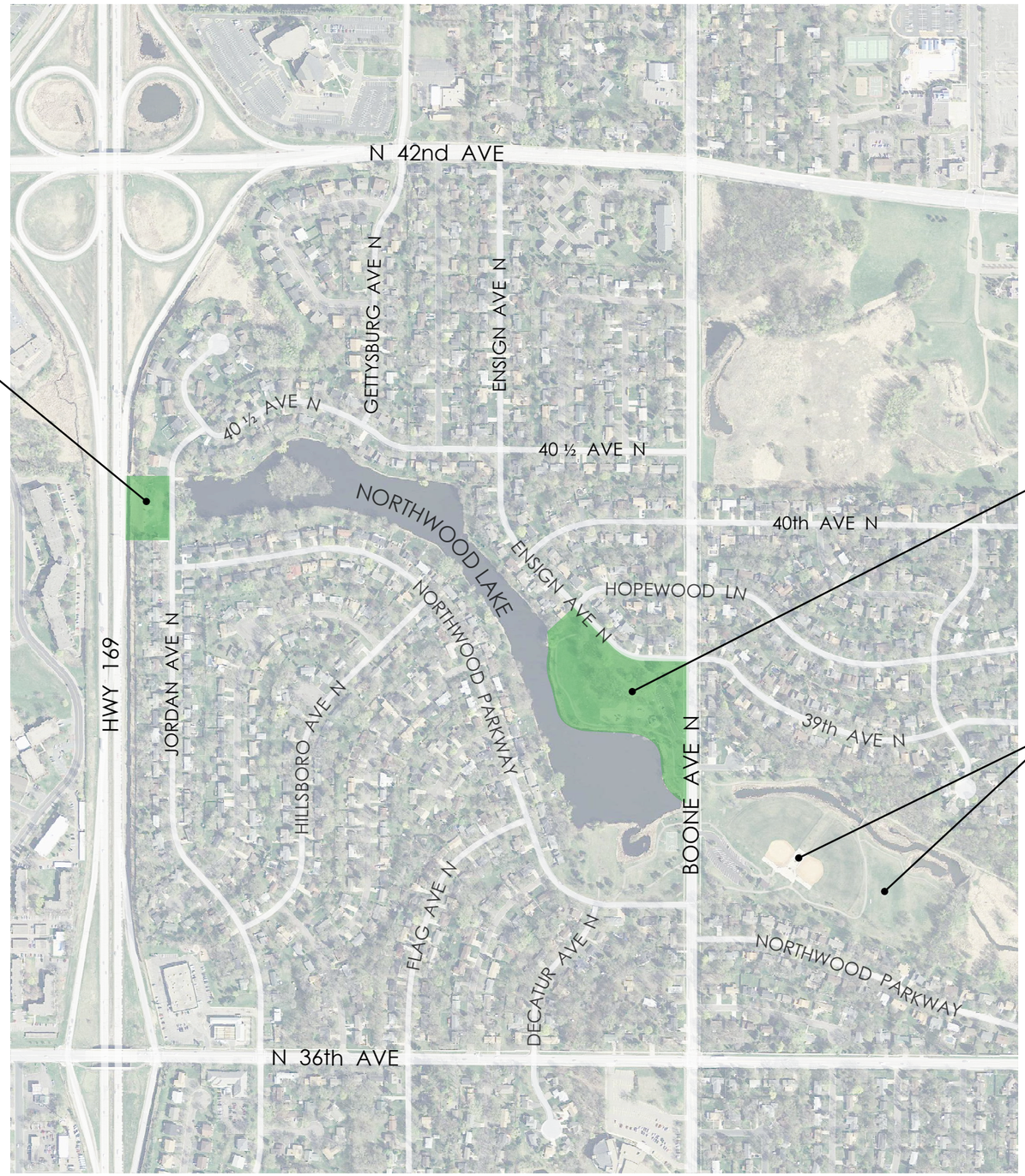

Jordan Avenue Site
* Concept C

Northwood Park Site
* Concept A
* Concept B

Concept A Irrigation Area
* 2 Baseball Fields
* 1 Soccer Field

N

0 300 600

LOCATION MAP

CITY OF NEW HOPE, MINNESOTA
2016 NORTHWOOD LAKE IMPROVEMENTS

FIGURE 1

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Existing Conditions

PRELIMINARY SURVEY/SITE FIELD INVESTIGATION

A preliminary survey and field investigation was completed in order to understand the existing site conditions, elevations, and the conditions of the existing storm water infrastructure. Two areas (see Figure 2 – Soil Boring Locations) adjacent to Northwood Lake were surveyed and investigated, and described below are the observations:

1. Jordan Avenue Area – City owned lot located west of Jordan Avenue, and east of TH-169.
    a. Existing site is at a raised elevation, and will require additional common excavation to construct a potential pond or storm water feature.
    b. Existing storm sewer to the south of the site on Jordan Avenue and Northwood Parkway will require improvements and further investigation in the future. All of the structures are failing and the records for the exact location of the storm pipe are unknown at the outlet to the south west side of the lake.
    c. The street of Jordan Avenue is in poor condition, and future improvements should be coordinated with any storm water improvements.

City Lot West of Jordan Avenue (looking northwest)

2. Northeast Northwood Lake Park Area – the park area located west of Boone Avenue, south of Ensign Avenue
    a. The 36-inch diameter storm sewer which outlets into the lake from Ensign Avenue and Hopewood Lane is at approximately the same elevation of the lake. In order to construct any potential dry cell storm water features such as rain gardens, the storm sewer will require upstream redirection to raise the storm sewer elevation.
    b. The primary open space at the park near the lake is at a low and similar lake level elevation, which was in a visible wet condition. According to City staff, the open space it typically unusable recreational space due to the wet conditions.
    c. Some of the existing storm sewer at the intersection of Hopewood Lane and Ensign Avenue will require improvements in the future, as a few structures are failing.

Northwood Park (looking southeast from Ensign Ave)

Wet Open Space (looking southeast)

SOIL BORING & SAMPLING RESULTS

A total of 10 geo-probe soil borings were performed at the location identified on Figure 2. Borings were performed in order to understand the type of soils and if infiltration or filtration BMP's could be utilized onsite. Ground water levels were also measured. Environmental testing was completed on the Jordan Avenue site, as City staff had identified this as a site where Northwood Lake dredging materials were placed in 1979 and 1980.

The soil borings generally revealed clay and slow draining soils. The sampled soils at the Jordan Avenue site meet the criteria of residential reuse soils for the analyzed compounds Copper, Arsenic, and PAH's. The detailed soil exploration report is located in Appendix B.

SOIL BORING LOCATIONS

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FIGURE 2

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Storm Water Improvement Concepts

As required by the BCWMC, multiple alternative concept options need to be reviewed in order to judge the merits of each alternative. The three concepts identified by the City of New Hope are described below. General sketches of these improvement concepts are shown on Figures 3, 4, and 5 on the following pages. More detailed information (i.e. infrastructure improvements, preliminary design information, etc.) is shown on Figures 6 through 9 on the following pages.

STAKEHOLDER FEEDBACK

In efforts to obtain resident and stakeholder feedback, two separate neighborhood meetings were held on June 24 and August 13 of 2014. At the first meeting we discussed initial concepts and the potential project background. The second meeting further discussed the potential storm water improvements with updated concepts based on previous feedback.

On August 18, 2014, the updated concepts were shown to the City Council. We discussed the feedback from the previous neighborhood meetings and provided a project update to the City Council.

In general, the residents and City Council were in favor of Concept A and Concept C. They were not in favor of constructing a pond for storm water improvements in the Concept A area, as they desire to maximize the limited and available open park space for recreational use. Previous storm water improvements around the lake include pre-treatment ponds, but have proven difficult to maintain and lack aesthetic value. Below summarizes additional feedback:

- In favor of completing storm water improvements to help improve the water quality of Northwood Lake and downstream waters
- Provide low maintenance improvements: easy access to structures and rain gardens; low maintenance plantings
- Minimize impact to park space
- Be cognizant of adjacent residents and improvement placement
- In favor of irrigation and water reuse concept
    - City water cost savings
    - Underground storm water tank has no impact to park space
- Improve and review the storm water quantity impacts of the improvements, as upstream flooding occurs

Based upon the feedback received from the different stakeholders, we updated the following three concept improvements provided in this report.

CONCEPT A IMPROVEMENTS

A general overview of the Concept A storm water improvements is shown on Figure 3, with the details of these improvements shown in Figure 6 and 7. The Concept A improvements include the redirection of storm sewer on Boone Avenue, installation of a storm water treatment structure, underground storage tank and water reuse for ball field irrigation, rain gardens, sump structure, curb cut, and emergency overflows. Preliminary design details for Concept A include:

- Approximately 84-percent of the drainage area flow from north of this site is redirected through new 36-inch storm sewer along the west side of Boone Avenue, between Hopewood Lane and Ensign Avenue.
    - Since the existing storm sewer at Hopewood Lane and Ensign Avenue is near the same elevation of the lake, it is required to redirect the storm sewer to achieve a higher elevation in order to utilize the underground storage tank and rain garden features.
- The new 36-inch storm sewer is routed through a storm water treatment structure which will capture course sediment as a means of pre-treatment of runoff prior to discharging to the underground storm water storage system.
- The underground storm water storage system is located in the northeast corner of Northwood Park and is proposed as a 160,000 gallon concrete vault to capture existing runoff from an 89 acre residential drainage area.
- Storm water in the storage system will be re-used and pumped through a pipe to the irrigation box location on the east side of Boone Avenue, and reused to irrigate 6.4 acres of baseball and soccer fields. During larger rain events and runoff volumes exceeding the re-use chamber capacity, storm water will overflow into a series of linear biofiltration basins along Ensign Avenue, receiving storm water filtration treatment prior to discharging to Northwood Lake. The improvements also identify a curb cut along Ensign Avenue to direct street drainage into the rain gardens.
- A sump structure would be installed at the location of the existing storm sewer to collect sediment prior to entering the lake.
- Estimated Storage Volume in Bioretention Features = 16,000 ft^3

This series of BMP's provides an innovative approach to storm water treatment combining storm water re-use, filtration, and pollutant uptake through vegetation.

Depending on the type of season and rainfall, the storm water re-use system will save the City approximately $5,000 to $10,000 per year in water costs, and will provide storage for approximately one to two weeks of irrigation during dry periods.

In regards to the biofiltration basins, as stated in the Soil Exploration Report in Appendix B, ground water was not identified or found in Borings 8-10. We anticipate ground water levels to be between elevations 885 and 891.5. During the design and potentially additional field investigation, biofiltration basin elevations and ground water elevations will be further evaluated. As augmented soils within biofiltration basins do not typically function well (when saturated, a quicksand type situation can occur), we plan on designing the bottom of the basins to be above the ground water level and/or separated with a clay layer of soil.

We understand there may be concern about the potential for lowering Northwood Lake water levels due to the runoff volume removed by the storm water reuse system. The drainage area routed to the storm water reuse system is less than 7% of the total Northwood Lake drainage area. In addition, once the reuse system tank is filled, the remaining runoff volume will be entirely diverted to Northwood Lake. Therefore, we believe that the proposed storm water reuse system will have a minimal impact on Northwood Lake water levels. Additional review utilizing the BCWMC's storm water models will occur during final design.

As there may be potential public health concerns related to storm water reuse, potential mitigation measures will be considered during the design phase. Discussions need to occur in regards to ultraviolet (UV) disinfection, irrigation schedule compared to that of the ball field users, and signs notifying the public of water reuse for irrigation. The final design will need to be reviewed with the City Public Works and Building Official for code compliance.

CONCEPT B IMPROVEMENTS

The Concept B Improvements are shown generally on Figure 4, with the details of this concept on Figure 8. The Concept B Improvements include redirecting flow in the existing 36-inch trunk storm sewer running along the west side of Northwood Park into a constructed wet ponding basin. Storm water runoff will be treated in the wet ponding basin, and ultimately discharge back into Northwood Lake.

- Pond Surface Area = 0.34 acre
- Pond Dead Storage Volume = 1.2 acre-feet

The existing trail will require relocation due to the new storm water pond. The pond was not shown further to the east, or larger in size, in efforts to minimize the park impact and preserve the open park space to the west of the existing playground. The final design location of the pond, if constructed, should be discussed and reviewed with the City and adjacent property owners.

As soil borings verified (see Appendix B), the ground water levels in the proposed pond location will not allow for a dry rain garden type improvement scenario. Any excavation improvements in the lower areas adjacent to the lake will likely supply wet conditions.

CONCEPT C IMPROVEMENTS

The Concept C Improvements are shown generally on Figure 5, with the details of this concept on Figure 9. The Concept C Improvements include the construction of a wet ponding basin in a green space area between Trunk Highway 169 and Jordan Avenue. Storm water runoff from both rear yard areas and Jordan Avenue draining from the south would be directed into a wet ponding basin for treatment, before discharging into an existing storm sewer pipe tributary to Northwood Lake.

- Pond Surface Area = 0.23 acre
- Pond Dead Storage Volume = 0.7 acre-feet

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NORTHWOOD PARK - CONCEPT A

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FIGURE 3

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NORTHWOOD PARK - CONCEPT B

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FIGURE 4

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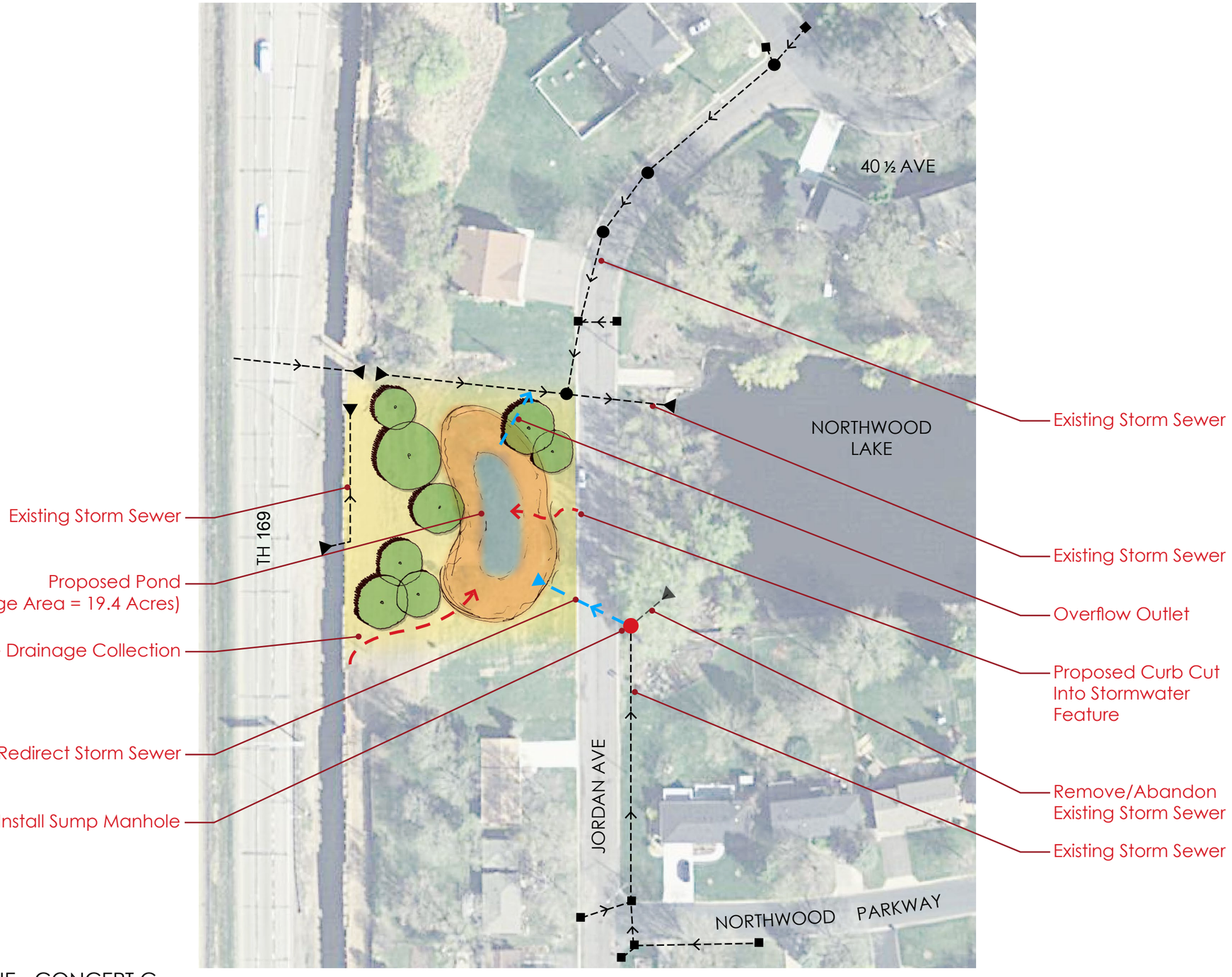

JORDAN AVENUE - CONCEPT C

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FIGURE 5

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(RECORD)
RIM: 890.59
INV: 887.40

(RECORD)
RIM:890.60
INV: 888.06

HOPEWOOD LANE

36" RCP
383' @ 1.52%

EXISTING RIM: 890.81
INV: 885.61
1.78' COVER

36"
150' @ 1.3%

(RECORD)
RIM: 898.10
INV:888.00
6.70' COVER

ABANDON EX.
STORM SEWER

PROPOSED CBMH
RIM:913.00
INV: 893.57

(RECORD)
RIM: 913.66
INV: 894.10

RIM: 890.79
INV: 885.89
1.28' COVER

23' @ 2.00%
12" RCP

REMOVE AND REPLACE
STRUCTURE WITH SUMP
CATCHBASIN MANHOLE

(RECORD)
RIM: 890.90
INV: 888.02

44' @0.64% 36"

159' @ 0.33% 36"

FES INV: 885.09

24" RCP
65' @ 0.5%

PROPOSED FES
INV: 887.00

ENSIGN AVENUE

36" RCP

304' @ 0.10%

BOONE AVENUE

PROPOSED STORM
TREATMENT STRUCTURE
RIM: 902.85
INV: 893.26

PROPOSED
OUTLET
CONTROL
STRUCTURE
RIM: 888.33

PROPOSED EOF

RAIN GARDEN (TYP.)

UNDERGROUND
STORM STORAGE TANK

40' @ 0.5%
36" RCP

PROPOSED
PUMP
HOUSE

LOOP TRAIL OPTION)

6" DRAINTILE (TYP.)

EOF
(TYP.)

WATER REUSE
SUPPLY PIPE FOR
BASEBALL FIELDS

SEE FIGURE 7 FOR
WATER USE AND
IRRIGATION DETAILS

N

0 30 60

CONCEPT A IMPROVEMENT DETAILS

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FIGURE 6

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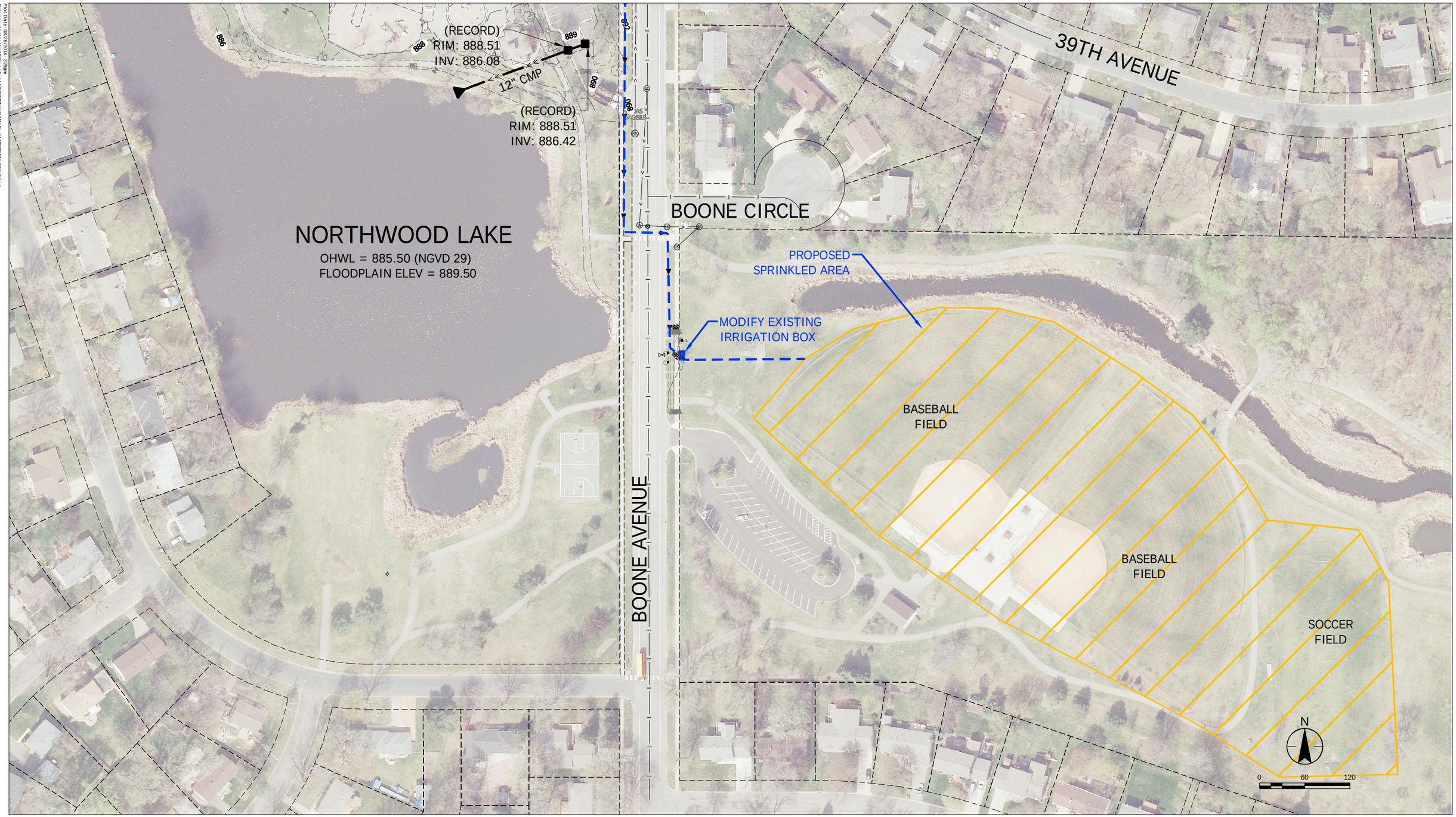

CONCEPT A IMPROVEMENT DETAILS

CITY OF NEW HOPE, MINNESOTA

2016 NORTHWOOD LAKE IMPROVEMENTS

FIGURE 7

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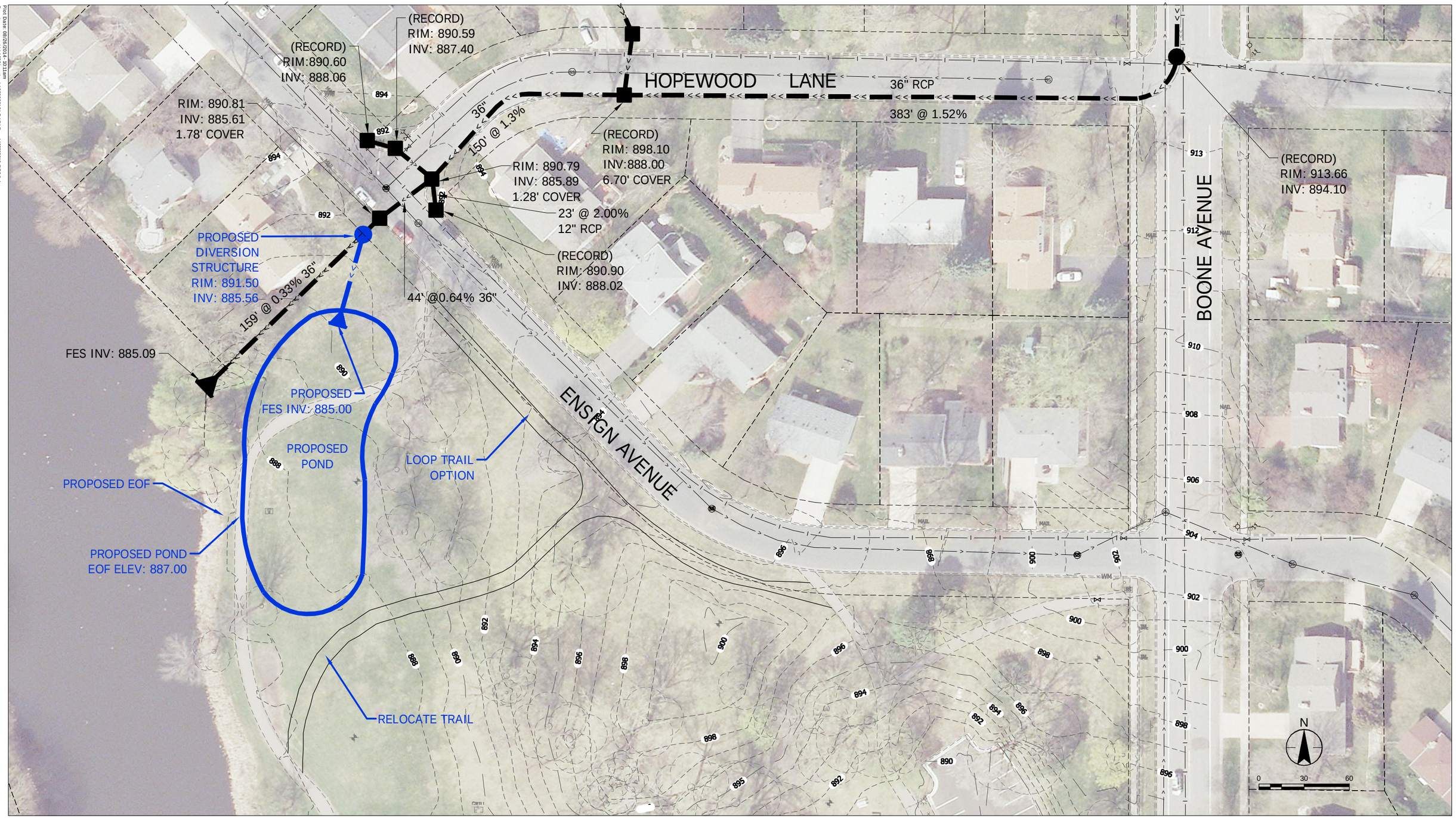

CONCEPT B IMPROVEMENT DETAILS

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FIGURE 8

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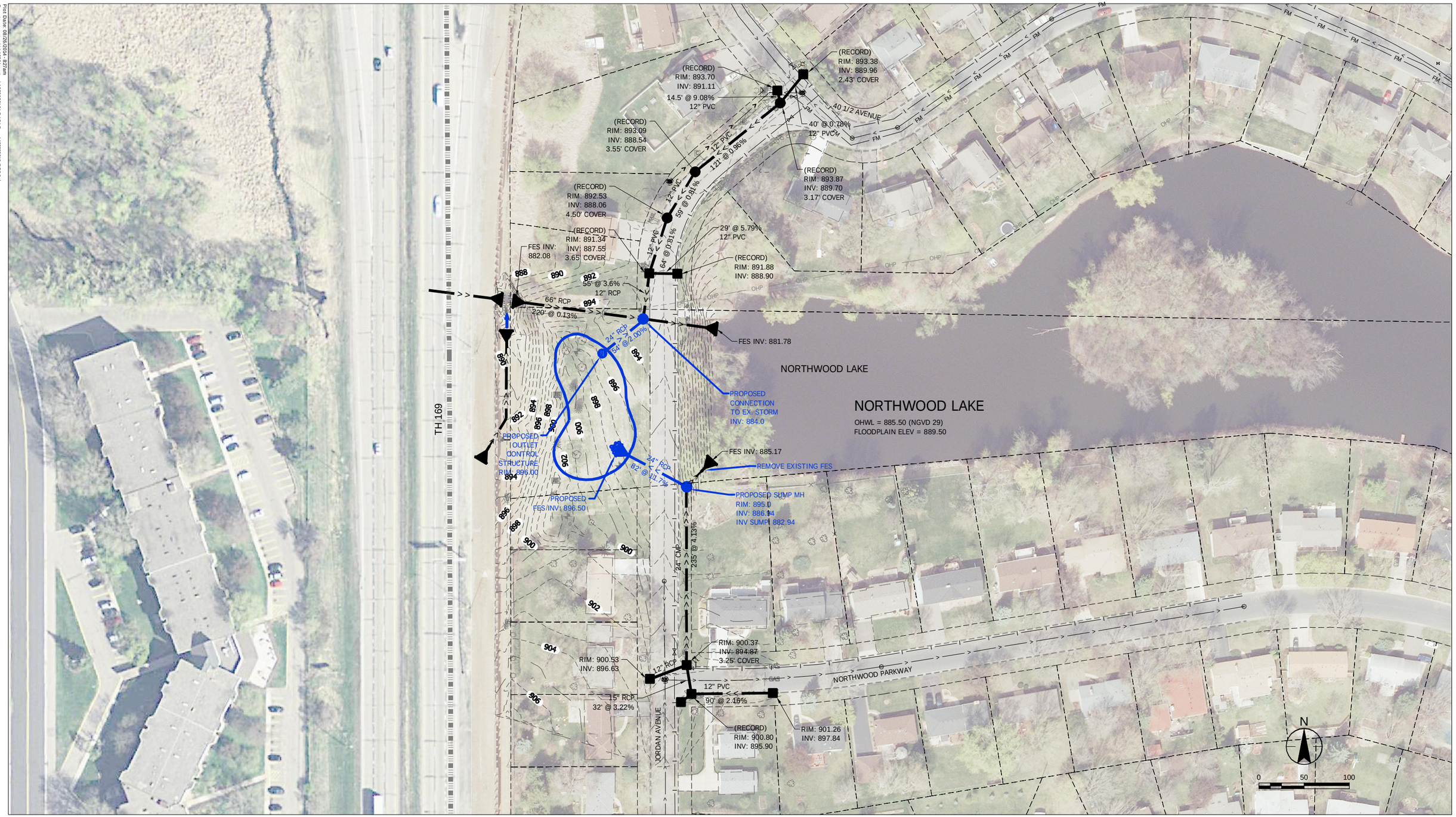

CONCEPT C IMPROVEMENT DETAILS

CITY OF NEW HOPE, MINNESOTA

2016 NORTHWOOD LAKE IMPROVEMENTS

FIGURE 9

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NEW AND/OR INNOVATIVE APPROACHES OR TECHNOLOGIES

Concept A proposes a combination of innovative storm water treatment Best Management Practices (BMPs); including a storm water re-use system with an overflow diversion to a series of biofiltration basins. Storm water re-use system is a new storm water treatment approach in Minnesota, and would be the first re-use system installed in New Hope. In addition, combining a re-use system with an overflow diversion to a series of biofiltration basins is considered an innovative treatment approach as provides a 2-stage treatment process to maximize the level of water quality treatment provided to the storm water system.

Concepts B and C utilize a traditional water quality treatment approach with wet storm water quality ponding.

PERMIT REQUIREMENTS

The proposed reuse feature in Concept A requires a Minnesota Department of Natural Resources' (MDNR) Water Appropriations Permit. All Concepts will include a BCWMC Review. Only Concept A will disturb more than 1 acre, and will require an NPDES Construction Storm Water Permit." The City will require a permit for grading.

Storm Water Analysis

To estimate and compare the water quality treatment performance of the three improvement concepts, we used the Minimal Impact Design Standards (MIDS) Calculator (Version 2: June 2014). This user-friendly calculator tool provides a consistent basis for comparison for a variety of water quality BMPs, including those proposed in Concepts A, B, and C.

A brief discussion of our analysis approach to each concept is provided below. In addition, a technical memo in Appendix C provides more detailed background regarding the inputs, assumptions, and results of the water quality treatment calculations.

CONCEPT A

The drainage areas for our analysis of Concept A are shown on the Concept A Drainage Area Map (Figure 10). Our approach to analyzing the water quality treatment benefit of Concept A includes a combination of two modeling tools, PondNET and the MIDS Calculator. We first used PondNET, a spreadsheet based water quality pond efficiency calculator, to estimate the performance of the two existing water quality pond adjacent to Boone Avenue, Ponds BC-P2.6A and BC-P2.6B. A copy of the PondNET spreadsheet is attached to the technical memo in Appendix C.

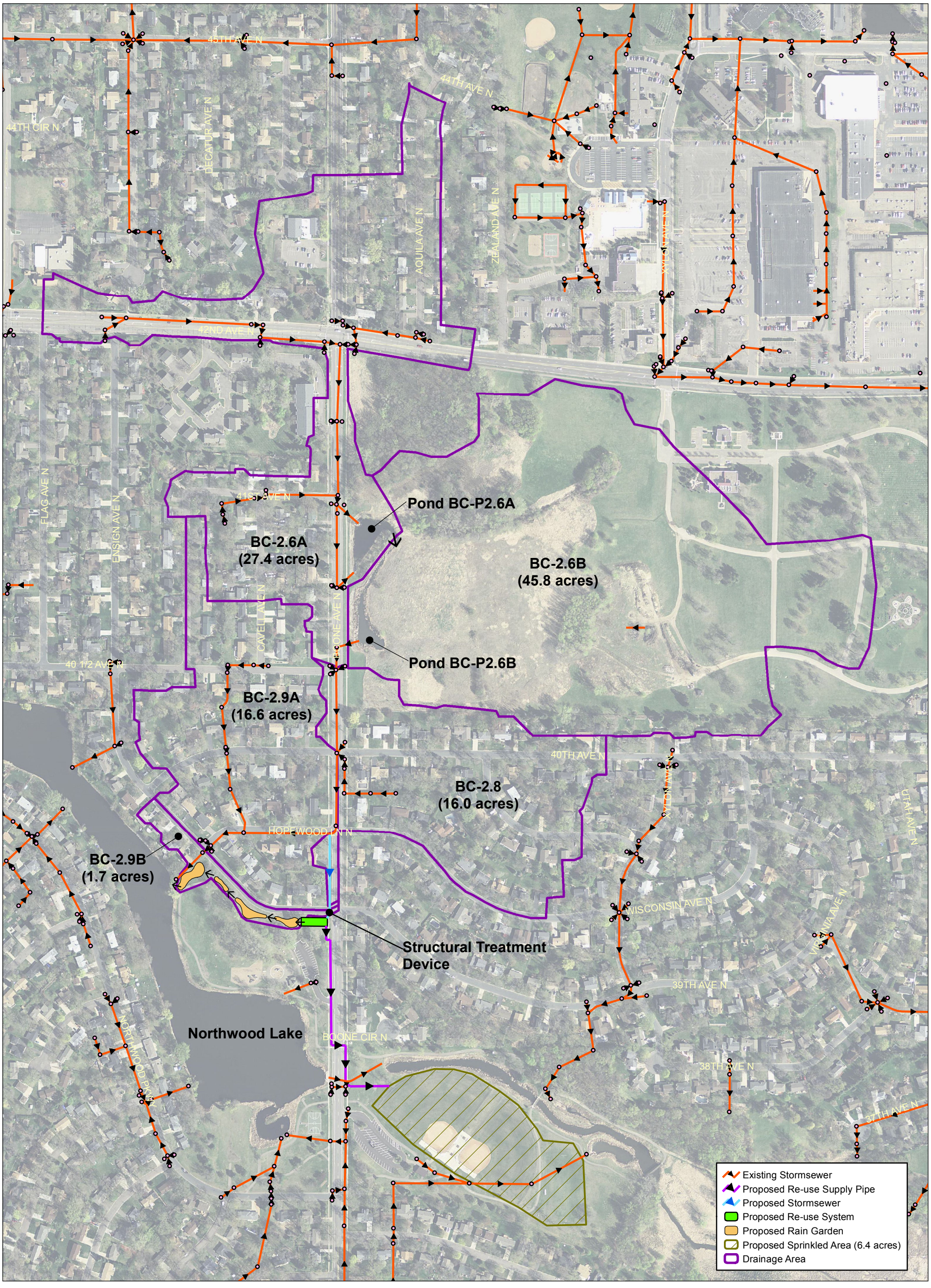
We transferred the pond TP and TSS removal efficiencies from PondNET directly into the MIDS Calculator as "Other" type BMPs, which are connected to a storm water reuse system BMP. Drainage area BC-2.8 is routed to the storm water reuse system. The reuse system BMP is routed to a series of biofiltration features adjacent to Ensign Avenue. Drainage area BC-2.9B is routed to the biofiltration features. Drainage area BC-2.9A bypasses the improvement BMPs and is routed directly to Northwood Lake. A summary of the MIDS Calculator for Concept A is attached to the technical memo in Appendix C.

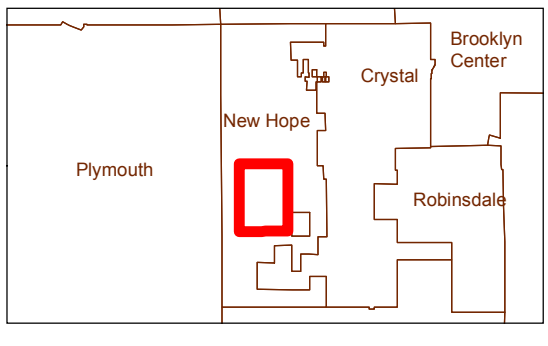
CONCEPT B

Concept B drainage areas are shown on the Concept B Drainage Area Map (Figure 11). As with Concept A, the treatment efficiencies of Ponds BC-P2.6A and BC-P2.6B from PondNET were added to the MIDS Calculator as "Other" type BMPs, which then discharge to the Concept B water quality pond. Drainage area BC-2.9 is routed directly to the Concept B water quality pond. A summary of the MIDS Calculator for Concept B is attached to the technical memo in Appendix C.

CONCEPT C

The drainage areas for Concept C are shown on the Concept C Drainage Area Map (Figure 12). Drainage area BC-2.17B is routed directly to the Concept C water quality pond. A summary of the MIDS Calculator for Concept C is attached to the technical memo in Appendix C.





Concept A Drainage Area Map

Figure 10

New Hope, MN

0 175 350 700 Feet

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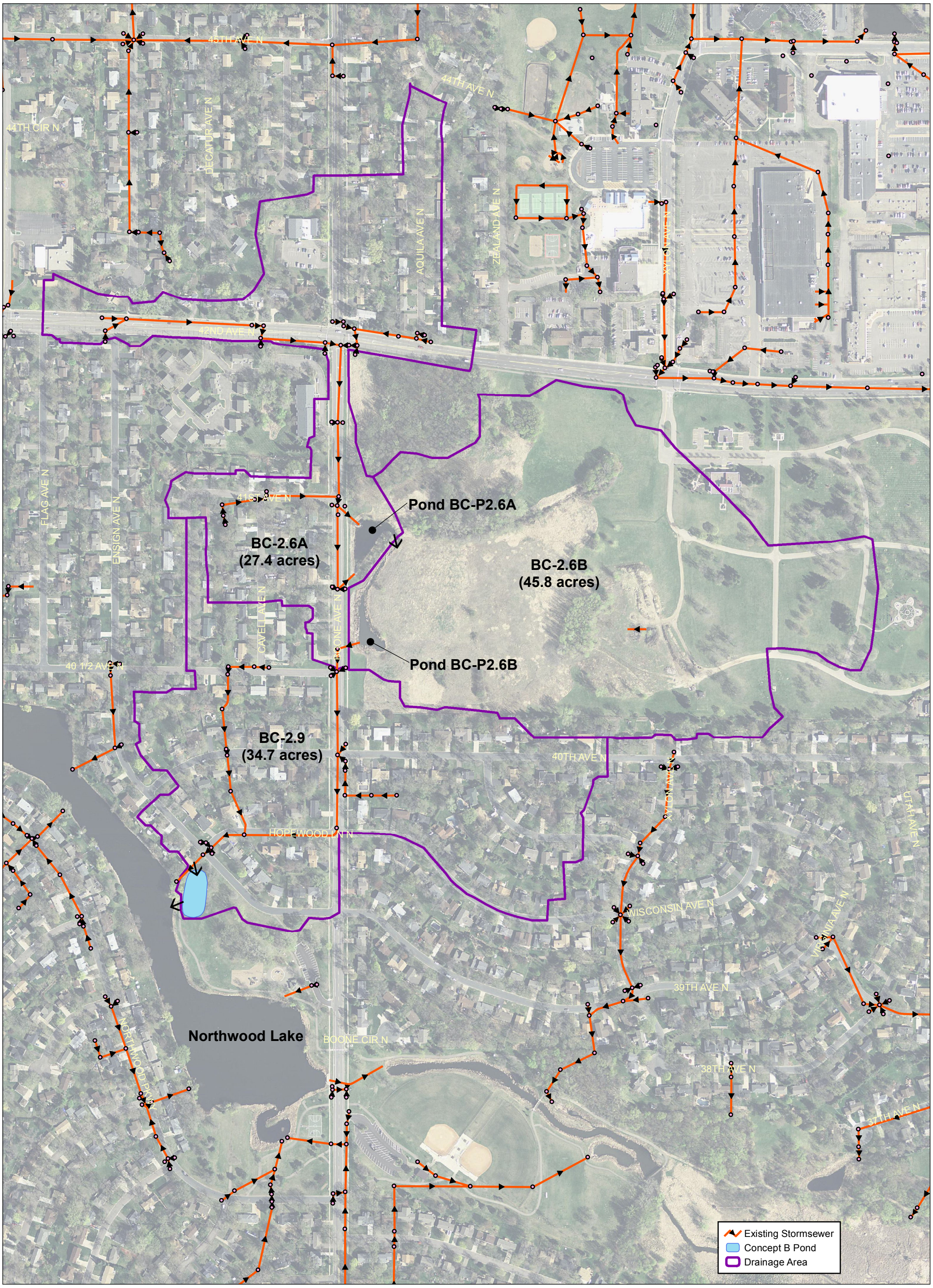

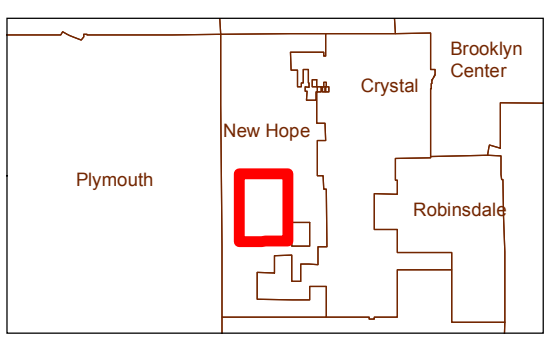

Concept B Drainage Area Map

Figure 11

New Hope, MN

0 175 350 700 Feet

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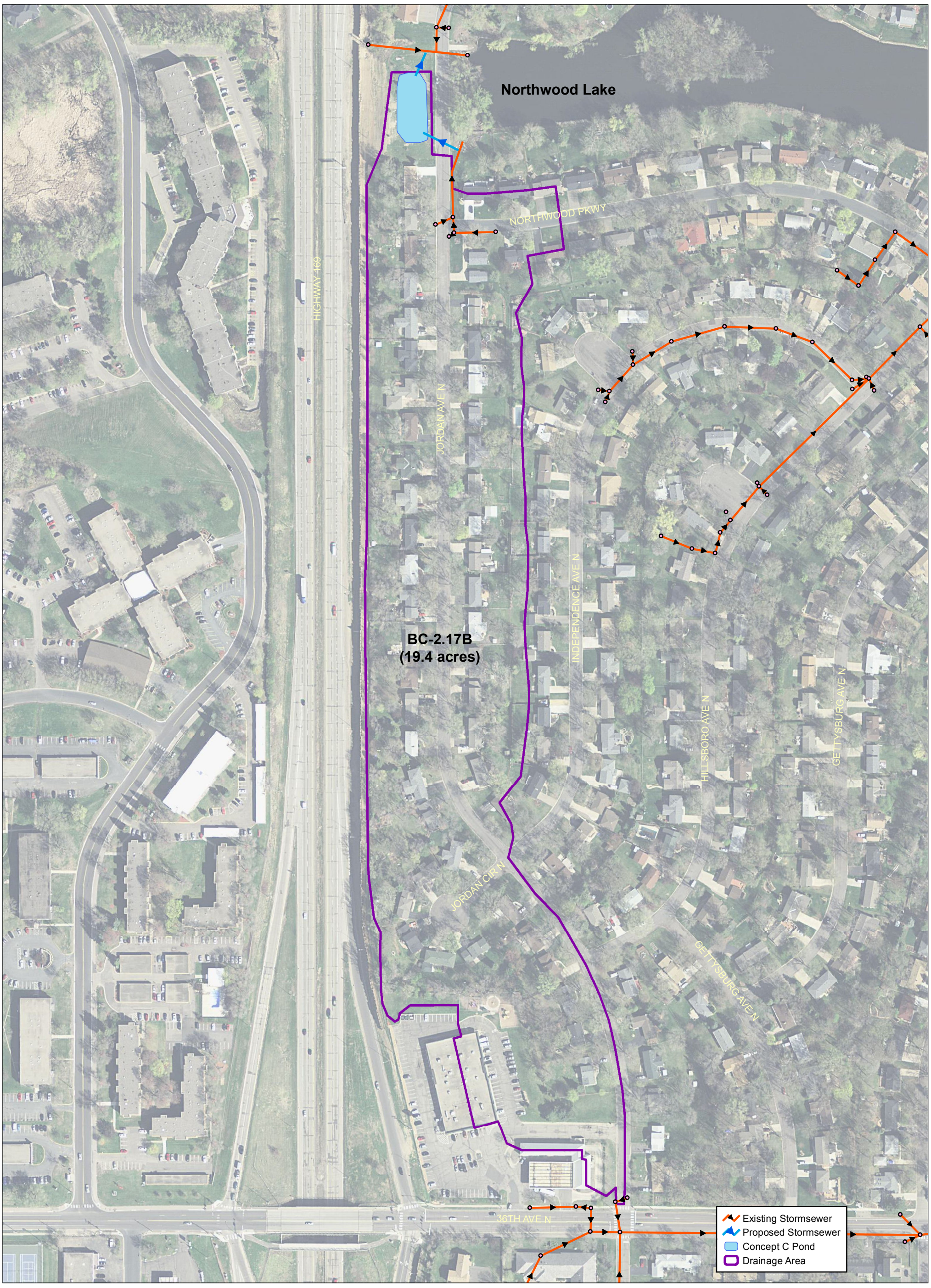

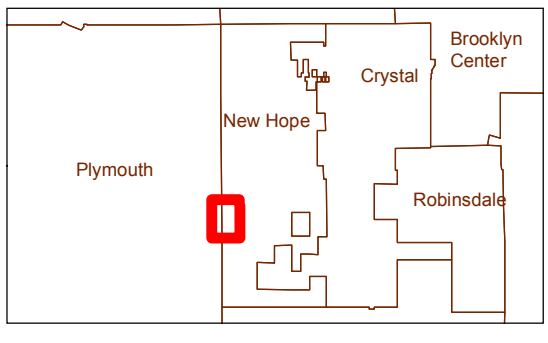

Concept C Drainage Area Map

Figure 12

New Hope, MN

0 100 200 400 Feet

1:2,400 (At original document size of 11x17)

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RUNOFF REDUCTION

TABLE 1 – RUNOFF VOLUME REDUCTION TABLE

Concept	Total Drainage Area in System	Total Annual Runoff Volume	Proposed Total Annual Runoff Volume Removed	Proposed Percent Annual Runoff Volume Removed
	(acres)	(acre-feet)	(acre-feet)	(%)
Concept A	90.8	74.3	10.2	14%
Concept B	107.4	93.7	0.0	0%
Concept C	19.4	20.4	0.0	0%

PHOSPHOROUS REDUCTION

TABLE 2 – TOTAL PHOSPHORUS REDUCTION TABLE

Concept	Total Drainage Area in System	Total Annual Phosphorus Load	Proposed Total Annual Phosphorus Removed	Proposed Percent Annual Phosphorus Removed
	(acres)	(pounds)	(pounds)	(%)
Concept A	90.8	60.6	16.3	27%
Concept B	107.4	76.4	15.4	20%
Concept C	19.4	16.6	5.7	34%

Cost Estimates

Cost estimates have been prepared for the three different improvement options, and detailed estimates are shown in Appendix A. As requested by City staff, a loop trail option is identified in Appendix A for Concept A and B, but is not associated to the storm water improvements and is only shown as potential future City costs. Summaries of the estimated storm water related costs are shown in Table 3 below. Estimated indirect costs include engineering, legal, fiscal, and contract administration.

TABLE 3 – TOTAL PROJECT COSTS
(Includes estimated 10% Contingencies and 25% Indirect Cost)

Concept	Total Project Cost
A	$1,200,872
B	$134,264
C	$150,456

ESTIMATED LIFE SPAN FOR CONCEPTS

The life span for each of the concepts was estimated below, with the 30 year life cost calculations assuming a 5% interest rate. All costs assume total project costs including indirect. Annual maintenance costs are shown in Table 4.

CONCEPT A

- Rain gardens – 20 Year Life
  - Assuming replacement of augmented soils, plantings, and mulch
  - Estimated Present Cost ~ $115,000
  - 30 Year Life Future Cost ~ $305,129
- Underground Stormwater Storage and Storm Piping – 80 Year Life
  - Assume concrete repairs every 15 years
  - Estimated Present Cost ~ $10,000
  - 30 Year Life Future Cost ~ $64,009
- Pump House, Pumps, Controls – 30 Year Life
  - Assume full replacement of pumps, controls, and valves
  - Estimated Present Cost ~ $120,000
  - 30 Year Life Future Cost ~ $518,633
- Pump House – 30 Year Life
  - Assume pump house maintenance
  - Estimated Present Cost ~ $25,000

  - 30 Year Life Future Cost ~ $108,049
- Operation and Maintenance – Annual
  - Assume general operation and maintenance of all the facilities and rain gardens, including energy use
  - Estimated Present Cost ~ $3,000
  - 30 Year Life Future Cost ~ $199,317
- Irrigation Savings – Annual
  - Assumes water savings for irrigation of the two baseball fields and one soccer field
  - Estimated Present Cost ~ $10,000
  - 30 Year Life Future Cost ~ $664,388

CONCEPT B

- Pond – 30 Year Life
  - Assume dredging required
  - Estimated Present Cost ~ $70,000
  - 30 Year Life Cost ~ $302,536
- Maintenance – Annual
  - Assume sediment cleanout vegetative maintenance at inlets, outlets, and sumps
  - Estimated Present Cost ~ $2,000
  - 30 Year Life Cost ~ $132,878

CONCEPT C

- Pond – 30 Year Life
  - Assume dredging required
  - Estimated Present Cost ~ 50,000
  - 30 Year Life Cost ~ $216,097
- Maintenance – Annual
  - Assume sediment cleanout vegetative maintenance at inlets, outlets, and sumps
  - Estimated Present Cost ~ $2,000
  - 30 Year Life Cost ~ $132,878

TABLE 4 – 30-YEAR LIFE MAINTENANCE COSTS

Concept	Maintenance	Present Maintenance Cost	Annual Life Maintenance Cost (using Capital Recovery)	Future Maintenance Cost
Concept A				
Rain Gardens	Replacement every 20 years	$115,000	$9,228	$305,129
Underground Storage and Storm Piping	Concrete repairs every 15 years	$10,000	$1,614	$64,009
Pumps and Controls	Full replacement of pumps, controls, valves every 30 years	$120,000	$7,806	$518,633
Pump House	Pump house maintenance every 30 years	$25,000	$1,626	$108,049
Operation and Maintenance	Annual general operation and maintenance of all the facilities and rain gardens	$3,000	$3,000	$199,317
Irrigation Savings	Annual water savings for irrigation	-$10,000	-$10,000	-$664,388
		Total	**$13,274**	**$530,748**
Concept B				
Pond		$70,000	$4,554	$302,536
Maintenance		$2,000	$2,000	$132,878
		Total	**$6,554**	**$435,414**
Concept C				
Pond		$50,000	$3,253	$216,097
Maintenance		$2,000	$2,000	$132,878
		Total	**$5,253**	**$348,975**

TABLE 5 – 30-YEAR LIFE CYCLE COSTS & PHOSPHOROUS REMOVAL

Concept	Total Initial Project Cost ($)	A_1	A_2	Total A	Annual Phosphorous Reduction (lb)	Annual Cost per Phosphorous Removal Over 30 Years ($/lb)
Concept A	$1,200,872	$78,118	$13,274	$91,393	16.3	$5,607
Concept B	$134,264	$8,734	$6,554	$15,288	15.4	$993
Concept C	$150,456	$9,787	$5,253	$15,040	5.7	$2,639

A_1 Annual Disbursement of Initial Project Cost in uniform series for 30 year period, at an interest rate of 5%

A_2 Annual Disbursement of Maintenance Cost in uniform series for 30 year period, at an interest rate of 5%

Financing

REVENUES

The following are possible sources of funding for the Northwood Lake Storm Water Improvements project:

- Bassett Creek Watershed Management Commission
- Grants
  - Minnesota Board of Soil and Water Resources – Clean Water Grant
  - Hennepin County Natural Resources Grant
  - Others
- City Storm Water Fund

TABLE 6 – POTENTIAL FUNDING SOURCE

Concept	BCWMC	Grants	City Storm Water Fund	Total Project Cost
Concept A	$595,000	$400,000	$205,872	$1,200,872
Concept B	$134,264			$134,264
Concept C	$150,456			$150,456

Project Schedule

The general schedule for the project is outlined below:

BCWMC – Review Draft Feasibility Study	September 18, 2014
City of New Hope – Approve Final Feasibility Study	November 10, 2014
BCWMC – Approve Final Feasibility Study	November 19, 2014
Design Improvements	January 2015 – January 2016
Bid Opening/Award Contract	February 2016
Construct Improvements	May – Sept., 2016

Concept Analysis

BCWMC OBJECTIVES

The following BCWMC objectives were met for each of the improvement alternatives:

TABLE 7 – BCWMC OBJECTIVES

	Flood Control	Water Quality	Aesthetics	Habitat	Recreation	Education
Concept A	x	x	x	x	x	x
Concept B		x	x	x	x	
Concept C		x	x	x		

PROS AND CONS

A statement of pros and cons for each concept is provided below.

TABLE 8 – PROS AND CONS

	Concept A	Concept B	Concept C
Pros	Volume control benefits	Effective TP and TSS removal	Effective TP and TSS removal
	Adds aesthetic value in Northwood Park	Minimal regular maintenance	Minimal regular maintenance
	Can be maintained regularly by City staff	Treats entire drainage area tributary to Northwood Lake	Treats entire drainage area tributary to Northwood Lake
	Removes soluble phosphorous		
	Water Conservation		
Cons	Capital cost	No volume control benefit	No volume control benefit
	Limited reuse tank capacity	Lack of public support	Limited drainage area
	Drainage area BC-2.9A cannot be routed into the Concept A BMPs	Limited aesthetic benefit in Northwood Park	Limited space for pond grading

INTANGIBLE BENEFITS – CONCEPT A

The Concept A improvements offer other intangible benefits which cannot be measured by only a cost per phosphorous removal analysis. The City and BCWMC both place high priority on projects with multiple benefits, and Concept A supports multiple benefits with an innovative approach.

A primary concern for the residents, City staff, and City Council was the preservation of the open park space. Concept A minimizes the impact on open park space by utilizing the underground storage tank, as well as providing a linear and aesthetically appealing series of rain garden filtration features. No storm water feature is proposed in the open space near the existing playground adjacent to the lake, as this area may be utilized for future park improvements or be maintained as

usable open park space. Although open park space may appear ideal or inexpensive for installing storm water treatment features, the space is highly valuable to the City and minimizing impact is essential.

Another main benefit for Concept A is the savings incurred on water consumption and costs associated to irrigating the ball fields. The reuse system will supply the publicly owned ball fields with irrigation for approximately a two week dry period. New Hope is a part of the Joint Water Commission and obtains their water supply from Minneapolis (Mississippi River) which has high water rates. Water will be conserved and costs will be saved with the reuse system.

As shown on the previous page in the Pros and Cons table (Table 8), the table references the ease of maintenance with Concept A for City staff. Past best management practice projects adjacent to Northwood Lake and around the City include storm water ponds. Although the initial construction cost of these ponds may be less expensive than more innovative BMP's, the ponds tend to be higher maintenance for City staff. Some of the pond maintenance requires contracted work rather than being able to utilize internal City staff. Typical ponds require regular weekly maintenance and limit aesthetic value over time, and the Concept B option near the lake is not favorable for the residents of New Hope.

Northwood Park is the premier park in New Hope, and is the highest used park. This park holds events such as Duk Duk Daze which attracts thousands of visitors every year. Many different groups use this park to gather and hold events. This park features many amenities including: two multi-use ball fields, a soccer field, basketball courts, nature areas, picnic areas, playgrounds, trails, and park shelters. As stated on the city's website, Northwood Park is the crown jewel of the city's park system. Concept A improvements preserve the open park space, while still providing storm water treatment and improving Northwood Lake and downstream waters.

Conclusion and Recommendations

It is the finding of this study that the proposed improvements for Concept A and Concept C are necessary, feasible, and cost effective. Pending the approval of funds as described in Table 6 – Potential Funding Source, both Concepts A and C will benefit Northwood Lake and downstream waters and could be completed as separate or combined projects. The priority for the City is completing Concept A; Concept C could be deferred to a future year as budget constraints may require constructing the projects separately and at different times.

Based on the feedback received from the residents, City staff, and the New Hope City Council, minimizing the impact to the already limited open park space is very critical. Improving water quality for Northwood Lake and downstream water is a priority, and any improvements shall consider the park and uses as a whole. Although the cost per phosphorous removal for Concept A and C improvements is high compared to Concept B, we recommend not completing the pond improvement option in Concept B as the impact to the park is not amenable to the City.

The following steps are recommended:

- Adopt this report as the guide for development of the proposed improvements
- Request approval for funding from the BCWMC
- Order the preparation of plans and specifications
- Provide additional public and adjacent resident feedback opportunities during the design phase, as final improvements and impacts need to be transparent
- Review plans and specifications – authorize bidding
- Receive bids
- Install the storm water improvements, with construction anticipated to be occur in 2016
- Complete storm water improvements in concurrence with future playground and park improvements

APPENDIX

Appendix A
Preliminary Cost Estimate

APPENDIX-A-1

PRELIMINARY COST ESTIMATES - SUMMARY

NORTHWOOD LAKE STORM WATER IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT A

ITEMS		PRICE
STORM WATER RELATED IMPROVEMENTS		
I. STORM SEWER REDIRECTION (INCLUDING TREATMENT STRUCTURE)	$	178,450.00
II. UNDERGROUND STORAGE TANK, 160,000 GALLON (WATER RE-USE)	$	301,500.00
III. WATER RE-USE PIPING; PUMP-HOUSE FOR IRRIGATION	$	207,000.00
IV. RAIN GARDENS (INCLUDING DRAINTILE, SUMP MH, PIPE, RIP RAP, EOF'S & TRAIL IMPROVEMENTS DUE TO STORM)	$	202,585.00
CONSTRUCTION COST SUBTOTAL (STORM WATER RELATED IMPROVEMENTS) =	$	889,535.00
CONTINGENCIES (10%) =	$	88,953.50
INDIRECT (25%) =	$	222,383.75
TOTAL COST (STORM WATER RELATED IMPROVEMENTS)	**$**	**1,200,872.25**
NON-STORM WATER RELATED IMPROVEMENTS		
V. LOOP TRAIL	$	18,950.00
CONSTRUCTION COST SUBTOTAL (NON-STORM WATER RELATED IMPROVEMENTS) =	$	18,950.00
CONTINGENCIES (10%) =	$	1,895.00
INDIRECT (25%) =	$	4,737.50
TOTAL COST (NON-STORM WATER RELATED IMPROVEMENTS) =	**$**	**25,582.50**

CONCEPT B

ITEMS		PRICE
STORM WATER RELATED IMPROVEMENTS		
I. POND (INCLUDING DIVERSION STRUCTURE, RIP RAP, EOF)	$	99,455.00
CONSTRUCTION COST SUBTOTAL (STORM WATER RELATED IMPROVEMENTS) =	$	99,455.00
CONTINGENCIES (10%) =	$	9,945.50
INDIRECT (25%) =	$	24,863.75
TOTAL COST (STORM WATER RELATED IMPROVEMENTS)	**$**	**134,264.25**
NON-STORM WATER RELATED IMPROVEMENTS		
II. LOOP TRAIL	$	21,700.00
CONSTRUCTION COST SUBTOTAL (NON-STORM WATER RELATED IMPROVEMENTS) =	$	21,700.00
CONTINGENCIES (10%) =	$	2,170.00
INDIRECT (25%) =	$	5,425.00
TOTAL COST (NON-STORM WATER RELATED IMPROVEMENTS) =	**$**	**29,295.00**

CONCEPT C

ITEMS		PRICE
STORM WATER RELATED IMPROVEMENTS		
I. POND (INCLUDING DIVERSION STRUCTURE, CURB CUT, RIP RAP, EOF)	$	111,449.00
CONSTRUCTION COST SUBTOTAL (STORM WATER RELATED IMPROVEMENTS) =	**$**	**111,449.00**
CONTINGENCIES (10%) =	$	11,144.90
INDIRECT (25%) =	$	27,862.25
TOTAL COST (STORM WATER RELATED IMPROVEMENTS)	**$**	**150,456.15**

APPENDIX A-2

PRELIMINARY COST ESTIMATES - CONCEPT A, PART I

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT A - PART I					
Storm Sewer Redirection (Including Treament Structure)					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 7,000.00	$ 7,000.00
2	TRAFFIC CONTROL	LS	1	$ 3,500.00	$ 3,500.00
3	TREE REMOVAL	EA	2	$ 750.00	$ 1,500.00
				GENERAL SUBTOTAL =	**$ 12,000.00**
STORM SEWER					
4	REMOVE EXISTING STORM SEWER PIPE	LF	20	$ 25.00	$ 500.00
5	36" RCP STORM SEWER PIPE	LF	385	$ 100.00	$ 38,500.00
6	12' DIAMETER STORM SEWER TREATMENT MANHOLE	EA	1	$ 50,000.00	$ 50,000.00
7	6' DIAMETER SEWER MANHOLE	EA	1	$ 4,000.00	$ 4,000.00
				STORM SEWER SUBTOTAL =	**$ 93,000.00**
STREETS					
8	REMOVE EXISTING CONCRETE CURB	LF	340	$ 5.00	$ 1,700.00
9	REMOVE EXISTING CONCRETE SIDEWALK	SF	1500	$ 2.00	$ 3,000.00
10	REMOVE EXISTING BITUMINOUS DRIVEWAY PAVEMENT	SY	25	$ 5.00	$ 125.00
11	REMOVE EXISTING BITUMINOUS PAVEMENT	SY	400	$ 4.00	$ 1,600.00
12	SALVAGE & REINSTALL SIGN	EA	3	$ 150.00	$ 450.00
13	CONCRETE CURB & GUTTER - B618	LF	340	$ 15.00	$ 5,100.00
14	4" CONCRETE SIDEWALK	SF	1500	$ 5.00	$ 7,500.00
15	6" PEDESTRIAN RAMP	SF	200	$ 9.00	$ 1,800.00
16	TRUNCATED DOMES	SF	40	$ 50.00	$ 2,000.00
17	BITUMINOUS MIXTURE FOR DRIVEWAYS	TN	20	$ 200.00	$ 4,000.00
18	BITUMINOUS MIXTURE FOR STREET	TN	150	$ 90.00	$ 13,500.00
19	TOPSOIL BORROW	CY	65	$ 25.00	$ 1,625.00
20	HYDROSEED WITH MULCH	SY	350	$ 3.00	$ 1,050.00
21	RELOCATE UTILITY POLE	EA	3	$ 10,000.00	$ 30,000.00
				STREETS SUBTOTAL =	**$ 73,450.00**
				CONCEPT A - PART I TOTAL CONSTRUCTION COST =	$ 178,450.00
				CONTINGENCIES (10%) =	$ 17,845.00
				INDIRECT (25%) =	$ 44,612.50
				CONCEPT A - PART I TOTAL COST =	**$ 240,907.50**

APPENDIX A-3

PRELIMINARY COST ESTIMATES - CONCEPT A, PART II

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT A - PART II					
Underground Storage Tank (Water Re-use)					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 12,000.00	$ 12,000.00
2	TRAFFIC CONTROL	LS	1	$ 6,000.00	$ 6,000.00
				GENERAL SUBTOTAL =	**$ 18,000.00**
RESERVOIR - 160,000 GALLONS					
3	COMMON EXCAVATION	LS	1	$ 20,000.00	$ 20,000.00
4	CONCRETE	LS	1	$ 250,000.00	$ 250,000.00
5	FINISH GRADING	LS	1	$ 12,500.00	$ 12,500.00
				RESERVOIR SUBTOTAL =	**$ 282,500.00**
METALS					
6	GALV. STEP LADDERS	LS	1	$ 850.00	$ 850.00
7	LADDER UP SAFETY POLE	EA	1	$ 150.00	$ 150.00
				METALS SUBTOTAL =	**$ 1,000.00**
				CONCEPT A - PART II CONSTRUCTION COST =	$ 301,500.00
				CONTINGENCIES (10%) =	$ 30,150.00
				INDIRECT (25%) =	$ 75,375.00
				CONCEPT A - PART II TOTAL COST =	**$ 407,025.00**

APPENDIX A-4

PRELIMINARY COST ESTIMATES - CONCEPT A, PART III

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT A - PART III					
Water Re-use Piping; Pump House for Irrigation					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 8,000.00	$ 8,000.00
2	TRAFFIC CONTROL	LS	1	$ 4,000.00	$ 4,000.00
				GENERAL SUBTOTAL =	**$ 12,000.00**
WATER MAIN					
3	4" FROM PUMP HOUSE TO IRRIGATION SYSTEM	LF	800	$ 50.00	$ 40,000.00
				WATER MAIN SUBTOTAL =	**$ 40,000.00**
PUMP HOUSE - 111 GPM					
4	BUILDING	SF	320	$ 150.00	$ 48,000.00
5	BUILDING - ELECTRICAL WORK	LS	1	$ 7,000.00	$ 7,000.00
6	BUILDING - PLUMBING & HVAC WORK	LS	1	$ 10,000.00	$ 10,000.00
7	MISC. BUILDING AMENITIES	LS	1	$ 2,500.00	$ 2,500.00
				PUMP HOUSE SUBTOTAL =	**$ 67,500.00**
PUMPS & CONTROLS					
8	6" VERTICAL PUMP & MOTOR SET IN RESERVOIR	EA	2	$ 12,000.00	$ 24,000.00
9	6" PUMP COLUMN X 16'	EA	2	$ 800.00	$ 1,600.00
10	6" CHECK VALVE	EA	2	$ 1,500.00	$ 3,000.00
11	VFD CONTROL PANEL FOR 15 HP	EA	1	$ 5,000.00	$ 5,000.00
12	ELECTRICAL (PROCESS/MCC)	LS	1	$ 12,000.00	$ 12,000.00
				PUMPS & CONTROLS SUBTOTAL =	**$ 45,600.00**
PUMP STATION PIPING & AMENITIES					
13	SELF-CLEANING FILTER	EA	2	$ 10,000.00	$ 20,000.00
14	PRESSURE TANKS	EA	1	$ 1,000.00	$ 1,000.00
15	PROPELLER METER	EA	1	$ 2,500.00	$ 2,500.00
16	4" RPZ BACKFLOW PREVENTER	EA	1	$ 3,000.00	$ 3,000.00
				PUMP STATION PIPING & AMENITIES SUBTOTAL =	**$ 26,500.00**
PROCESS PIPING					
17	4" BUTTERFLY VALVE	EA	8	$ 250.00	$ 2,000.00
18	4" CHECK VALVE	EA	2	$ 750.00	$ 1,500.00
19	EXP. JOINTS, RUBBER & ADAPTER	EA	1	$ 500.00	$ 500.00
20	4" FLG. DIP C153	FT	40	$ 35.00	$ 1,400.00
21	6" FITTINGS	LB	1000	$ 5.00	$ 5,000.00
22	MISC. SPECIAL, BOLTS/GASKETS/ETC…	LS	1	$ 500.00	$ 500.00
23	LABOR	LS	1	$ 4,500.00	$ 4,500.00
				STREETS SUBTOTAL =	**$ 15,400.00**
				CONCEPT A - PART III CONSTRUCTION COST =	$ 207,000.00
				CONTINGENCIES (10%) =	$ 20,700.00
				INDIRECT (25%) =	$ 51,750.00
				CONCEPT A - PART III TOTAL COST =	**$ 279,450.00**

APPENDIX A-5

PRELIMINARY COST ESTIMATES - CONCEPT A, PART IV

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT A - PART IV					
Rain Gardens (Including Draintile, Sump MH, Pipe, Rip Rap, EOF's & Trail Improvements)					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 10,000.00	$ 10,000.00
2	TRAFFIC CONTROL	LS	1	$ 5,000.00	$ 5,000.00
				GENERAL SUBTOTAL =	**$ 15,000.00**
RAIN GARDENS & STORM SEWER					
3	REMOVE EXISTING STORM MANHOLE OR CATCH BASIN	EA	1	$ 500.00	$ 500.00
4	REMOVE TREE	EA	3	$ 750.00	$ 2,250.00
5	CLEARING & GRUBBING	LS	1	$ 2,000.00	$ 2,000.00
6	CONSTRUCT RAIN GARDEN	SF	11050	$ 5.00	$ 55,250.00
7	DOUBLE SHREDDED HARDWOOD MULCH (3" DEPTH)	CY	150	$ 50.00	$ 7,500.00
9	PLANTINGS	LS	1	$ 50,000.00	$ 50,000.00
10	6" PERFORATED HDPE DRAIN TILE	LF	600	$ 30.00	$ 18,000.00
11	INSTALL SUMP MANHOLE	EA	1	$ 4,000.00	$ 4,000.00
12	24" RCP STORM SEWER	LF	65	$ 40.00	$ 2,600.00
13	OUTLET CONTROL STRUCTURE	EA	1	$ 3,000.00	$ 3,000.00
14	24" FLARED END SECTION	EA	1	$ 1,000.00	$ 1,000.00
15	EMERGENCY OVERFLOW (TURF REINFORCEMENT MAT)	SY	340	$ 15.00	$ 5,100.00
				RAIN GARDENS & STORM SEWER SUBTOTAL =	**$ 151,200.00**
STREETS					
16	REMOVE EXISTING CONCRETE CURB	LF	20	$ 5.00	$ 100.00
17	SALVAGE & REINSTALL SIGN	EA	1	$ 150.00	$ 150.00
18	REMOVE EXISTING BITUMINOUS PAVEMENT	SY	30	$ 4.00	$ 120.00
19	CONCRETE CURB & GUTTER - B618	LF	20	$ 15.00	$ 300.00
20	6" PEDESTRIAN RAMP	SF	250	$ 9.00	$ 2,250.00
21	TRUNCATED DOMES	SF	32	$ 50.00	$ 1,600.00
22	BITUMINOUS MIXTURE FOR STREET	TN	10	$ 90.00	$ 900.00
23	AGGREGATE BASE, CLASS V - STREET	TN	20	$ 20.00	$ 400.00
24	SELECT GRANULAR BORROW - STREET	CY	15	$ 15.00	$ 225.00
25	2" BITUMINOUS MIXTURE FOR TRAILS	TN	90	$ 80.00	$ 7,200.00
26	AGGREGATE BASE, CLASS V - TRAIL	TN	315	$ 12.00	$ 3,780.00
27	SELECT GRANULAR BORROW - TRAIL	CY	270	$ 8.00	$ 2,160.00
28	TOPSOIL BORROW	CY	400	$ 25.00	$ 10,000.00
29	HYDROSEED WITH MULCH	SY	2400	$ 3.00	$ 7,200.00
				STREETS SUBTOTAL =	**$ 36,385.00**
				CONCEPT A - PART IV CONSTRUCTION COST =	$ 202,585.00
				CONTINGENCIES (10%) =	$ 20,258.50
				INDIRECT (25%) =	$ 50,646.25
				CONCEPT A - PART IV TOTAL COST =	**$ 273,489.75**

APPENDIX A-6

PRELIMINARY COST ESTIMATES - CONCEPT A, PART V

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT A - PART V					
Loop Trail (Non-Storm Water Related Improvements)					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 1,000.00	$ 1,000.00
2	TRAFFIC CONTROL	LS	1	$ 500.00	$ 500.00
				GENERAL SUBTOTAL =	**$ 1,500.00**
TRAIL					
3	3" BITUMINOUS MIXTURE FOR TRAILS	TN	90	$ 80.00	$ 7,200.00
4	AGGREGATE BASE, CLASS V	TN	210	$ 20.00	$ 4,200.00
5	SELECT GRANULAR BORROW	CY	180	$ 15.00	$ 2,700.00
6	TOPSOIL BORROW	CY	80	$ 25.00	$ 2,000.00
7	HYDROSEED WITH MULCH	SY	450	$ 3.00	$ 1,350.00
				STREETS SUBTOTAL =	**$ 17,450.00**
				CONCEPT A - PART V CONSTRUCTION COST =	$ 18,950.00
				CONTINGENCIES (10%) =	$ 1,895.00
				INDIRECT (25%) =	$ 4,737.50
				CONCEPT A - PART V TOTAL COST =	**$ 25,582.50**

APPENDIX A-7

PRELIMINARY COST ESTIMATES - CONCEPT B, PART I

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT B - PART I					
Pond (Including Diversion Structure, Rip Rap, EOF)					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 3,000.00	$ 3,000.00
2	TRAFFIC CONTROL	LS	1	$ 1,500.00	$ 1,500.00
				GENERAL SUBTOTAL =	**$ 4,500.00**
DEMOLITION/EXCAVATION					
3	TREE REMOVAL	EA	3	$ 750.00	$ 2,250.00
4	CLEARING & GRUBBING	LS	1	$ 1,000.00	$ 1,000.00
5	COMMON EXCAVATION	CY	4000	$ 4.00	$ 16,000.00
6	SITE GRADING	LS	1	$ 15,000.00	$ 15,000.00
				DEMOLITION/EXCAVATION SUBTOTAL =	**$ 34,250.00**
STORM SEWER					
7	INSTALL STORM DIVERSION STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
8	36" RCP STORM SEWER PIPE	LF	50	$ 80.00	$ 4,000.00
9	36" RCP FLARED END SECTION	EA	1	$ 900.00	$ 900.00
10	CLASS III RIP RAP	CY	50	$ 85.00	$ 4,250.00
11	PLANTINGS	LS	1	$ 25,000.00	$ 25,000.00
				STORM SEWER SUBTOTAL =	**$ 49,150.00**
STREETS					
16	3" BITUMINOUS MIXTURE FOR TRAILS	TN	90	$ 25.00	$ 2,250.00
17	AGGREGATE BASE, CLASS V	TN	205	$ 3.00	$ 615.00
18	SELECT GRANULAR BORROW	CY	180	$ 8.00	$ 1,440.00
19	TOPSOIL BORROW	CY	170	$ 25.00	$ 4,250.00
20	HYDROSEED WITH MULCH	SY	1000	$ 3.00	$ 3,000.00
				STREETS SUBTOTAL =	**$ 11,555.00**
				CONCEPT C - PART I CONSTRUCTION COST =	$ 99,455.00
				CONTINGENCIES (10%) =	$ 9,945.50
				INDIRECT (25%) =	$ 24,863.75
				CONCEPT C - PART I TOTAL COST =	**$ 134,264.25**

APPENDIX A-8

PRELIMINARY COST ESTIMATES - CONCEPT B, PART II

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT B - PART II					
Loop Trail					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 1,000.00	$ 1,000.00
2	TRAFFIC CONTROL	LS	1	$ 500.00	$ 500.00
				GENERAL SUBTOTAL =	**$ 1,500.00**
DEMOLITION/EXCAVATION					
3	REMOVE TREE	EA	3	$ 750.00	$ 2,250.00
4	CLEARING & GRUBBING	LS	1	$ 500.00	$ 500.00
				DEMOLITION/EXCAVATION SUBTOTAL =	**$ 2,750.00**
TRAIL					
5	3" BITUMINOUS MIXTURE FOR TRAILS	TN	90	$ 80.00	$ 7,200.00
6	AGGREGATE BASE, CLASS V	TN	210	$ 20.00	$ 4,200.00
7	SELECT GRANULAR BORROW	CY	180	$ 15.00	$ 2,700.00
8	TOPSOIL BORROW	CY	80	$ 25.00	$ 2,000.00
9	HYDROSEED WITH MULCH	SY	450	$ 3.00	$ 1,350.00
				STREETS SUBTOTAL =	**$ 17,450.00**
				CONCEPT B - PART II CONSTRUCTION COST =	$ 21,700.00
				CONTINGENCIES (10%) =	$ 2,170.00
				INDIRECT (25%) =	$ 5,425.00
				CONCEPT B - PART II TOTAL COST =	**$ 29,295.00**

APPENDIX A-9

PRELIMINARY COST ESTIMATES - CONCEPT C, PART I

2016 NORTHWOOD LAKE IMPROVEMENTS PROJECT

SEPTEMBER 2014

CONCEPT C - PART I					
Pond (Including Diversion Structure, Curb Cut, Rip Rap, EOF)					
NO.	**ITEM**	**UNITS**	**QTY**	**UNIT PRICE**	**TOTAL PRICE**
GENERAL					
1	MOBILIZATION	LS	1	$ 3,500.00	$ 3,500.00
2	TRAFFIC CONTROL	LS	1	$ 1,750.00	$ 1,750.00
				GENERAL SUBTOTAL =	**$ 5,250.00**
DEMOLITION/EXCAVATION					
3	TREE REMOVAL	EA	7	$ 500.00	$ 3,500.00
4	CLEARING & GRUBBING	LS	1	$ 800.00	$ 800.00
5	COMMON EXCAVATION	CY	2400	$ 4.00	$ 9,600.00
6	REMOVE EXISTING STORM SEWER PIPE	LF	30	$ 12.00	$ 360.00
7	REMOVE EXISTING BITUMINOUS PAVEMENT	SY	56	$ 4.00	$ 224.00
8	REMOVE EXISTING CONCRETE CURB	LF	40	$ 5.00	$ 200.00
9	POND GRADING	LS	1	$ 35,000.00	$ 35,000.00
				DEMOLITION/EXCAVATION SUBTOTAL =	**$ 49,684.00**
STORM SEWER					
10	INSTALL SUMP MANHOLE	EA	1	$ 4,000.00	$ 4,000.00
11	24" RCP STORM SEWER PIPE	LF	140	$ 65.00	$ 9,100.00
13	24" RCP FLARED END SECTION	EA	1	$ 900.00	$ 900.00
15	CLASS III RIP RAP	CY	15	$ 85.00	$ 1,275.00
16	CONNECT TO EXISTING STORM STRUCTURE	EA	1	$ 700.00	$ 700.00
17	PLANTINGS	LS	1	$ 20,000.00	$ 20,000.00
18	REMOVE & REPLACE CASTING & RINGS	EA	1	$ 800.00	$ 800.00
				STORM SEWER SUBTOTAL =	**$ 36,775.00**
STREETS					
19	REMOVE EXISTING CONCRETE CURB	LF	40	$ 5.00	$ 200.00
20	REMOVE EXISTING BITUMINOUS PAVEMENT	SY	60	$ 4.00	$ 240.00
21	CONCRETE CURB & GUTTER - B618	LF	40	$ 15.00	$ 600.00
22	BITUMINOUS MIXTURE FOR STREET	TN	20	$ 90.00	$ 1,800.00
23	TOPSOIL BORROW	CY	400	$ 25.00	$ 10,000.00
24	HYDROSEED WITH MULCH	SY	2300	$ 3.00	$ 6,900.00
				STREETS SUBTOTAL =	**$ 19,740.00**
				CONCEPT C - PART I CONSTRUCTION COST =	$ 111,449.00
				CONTINGENCIES (10%) =	$ 11,144.90
				INDIRECT (25%) =	$ 27,862.25
				CONCEPT C - PART I TOTAL COST =	**$ 150,456.15**

Appendix B
Soil Boring Report

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

August 20, 2014

Stantec
2335 Highway 36 West
St. Paul, MN 55113

Attention: Chris Long

RE: Soil Exploration
Northwood Lake
New Hope, Minnesota
AET Project No. 01-06193

Dear Mr. Long:

Per our July 11, 2014 proposal, we are submitting the soil boring logs and laboratory test results for the potential stormwater management improvements around Northwood Lake.

Field Work

We performed a total of 10 geoprobe borings. Please refer to the attached sheet entitled "Environmental Sampling Methods – Push Probes" for details regarding drilling and sampling of geoprobe borings. The approximate boring locations are shown on the attached aerial photos.

We performed three borings on the west side of Northwood Lake. At these borings we generally found 4 to 9 feet of clayey fill overlying swamp deposits and then alluvial soils. The soils are generally slow draining, so the fact that a water level wasn't encountered in a boring doesn't mean that the ground water level is below the boring depth. We installed a piezometer at Boring 3 and measured a water level at 4.7 feet below grade (elevation 892½) on 7/24/14 and this should be representative of the approximate ground water level at Borings 1 and 2 also.

We advanced seven borings on the east side of Northwood Lake. Borings 4 through 7 were located in a relatively low area (roughly a couple feet above the lake level), and at these borings we generally found fill over swamp deposits. At the remaining borings away from the lake and at higher elevations, fill and glacial till were found. We installed a piezometer in Boring 8 to 9 feet below grade – this was dry on 7/24/14 indicating the ground water level was below about elevation 891½. We found shallow ground water at elevations slightly above the lake level in Borings 4 thru 7. We didn't measure a water level in Borings 9 and 10, and presumably it is in between the lake level (about 885) and elevation 891½.

Laboratory Testing

We submitted three soil samples to Pace Analytical Services, Inc., for environmental testing. The soil samples were collected from 1 to 4 feet deep in Borings 1 through 3. The samples were analyzed for:

- Copper by method EPA 6010,
- Arsenic by method EPA 6010,
- Polycyclic Aromatic Hydrocarbons (PAHs) by method EPA 8270.

The laboratory analytical results indicated that metals were present in concentrations less than Minnesota Pollution Control Agency (MPCA) established residential soil reference values (SRVs). The results for the PAHs indicated non-detect concentrations in two of the three samples collected (B-1 and B-3). Sample B-2 had detections of various chemical compounds, but all were below their respective residential SRV. The Benzo(a)Pyrene equivalent (BaP equivalent) for sample B-2 was calculated to be 0.081(mg/kg) which is less than the residential SRV. The sampled soils meet the criteria of residential reuse soils for the analyzed compounds Copper, Arsenic and PAHs.

Closure

If you have any questions regarding the work reported herein, or if we can be of further service to you, please do not hesitate to contact me at 651-789-4645.

Report Prepared by:

American Engineering Testing

Jay Brekke, P.E.
Senior Engineer
jbrekke@amengtest.com

Report Reviewed by:

American Engineering Testing

Allan Kestler, EIT
Environmental Engineer II

Attachments: Environmental Sampling Methods – Push Probes
Boring Locations and Subsurface Boring Logs
Laboratory Analytical Results

Contamination Reduction

The push-probe down hole tooling is steam cleaned prior to mobilization. New clear plastic liners are used for each drive, and the tooling is cleaned between borings to minimize cross contamination. The cleaning procedure consists of an alconox detergent-water wash using a brush, followed by a tapwater rinse. The alconox wash and rinse water are changed regularly – typically between borings. Certain types of projects may entail more stringent decontamination procedures.

Soil Boring Advancement and Limitations

Soil sampling in the soil borings is performed using a Geoprobe® system. Soil borings are advanced using a vehicle-mounted, hydraulically-powered, soil probing machine, which uses static force (vehicle weight) and percussion to advance small-diameter sampling tools into the subsurface for collecting soil core, soil gas, or groundwater samples. Using this system, a 2" outer-diameter (OD) MacroCore® soil sampler containing a 1.75" OD clear plastic liner is driven into the soil in distinct 48" depth intervals, except where subsurface conditions limit the equipment to shorter drive lengths. In cases where soil recovery is poor, typically due to grain-size or moisture, a smaller "discrete" soil sampler (1.5" OD containing a 1.0" OD clear plastic liner) with a retractable piston tip may be used to collect soil in distinct 24" depth intervals. Probe rods are added to extend borings deeper beneath the surface. The plastic liner is removed from the sampler and cut lengthwise to expose discrete sections of soil for classification and sampling.

Unless actually observed, contacts between soil layers are estimated based on the spacing of samples and the action of the push-probe system. Cobbles, boulders, and other large objects generally cannot be recovered from push-probe soil borings, and may be present in the ground even if they are not noted on the boring logs. Impacted soils or buried debris may be present that are not observed due to the spacing and depths of sampling points. Best judgment determinations, based on known site conditions and past experience in similar situations, do not guarantee identification of all impacts.

Soil Classification

As the samples are obtained in the field, they are visually and manually classified by the field staff. Representative portions of the samples may be returned to the laboratory for further observation and for verification of the field classification. Logs of the borings are prepared indicating the depth and identification of the various strata, water level information, and other pertinent information regarding the method of advancing the borings. A chart illustrating the descriptive terminology and symbols used on the borings logs is also provided.

Boring logs include judgments of the geologic depositional origin. This judgment is primarily based on observations of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment. Visual/odor observations may aid in assessing impacts but are not relied on exclusively.

Soil Sample Vapor Screening

Soil samples collected directly from the sampling liner are screened with a photoionization detector (PID) for the presence of organic vapors with ionization potentials less than the lamp voltage. The PID is calibrated for direct reading in parts-per-million-volume (PPMv) of a benzene equivalent. Soil samples are collected and screened according to the bag-headspace field screening procedure, which consists of placing freshly collected soil into a polyethylene Whirl-Pak or freezer "baggie" (i.e., bag), sealing the bag to contain an air pocket (i.e., headspace), and allowing 10 to 20 minutes for vapors to disperse from the soil to the headspace. The highest reading upon inserting the PID probe into the bag headspace – typically attained within two to five seconds of probe insertion – is recorded on the boring log. Excessive moisture, temperature extremes, ambient vapors, or other unusual field circumstances can affect screening results.

Other Field Screening

For certain sites, field screening may be conducted for additional parameters in accordance with AET's Field Screening Methods Supplemental information sheet.

Soil Sampling for Chemical Analysis

Soil samples obtained for chemical analysis are collected directly from the sampling liner and placed into laboratory-prepared containers with appropriate preservatives, according to laboratory protocols. The samples are delivered to the analytical laboratory within prescribed holding times, accompanied by proper chain-of-custody forms.

Not all methods summarized on this information sheet are conducted at all sites. Special conditions may also occur which require modifications to these methods. Any descriptions of field methods within the report text take precedence.

Water Level Measurements

The groundwater level measurements are shown at the bottom of the boring logs. The following information appears under Water Level Measurements on the logs:

- Date and time of measurement
- Sampled Depth: greatest depth of soil sampling at the time of measurement
- Cave-in Depth: tape-measured depth of borehole
- Water Level: tape-measured depth of free water in the borehole

The true depth of the water table at the boring locations may be different from the water levels measured in the boreholes. This is possible because several factors can affect the water level measurements in the borehole such as permeability of each soil layer in profile, presence of perched water, amount of time between water-level readings, and weather conditions.

Groundwater Sampling for Chemical Analysis

Groundwater sampling in the boreholes/temporary monitoring wells is performed using a Geoprobe® system. Using this system, a 1.5" OD groundwater sampler with a 41" stainless-steel or PVC screen is driven into the soil to the desired sampling depth using static and percussive forces. The operation of extension rods through the hollow interior of the probe rods enables advancement of the screen beyond the depth of the probe rods while maintaining a closed system above the desired sampling depth.

Using a peristaltic pump or check-valve assembly, samples are pumped directly from the screen through new polyethylene tubing extended to depth through the probe rods. Samples are collected in laboratory-prepared containers with appropriate preservatives, according to laboratory protocols. For analyses in which field-filtering is performed, samples are vacuum-filtered through a new dedicated plastic filter with 0.45-μm pores. The samples are delivered to the analytical laboratory within prescribed holding times, accompanied by proper chain-of-custody forms.

Because boreholes are not typically in equilibrium with ambient groundwater, results provide qualitative groundwater data. Purging additional water prior to sampling may improve the data representativeness somewhat. Monitoring wells are necessary to obtain more accurate quantitative groundwater data.

Soil Vapor Probes

For assessment of vapor encroachment or intrusion into structures, soil vapor sampling is performed using a Geoprobe® system. A 1.25" OD retractable rod with soil vapor adaptor tip is driven into the soil to the desired sampling depth (typically basement floor or base-of-foundation) using static and percussive forces. New polyethylene tubing is attached to the tip, and the rods are retracted approximately 6", creating a closed system. Air samples are pumped through the tubing, and collected in either summa canisters or tedlar bags, as approved by regulatory authorities. The samples are delivered to the analytical laboratory within prescribed holding times, accompanied by proper chain-of-custody forms.

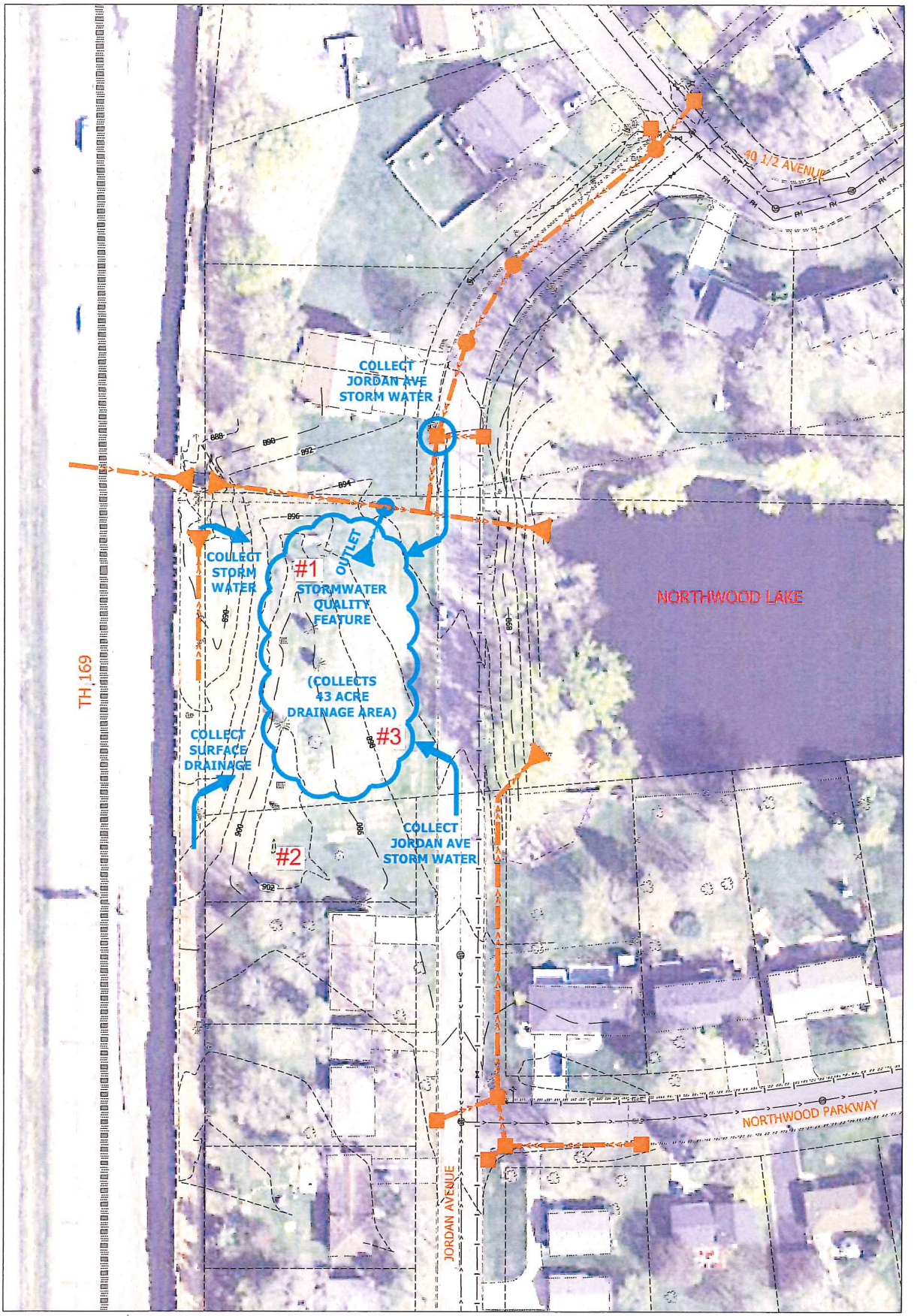
As appropriate, bore holes are stabilized in relative equilibrium with air in soil void spaces by removing a minimum of two borehole volumes of air as measured by a flow gauge. Due to the actions of push-probe tools, potential surface leakage, and diffusion from surrounding soils, air samples may not attain equilibrium with the air in soil void spaces; this method is considered a screening measurement.

Boring Elevations, Locations, and Abandonment

Following sampling, ground surface elevations at boring locations are typically measured to the nearest 0.1 foot. If a permanent benchmark of known elevation is unavailable, the measurement is referenced to a nearby temporary benchmark given the arbitrary reference elevation of 100.0 feet. Horizontal location control is typically based on tape measurements from fixed site features. Certain types of projects may entail more stringent measures such as global positioning systems (GPS) or contracting registered surveyors.

Boreholes/temporary monitoring wells are abandoned using appropriate grouting materials and methods. Licensed well contractors on staff ensure compliance with state and local standards.

Not all methods summarized on this information sheet are conducted at all sites. Special conditions may also occur which require modifications to these methods. Any descriptions of field methods within the report text take precedence.



PROPOSED BORING LOCATIONS =

JORDAN OUTLOT POND STORMWATER IMPROVEMENT CONCEPT

CITY OF NEW HOPE, MINNESOTA

2016 NORTHWOOD LAKE IMPROVEMENTS

FIGURE 1

DATE: JUNE 2014 PROJ. NO.: 193802816

N

0 30 60

Stantec

2335 Highway 36 W
St. Paul, MN 55113
www.stantec.com

Plot Date: 06/24/2014 - 11:01am
Drawing name: \\fs1\data\mpls\193802816\CAD\Dwg\193802816_FIG1-2.dwg
Xrefs: 193802816_CP01.dwg

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **1 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

SURFACE ELEVATION: **897.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS: WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand, trace roots, grayish brown, a little brown and light gray	FILL		M		40					
3	FILL, mostly organic clay, trace roots, black (OH)			M							
4	ORGANIC CLAY, trace roots, black, a little brown (OH)	SWAMP DEPOSIT		M							
6				M		58					
8	FAT CLAY, slightly organic, dark brownish gray, a little black, a lens of organic clay (CH)	FINE ALLUVIUM		M							
10	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' Geoprobe	**7/14/14**						**None**
BORING COMPLETED: **7/14/14**							
DR: **PS** LG: Rig: **Geoprobe**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **2 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

DEPTH IN FEET	SURFACE ELEVATION: 902.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand with organic fines, a little gravel and clayey sand, grayish brown, a little light brown and gray	FILL		M		55					
2											
3				M							
4											
5											
6											
7				M		58					
8											
9	SAPRIC PEAT, black, a little gray, laminations of organic clay and lean clay (PT)	SWAMP DEPOSIT		M							
10	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-10' Geoprobe	**7/14/14**						**None**	
BORING COMPLETED: **7/14/14**								
DR: **PS** LG: Rig: **Geoprobe**								

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **3 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

SURFACE ELEVATION: **897.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	FILL, mostly clayey sand, a little gravel, trace roots, grayish brown, a little gray	FILL		M		58					
1	FILL, mostly clayey sand with gravel, brown and dark brown			M							
2	FILL, mostly clayey sand, a little gravel, dark brown										
3				M							
4	FILL, mostly organic clay, a little sandy lean clay, trace roots, black, a little brown										
				M							
5											
				M		55					
6	ORGANIC CLAY, black, a little gray, a lens of fat clay around 6½' (OH)	SWAMP DEPOSIT		M							
7				M							
8	CLAYEY SAND, a little gravel, trace roots, brownish gray, a little dark brown, a lens of organic clay (SC)	MIXED ALLUVIUM									
9				M							
10	**END OF BORING**										

DEPTH: DRILLING METHOD

0-10' Geoprobe

BORING COMPLETED: **7/14/14**

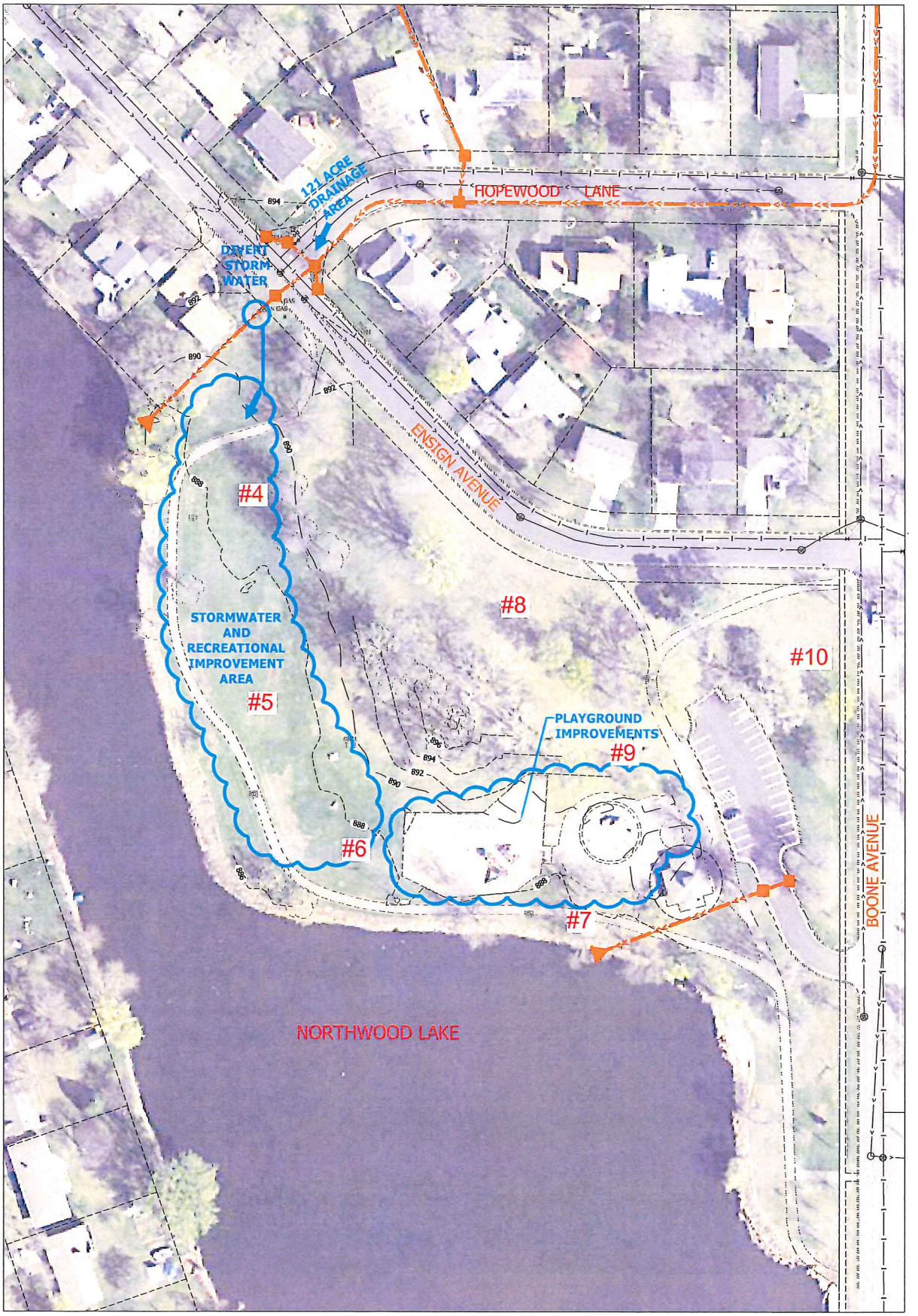
DR: **PS** LG: Rig: **Geoprobe**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/14/14						**None**
7/24/14						**4.7**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14



PROPOSED BORING LOCATIONS =

N

0 40 80

NORTHWOOD LAKE IMPROVEMENT CONCEPT AREAS

CITY OF NEW HOPE, MINNESOTA

2016 NORTHWOOD LAKE IMPROVEMENTS

FIGURE 2

DATE: JUNE 2014 PROJ. NO.: 193802816

Stantec
2335 Highway 36 W
St. Paul, MN 55113
www.stantec.com

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **4 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

SURFACE ELEVATION: **888.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS: WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand with organic fines and clayey sand, a little gravel, trace roots, dark brown and brown	FILL		M		40					
	FILL, mostly clayey sand, a little gravel, brown			M							
2	ORGANIC CLAY, trace roots, black (OH)	SWAMP DEPOSIT		▽ M							
3	LEAN CLAY, trace roots, dark brown (CL)	FINE ALLUVIUM									
4				M							
5	ORGANIC CLAY, trace roots, black (OH)	SWAMP DEPOSIT									
6											
7				M							
8											
9	LEAN CLAY, gray and brown mottled, laminations of silty sand (CL)	FINE ALLUVIUM		M							
10	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' Geoprobe	**7/14/14**						**2.0**
BORING COMPLETED: **7/14/14**							
DR: **PS** LG: Rig: **Geoprobe**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **5 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

SURFACE ELEVATION: **887.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand with organic fines, trace roots	FILL		M ▽		34					
2	FILL, mostly clayey sand, a little gravel and lean clay, brown, a little light brown			M							
3	ORGANIC CLAY, trace roots, black (OH)	SWAMP DEPOSIT									
4				M							
5											
6				M							
7	LEAN CLAY, gray (CL)	FINE ALLUVIUM									
8				M		32					
9	CLAYEY SAND WITH GRAVEL, trace roots, gray (SC)	TILL		M							
10	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' Geoprobe	**7/14/14**						**1.0**
BORING COMPLETED: **7/14/14**							
DR: **PS** LG: Rig: **Geoprobe**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **6 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

DEPTH IN FEET	SURFACE ELEVATION: 887.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand with organic fines, trace roots, dark brown	FILL		M		26½					
	FILL, mostly clayey sand, a little gravel and sand, brown			M							
2	ORGANIC CLAY, trace roots and shells, black (OL)	SWAMP DEPOSIT									
3				M							
4											
5											
6				M							
7	CLAYEY SAND, a little gravel, light brownish gray to brown and gray mottled, a lens of sand around 9' (SC)	TILL									
8				M		38					
9											
10	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-10'	**Geoprobe**	**7/14/14**						**1.0**	
BORING COMPLETED: **7/14/14**									
DR: **PS** LG:	Rig: **Geoprobe**								

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **7 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

DEPTH IN FEET	SURFACE ELEVATION: 886.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0	FILL, mostly clayey sand with organic fines, trace roots, dark brown	FILL		M		36					
1	FILL, mostly clayey sand, a little gravel, grayish brown			▽							
2				M							
3	SAPRIC PEAT, dark brown (PT)	SWAMP DEPOSIT									
4				M							
5											
6											
7				M		35					
8	ORGANIC CLAY, black (OH)			M							
9	LEAN CLAY, gray, a lens of sand (CL)	FINE ALLUVIUM		M							
10	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' Geoprobe	**7/14/14**						**1.0**
BORING COMPLETED: **7/14/14**							
DR: **PS** LG: Rig: **Geoprobe**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **8 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

DEPTH IN FEET	SURFACE ELEVATION: 900.3 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	CLAYEY SAND WITH ORGANIC FINES, trace roots, dark brown (SC)	TOPSOIL		M		52					
1	CLAYEY SAND, a little gravel, brown mottled to light brownish gray and brown mottled, laminations of sandy silt and sand (SC)	TILL									
2											
3				M							
4											
5											
6											
7											
8				M		55½					
9											
10	**END OF BORING**										
	Installed temporary piezometer to 9 feet below grade										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-10' Geoprobe	**7/14/14**						**None**	
	7/24/14						**None**	
BORING COMPLETED: **7/14/14**								
DR: **PS** LG: Rig: **Geoprobe**								

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **9 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

DEPTH IN FEET	SURFACE ELEVATION: 891.6 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand with organic fines, trace roots, grayish brown	FILL		M		42					
2											
3	FILL, mostly clayey sand, a little gravel, trace roots, grayish brown to brown										
4				M							
5											
6				M		58					
7	CLAYEY SAND, a little gravel, gray and brown mottled (SC)	TILL									
8				M							
9											
10	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-10'	**Geoprobe**
BORING COMPLETED:	**7/14/14**
DR: **PS**	LG: Rig: **Geoprobe**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/14/14						**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-06193** LOG OF BORING NO. **10 (p. 1 of 1)**

PROJECT: **Northwood Lake; New Hope, MN**

DEPTH IN FEET	SURFACE ELEVATION: 898.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0	FILL, mostly clayey sand with organic fines, trace roots, grayish brown	FILL		M		42					
1	FILL, mostly clayey sand, a little gravel, trace roots, light brown and brown, a little dark brown										
2											
3				M							
4											
5											
6	CLAYEY SAND, light brownish gray and brown mottled, laminations of sand (SC)	TILL		M		58					
7											
8				M							
9											
10	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' Geoprobe	**7/14/14**						**None**
BORING COMPLETED: **7/14/14**							
DR: **PS** LG: Rig: **Geoprobe**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 01-06193.GPJ AET+CPT+WELL.GDT 7/28/14

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

August 13, 2014

Allan Kestler
AET
550 Cleveland Avenue North
Saint Paul, MN 55114

RE: Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Dear Allan Kestler:
Enclosed are the analytical results for sample(s) received by the laboratory on July 29, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Chris Bremer for
Beth Kadlec
beth.kadlec@pacelabs.com
Project Manager

Enclosures

REVIEWED
By Allan Kestler at 8:22 am, Aug 13, 2014

REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Minnesota Certification IDs

1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alabama Certification #40770
Alabama Certification #40770
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: 8TMS-L
Florida/NELAP Certification #: E87605
Guam Certification #: Pace
Georgia Certification #: 959
Idaho Certification #: MN00064
Hawaii Certification #MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Kentucky Dept of Envi. Protection - WW #:90062
Louisiana DEQ Certification #: 3086
Louisiana DHH #: LA140001
Maine Certification #: 2013011
Maryland Certification #: 322
Michigan DEPH Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT0092
Nebraska Certification #: Pace
New York Certification #: 11647
North Carolina Certification #: 530
North Carolina State Public Health #: 27700
North Dakota Certification #: R-036
Ohio EPA #: 4150
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Saipan (CNMI) #:MP0003
South Carolina #:74003001
Texas Certification #: T104704192
Tennessee Certification #: 02818
Utah Certification #: MN000642013-4
Virginia DGS Certification #: 251
Virginia/VELAP Certification #: Pace
Washington Certification #: C486
Wisconsin Certification #: 999407970
West Virginia Certification #: 382
West Virginia DHHR #:9952C

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SAMPLE SUMMARY

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10275627001	**B-1 1-4ft**	Solid	07/29/14 09:10	07/29/14 10:56
10275627002	**B-2 1-4ft**	Solid	07/29/14 09:15	07/29/14 10:56
10275627003	**B-3 1-4ft**	Solid	07/29/14 09:20	07/29/14 10:56

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SAMPLE ANALYTE COUNT

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Lab ID	Sample ID	Method	Analysts	Analytes Reported
10275627001	**B-1 1-4ft**	EPA 6010	IP	2
		ASTM D2974	JDL	1
		EPA 8270 by SIM	JLR	41
10275627002	**B-2 1-4ft**	EPA 6010	IP	2
		ASTM D2974	JDL	1
		EPA 8270 by SIM	JLR	41
10275627003	**B-3 1-4ft**	EPA 6010	IP	2
		ASTM D2974	JDL	1
		EPA 8270 by SIM	JLR	41

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ANALYTICAL RESULTS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Sample: B-1 1-4ft **Lab ID: 10275627001** Collected: 07/29/14 09:10 Received: 07/29/14 10:56 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050							
Arsenic	ND	mg/kg	1.3	1	08/07/14 10:05	08/12/14 09:10	7440-38-2	
Copper	**25.6**	mg/kg	0.64	1	08/07/14 10:05	08/12/14 09:10	7440-50-8	
Dry Weight	Analytical Method: ASTM D2974							
Percent Moisture	**28.1**	%	0.10	1		08/06/14 00:00		
8270 MSSV CPAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3550							
Acenaphthene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	83-32-9	
Acenaphthylene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	208-96-8	
Anthracene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	120-12-7	
Benzo(a)anthracene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	56-55-3	
Benzo(a)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	50-32-8	
Benzo(e)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	192-97-2	
Benzo(g,h,i)perylene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	191-24-2	
Benzofluoranthenes (Total)	ND	ug/kg	41.7	1	08/04/14 09:09	08/12/14 00:38		
Carbazole	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	86-74-8	
2-Chloronaphthalene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	91-58-7	
Chrysene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	218-01-9	
Dibenz(a,h)acridine	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	226-36-8	
Dibenz(a,h)anthracene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	53-70-3	
Dibenz(a,j)acridine	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	224-42-0	L2
Dibenzo(a,e)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	192-65-4	
Dibenzo(a,h)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	189-64-0	
Dibenzo(a,i)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	189-55-9	
Dibenzo(a,l)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	191-30-0	L2
7H-Dibenzo(c,g)carbazole	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	194-59-2	
Dibenzofuran	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	132-64-9	
7,12-Dimethylbenz(a)anthracene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	57-97-6	
1,6-Dinitropyrene	ND	ug/kg	139	1	08/04/14 09:09	08/12/14 00:38	42397-64-8	L2
1,8-Dinitropyrene	ND	ug/kg	139	1	08/04/14 09:09	08/12/14 00:38	42397-65-9	L2
Fluoranthene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	206-44-0	
Fluorene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	193-39-5	
3-Methylcholanthrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	56-49-5	
5-Methylchrysene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	3697-24-3	
1-Methylnaphthalene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	90-12-0	
2-Methylnaphthalene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	91-57-6	
Naphthalene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	91-20-3	
5-Nitroacenaphthene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	602-57-8	
6-Nitrochrysene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	7496-02-8	
2-Nitrofluorene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	607-57-8	
1-Nitropyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	5522-43-0	
4-Nitropyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	57835-92-4	
Perylene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	198-55-0	
Phenanthrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	85-01-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Sample: B-1 1-4ft **Lab ID: 10275627001** Collected: 07/29/14 09:10 Received: 07/29/14 10:56 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV CPAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3550							
Pyrene	ND	ug/kg	13.9	1	08/04/14 09:09	08/12/14 00:38	129-00-0	
Surrogates								
2-Fluorobiphenyl (S)	78	%.	33-125	1	08/04/14 09:09	08/12/14 00:38	321-60-8	
Terphenyl-d14 (S)	84	%.	35-125	1	08/04/14 09:09	08/12/14 00:38	1718-51-0	

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ANALYTICAL RESULTS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Sample: B-2 1-4ft **Lab ID: 10275627002** Collected: 07/29/14 09:15 Received: 07/29/14 10:56 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050							
Arsenic	**1.4**	mg/kg	1.1	1	08/07/14 10:05	08/12/14 09:38	7440-38-2	
Copper	**10.5**	mg/kg	0.53	1	08/07/14 10:05	08/12/14 09:38	7440-50-8	
Dry Weight	Analytical Method: ASTM D2974							
Percent Moisture	**19.2**	%	0.10	1		08/06/14 00:00		
8270 MSSV CPAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3550							
Acenaphthene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	83-32-9	
Acenaphthylene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	208-96-8	
Anthracene	**33.0**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	120-12-7	
Benzo(a)anthracene	**72.1**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	56-55-3	
Benzo(a)pyrene	**71.4**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	50-32-8	
Benzo(e)pyrene	**42.0**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	192-97-2	
Benzo(g,h,i)perylene	**22.2**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	191-24-2	
Benzofluoranthenes (Total)	**130**	ug/kg	37.0	1	08/04/14 09:09	08/12/14 01:08		
Carbazole	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	86-74-8	
2-Chloronaphthalene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	91-58-7	
Chrysene	**74.0**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	218-01-9	
Dibenz(a,h)acridine	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	226-36-8	
Dibenz(a,h)anthracene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	53-70-3	
Dibenz(a,j)acridine	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	224-42-0	L2
Dibenzo(a,e)pyrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	192-65-4	
Dibenzo(a,h)pyrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	189-64-0	
Dibenzo(a,i)pyrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	189-55-9	
Dibenzo(a,l)pyrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	191-30-0	L2
7H-Dibenzo(c,g)carbazole	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	194-59-2	
Dibenzofuran	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	132-64-9	
7,12-Dimethylbenz(a)anthracene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	57-97-6	
1,6-Dinitropyrene	ND	ug/kg	123	1	08/04/14 09:09	08/12/14 01:08	42397-64-8	L2
1,8-Dinitropyrene	ND	ug/kg	123	1	08/04/14 09:09	08/12/14 01:08	42397-65-9	L2
Fluoranthene	**219**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	206-44-0	
Fluorene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	86-73-7	
Indeno(1,2,3-cd)pyrene	**21.0**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	193-39-5	
3-Methylcholanthrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	56-49-5	
5-Methylchrysene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	3697-24-3	
1-Methylnaphthalene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	90-12-0	
2-Methylnaphthalene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	91-57-6	
Naphthalene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	91-20-3	
5-Nitroacenaphthene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	602-57-8	
6-Nitrochrysene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	7496-02-8	
2-Nitrofluorene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	607-57-8	
1-Nitropyrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	5522-43-0	
4-Nitropyrene	ND	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	57835-92-4	
Perylene	**20.5**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	198-55-0	
Phenanthrene	**134**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	85-01-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Sample: B-2 1-4ft **Lab ID: 10275627002** Collected: 07/29/14 09:15 Received: 07/29/14 10:56 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV CPAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3550							
Pyrene	**173**	ug/kg	12.3	1	08/04/14 09:09	08/12/14 01:08	129-00-0	
Surrogates								
2-Fluorobiphenyl (S)	80	%.	33-125	1	08/04/14 09:09	08/12/14 01:08	321-60-8	
Terphenyl-d14 (S)	83	%.	35-125	1	08/04/14 09:09	08/12/14 01:08	1718-51-0	

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ANALYTICAL RESULTS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Sample: B-3 1-4ft **Lab ID: 10275627003** Collected: 07/29/14 09:20 Received: 07/29/14 10:56 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050							
Arsenic	ND	mg/kg	1.1	1	08/07/14 10:05	08/12/14 09:44	7440-38-2	
Copper	**18.1**	mg/kg	0.53	1	08/07/14 10:05	08/12/14 09:44	7440-50-8	
Dry Weight	Analytical Method: ASTM D2974							
Percent Moisture	**22.1**	%	0.10	1		08/06/14 00:00		
8270 MSSV CPAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3550							
Acenaphthene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	83-32-9	
Acenaphthylene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	208-96-8	
Anthracene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	120-12-7	
Benzo(a)anthracene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	56-55-3	
Benzo(a)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	50-32-8	
Benzo(e)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	192-97-2	
Benzo(g,h,i)perylene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	191-24-2	
Benzofluoranthenes (Total)	ND	ug/kg	38.5	1	08/04/14 09:09	08/12/14 01:37		
Carbazole	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	86-74-8	
2-Chloronaphthalene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	91-58-7	
Chrysene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	218-01-9	
Dibenz(a,h)acridine	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	226-36-8	
Dibenz(a,h)anthracene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	53-70-3	
Dibenz(a,j)acridine	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	224-42-0	L2
Dibenzo(a,e)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	192-65-4	
Dibenzo(a,h)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	189-64-0	
Dibenzo(a,i)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	189-55-9	
Dibenzo(a,l)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	191-30-0	L2
7H-Dibenzo(c,g)carbazole	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	194-59-2	
Dibenzofuran	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	132-64-9	
7,12-Dimethylbenz(a)anthracene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	57-97-6	
1,6-Dinitropyrene	ND	ug/kg	128	1	08/04/14 09:09	08/12/14 01:37	42397-64-8	L2
1,8-Dinitropyrene	ND	ug/kg	128	1	08/04/14 09:09	08/12/14 01:37	42397-65-9	L2
Fluoranthene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	206-44-0	
Fluorene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	86-73-7	
Indeno(1,2,3-cd)pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	193-39-5	
3-Methylcholanthrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	56-49-5	
5-Methylchrysene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	3697-24-3	
1-Methylnaphthalene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	90-12-0	
2-Methylnaphthalene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	91-57-6	
Naphthalene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	91-20-3	
5-Nitroacenaphthene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	602-57-8	
6-Nitrochrysene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	7496-02-8	
2-Nitrofluorene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	607-57-8	
1-Nitropyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	5522-43-0	
4-Nitropyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	57835-92-4	
Perylene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	198-55-0	
Phenanthrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	85-01-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Sample: B-3 1-4ft **Lab ID: 10275627003** Collected: 07/29/14 09:20 Received: 07/29/14 10:56 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV CPAH by SIM	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3550							
Pyrene	ND	ug/kg	12.8	1	08/04/14 09:09	08/12/14 01:37	129-00-0	
Surrogates								
2-Fluorobiphenyl (S)	77	%.	33-125	1	08/04/14 09:09	08/12/14 01:37	321-60-8	
Terphenyl-d14 (S)	80	%.	35-125	1	08/04/14 09:09	08/12/14 01:37	1718-51-0	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

QC Batch: MPRP/48078 Analysis Method: EPA 6010
QC Batch Method: EPA 3050 Analysis Description: 6010 MET
Associated Lab Samples: 10275627001, 10275627002, 10275627003

METHOD BLANK: 1754258 Matrix: Solid
Associated Lab Samples: 10275627001, 10275627002, 10275627003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Arsenic	mg/kg	ND	0.97	08/12/14 09:01	
Copper	mg/kg	ND	0.49	08/12/14 09:01	

LABORATORY CONTROL SAMPLE: 1754259

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	mg/kg	48.1	45.6	95	80-120	
Copper	mg/kg	48.1	48.2	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1754260 1754261

Parameter	Units	10275627001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	mg/kg	ND	58	65.6	53.7	62.5	93	95	75-125	15	30	
Copper	mg/kg	25.6	58	65.6	86.3	84.3	105	89	75-125	2	30	

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QUALITY CONTROL DATA

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

QC Batch: MPRP/48064
QC Batch Method: ASTM D2974
Analysis Method: ASTM D2974
Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 10275627001

SAMPLE DUPLICATE: 1753801

Parameter	Units	10275976024 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	10.3	12.5	19	30	

SAMPLE DUPLICATE: 1753802

Parameter	Units	10275627001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	28.1	30.3	8	30	

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QUALITY CONTROL DATA

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

QC Batch: MPRP/48065
QC Batch Method: ASTM D2974
Analysis Method: ASTM D2974
Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 10275627002, 10275627003

SAMPLE DUPLICATE: 1753896

Parameter	Units	50101541007 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	17.2	17.3	0	30	

SAMPLE DUPLICATE: 1753897

Parameter	Units	10275766004 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	4.8	5.1	6	30	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

QC Batch: OEXT/25922 Analysis Method: EPA 8270 by SIM
QC Batch Method: EPA 3550 Analysis Description: 8270 CPAH by SIM MSSV
Associated Lab Samples: 10275627001, 10275627002, 10275627003

METHOD BLANK: 1751132 Matrix: Solid
Associated Lab Samples: 10275627001, 10275627002, 10275627003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,6-Dinitropyrene	ug/kg	ND	100	08/11/14 20:41	
1,8-Dinitropyrene	ug/kg	ND	100	08/11/14 20:41	
1-Methylnaphthalene	ug/kg	ND	10.0	08/11/14 20:41	
1-Nitropyrene	ug/kg	ND	10.0	08/11/14 20:41	
2-Chloronaphthalene	ug/kg	ND	10.0	08/11/14 20:41	
2-Methylnaphthalene	ug/kg	ND	10.0	08/11/14 20:41	
2-Nitrofluorene	ug/kg	ND	10.0	08/11/14 20:41	
3-Methylcholanthrene	ug/kg	ND	10.0	08/11/14 20:41	
4-Nitropyrene	ug/kg	ND	10.0	08/11/14 20:41	
5-Methylchrysene	ug/kg	ND	10.0	08/11/14 20:41	
5-Nitroacenaphthene	ug/kg	ND	10.0	08/11/14 20:41	
6-Nitrochrysene	ug/kg	ND	10.0	08/11/14 20:41	
7,12-Dimethylbenz(a)anthracene	ug/kg	ND	10.0	08/11/14 20:41	
7H-Dibenzo(c,g)carbazole	ug/kg	ND	10.0	08/11/14 20:41	
Acenaphthene	ug/kg	ND	10.0	08/11/14 20:41	
Acenaphthylene	ug/kg	ND	10.0	08/11/14 20:41	
Anthracene	ug/kg	ND	10.0	08/11/14 20:41	
Benzo(a)anthracene	ug/kg	ND	10.0	08/11/14 20:41	
Benzo(a)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Benzo(e)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Benzo(g,h,i)perylene	ug/kg	ND	10.0	08/11/14 20:41	
Benzofluoranthenes (Total)	ug/kg	ND	30.0	08/11/14 20:41	
Carbazole	ug/kg	ND	10.0	08/11/14 20:41	
Chrysene	ug/kg	ND	10.0	08/11/14 20:41	
Dibenz(a,h)acridine	ug/kg	ND	10.0	08/11/14 20:41	
Dibenz(a,h)anthracene	ug/kg	ND	10.0	08/11/14 20:41	
Dibenz(a,j)acridine	ug/kg	ND	10.0	08/11/14 20:41	
Dibenzo(a,e)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Dibenzo(a,h)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Dibenzo(a,i)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Dibenzo(a,l)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Dibenzofuran	ug/kg	ND	10.0	08/11/14 20:41	
Fluoranthene	ug/kg	ND	10.0	08/11/14 20:41	
Fluorene	ug/kg	ND	10.0	08/11/14 20:41	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	10.0	08/11/14 20:41	
Naphthalene	ug/kg	ND	10.0	08/11/14 20:41	
Perylene	ug/kg	ND	10.0	08/11/14 20:41	
Phenanthrene	ug/kg	ND	10.0	08/11/14 20:41	
Pyrene	ug/kg	ND	10.0	08/11/14 20:41	
2-Fluorobiphenyl (S)	%.	76	33-125	08/11/14 20:41	
Terphenyl-d14 (S)	%.	102	35-125	08/11/14 20:41	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

LABORATORY CONTROL SAMPLE: 1751133

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,6-Dinitropyrene	ug/kg	100	ND	0	30-125	L0
1,8-Dinitropyrene	ug/kg	100	ND	0	30-125	L0
1-Methylnaphthalene	ug/kg	100	46.4	46	46-125	
1-Nitropyrene	ug/kg	100	66.2	66	31-125	
2-Chloronaphthalene	ug/kg	100	48.2	48	32-125	
2-Methylnaphthalene	ug/kg	100	46.5	47	46-125	
2-Nitrofluorene	ug/kg	100	78.1	78	58-125	
3-Methylcholanthrene	ug/kg	100	57.1	57	30-125	
4-Nitropyrene	ug/kg	100	70.2	70	44-125	
5-Methylchrysene	ug/kg	100	79.1	79	68-125	
5-Nitroacenaphthene	ug/kg	100	77.5	77	58-125	
6-Nitrochrysene	ug/kg	100	62.8	63	31-125	
7,12-Dimethylbenz(a)anthracene	ug/kg	100	73.0	73	30-150	SS
7H-Dibenzo(c,g)carbazole	ug/kg	100	75.6	76	56-125	
Acenaphthene	ug/kg	100	51.0	51	45-125	
Acenaphthylene	ug/kg	100	49.9	50	45-125	
Anthracene	ug/kg	100	71.3	71	54-125	
Benzo(a)anthracene	ug/kg	100	73.2	73	57-125	
Benzo(a)pyrene	ug/kg	100	72.9	73	57-125	
Benzo(e)pyrene	ug/kg	100	76.3	76	60-125	
Benzo(g,h,i)perylene	ug/kg	100	73.6	74	57-128	
Benzofluoranthenes (Total)	ug/kg	300	240	80	64-125	
Carbazole	ug/kg	100	76.9	77	58-125	
Chrysene	ug/kg	100	74.8	75	59-125	
Dibenz(a,h)acridine	ug/kg	100	75.5	76	64-125	
Dibenz(a,h)anthracene	ug/kg	100	78.1	78	59-125	
Dibenz(a,j)acridine	ug/kg	100	21.1	21	30-133	L0
Dibenzo(a,e)pyrene	ug/kg	100	72.7	73	52-125	
Dibenzo(a,h)pyrene	ug/kg	100	78.3	78	46-133	
Dibenzo(a,i)pyrene	ug/kg	100	63.5	64	39-125	
Dibenzo(a,l)pyrene	ug/kg	100	29.1	29	30-125	L0
Dibenzofuran	ug/kg	100	54.7	55	55-125	
Fluoranthene	ug/kg	100	78.8	79	60-129	
Fluorene	ug/kg	100	62.0	62	55-125	
Indeno(1,2,3-cd)pyrene	ug/kg	100	77.3	77	57-126	
Naphthalene	ug/kg	100	45.7	46	39-125	
Perylene	ug/kg	100	70.9	71	66-125	
Phenanthrene	ug/kg	100	72.1	72	56-125	
Pyrene	ug/kg	100	77.2	77	60-125	
2-Fluorobiphenyl (S)	%.			55	33-125	
Terphenyl-d14 (S)	%.			88	35-125	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1751134 1751135

Parameter	Units	10276106001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1,6-Dinitropyrene	ug/kg	ND	115	115	ND	ND	0	0	30-125		30	M0
1,8-Dinitropyrene	ug/kg	ND	115	115	ND	ND	0	0	30-125		30	M0
1-Methylnaphthalene	ug/kg	ND	115	115	78.4	82.4	68	71	47-125	5	30	
1-Nitropyrene	ug/kg	ND	115	115	49.3	42.4	43	37	58-125	15	30	M1
2-Chloronaphthalene	ug/kg	ND	115	115	82.8	82.4	72	71	31-125	1	30	
2-Methylnaphthalene	ug/kg	ND	115	115	78.1	82.4	68	71	30-125	5	30	
2-Nitrofluorene	ug/kg	ND	115	115	82.6	77.8	72	67	30-132	6	30	
3-Methylcholanthrene	ug/kg	ND	115	115	90.5	87.4	78	76	30-150	3	30	
4-Nitropyrene	ug/kg	ND	115	115	55.2	47.7	48	41	30-127	15	30	
5-Methylchrysene	ug/kg	ND	115	115	95.5	93.5	76	74	30-150	2	30	
5-Nitroacenaphthene	ug/kg	ND	115	115	91.7	91.1	80	79	30-150	1	30	
6-Nitrochrysene	ug/kg	ND	115	115	40.2	37.8	35	33	30-125	6	30	
7,12-Dimethylbenz(a)anthracene	ug/kg	ND	115	115	80.6	87.3	70	76	30-150	8	30	SS
7H-Dibenzo(c,g)carbazole	ug/kg	ND	115	115	76.1	62.2	66	54	30-140	20	30	
Acenaphthene	ug/kg	40.0	115	115	87.8	90.9	41	44	30-150	3	30	
Acenaphthylene	ug/kg	13.9	115	115	92.4	100	68	75	30-150	8	30	
Anthracene	ug/kg	127	115	115	106	121	-18	-6	30-150	13	30	M1
Benzo(a)anthracene	ug/kg	180	115	115	134	176	-40	-3	30-150	27	30	M1
Benzo(a)pyrene	ug/kg	161	115	115	142	184	-17	20	30-150	26	30	M1
Benzo(e)pyrene	ug/kg	90.2	115	115	120	147	26	49	30-150	20	30	M1
Benzo(g,h,i)perylene	ug/kg	69.7	115	115	94.3	91.1	21	19	30-150	3	30	M1
Benzofluoranthenes (Total)	ug/kg	283	346	346	374	464	26	52	30-150	21	30	M1
Carbazole	ug/kg	33.9	115	115	96.5	97.0	54	55	30-150	0	30	
Chrysene	ug/kg	184	115	115	136	174	-42	-9	30-150	25	30	M1
Dibenz(a,h)acridine	ug/kg	ND	115	115	88.2	79.0	77	68	30-150	11	30	
Dibenz(a,h)anthracene	ug/kg	22.6	115	115	85.2	77.0	54	47	30-150	10	30	
Dibenz(a,j)acridine	ug/kg	ND	115	115	76.9	66.0	67	57	30-141	15	30	
Dibenzo(a,e)pyrene	ug/kg	25.9	115	115	59.7	47.6	29	19	30-150	22	30	M1
Dibenzo(a,h)pyrene	ug/kg	ND	115	115	45.2	30.5	31	18	30-150	39	30	M1,R1
Dibenzo(a,i)pyrene	ug/kg	ND	115	115	37.5	26.0	33	23	30-125	36	30	M1,R1
Dibenzo(a,l)pyrene	ug/kg	ND	115	115	34.2	24.0	30	21	30-127	35	30	M0,R1
Dibenzofuran	ug/kg	20.6	115	115	88.7	91.5	59	61	30-150	3	30	
Fluoranthene	ug/kg	517	115	115	198	294	-277	-194	30-150	39	30	M1,R1
Fluorene	ug/kg	50.6	115	115	94.3	100	38	43	30-150	6	30	
Indeno(1,2,3-cd)pyrene	ug/kg	64.0	115	115	99.6	99.7	31	31	30-150	0	30	
Naphthalene	ug/kg	ND	115	115	72.5	77.2	63	67	30-150	6	30	
Perylene	ug/kg	41.1	115	115	105	116	55	65	30-150	10	30	
Phenanthrene	ug/kg	430	115	115	131	172	-260	-224	30-150	27	30	M1
Pyrene	ug/kg	369	115	115	158	224	-182	-125	30-150	35	30	M1,R1
2-Fluorobiphenyl (S)	%.						83	83	33-125			
Terphenyl-d14 (S)	%.						83	81	35-125			

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QUALIFIERS

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

BATCH QUALIFIERS

Batch: MSSV/10938

[1]	1,6-dinitropyrene and 1,8-dinitropyrene are outside of the method control limits in the initial calibration. The result is estimated.

ANALYTE QUALIFIERS

L0	Analyte recovery in the laboratory control sample (LCS) was outside QC limits.
L2	Analyte recovery in the laboratory control sample (LCS) was below QC limits. Results may be biased low.
M0	Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.
SS	This analyte did not meet the secondary source verification criteria for the initial calibration. The reported result should be considered an estimated value.

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 01-06193 Northwood Lake:New Ho
Pace Project No.: 10275627

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10275627001	**B-1 1-4ft**	EPA 3050	MPRP/48078	EPA 6010	ICP/20469
10275627002	**B-2 1-4ft**	EPA 3050	MPRP/48078	EPA 6010	ICP/20469
10275627003	**B-3 1-4ft**	EPA 3050	MPRP/48078	EPA 6010	ICP/20469
10275627001	**B-1 1-4ft**	ASTM D2974	MPRP/48064		
10275627002	**B-2 1-4ft**	ASTM D2974	MPRP/48065		
10275627003	**B-3 1-4ft**	ASTM D2974	MPRP/48065		
10275627001	**B-1 1-4ft**	EPA 3550	OEXT/25922	EPA 8270 by SIM	MSSV/10938
10275627002	**B-2 1-4ft**	EPA 3550	OEXT/25922	EPA 8270 by SIM	MSSV/10938
10275627003	**B-3 1-4ft**	EPA 3550	OEXT/25922	EPA 8270 by SIM	MSSV/10938

1299

AMERICAN ENGINEERING TESTING, INC.

☒ St. Paul Office
550 Cleveland Ave. N.
St. Paul, MN 55114
651-659-9001
651-659-1379 (fax)

☐ OTHER _____

ADDRESS: _____

PHONE: _____

17250

PAGE 1 OF 1

AET PROJECT NUMBER 01-06193

PROJECT NAME/LOCATION Northwood Lake; New Hope

AET PROJECT MANAGER Jay Brekke, Al Kestler

SEND REPORT TO akestler@amengtest.com

SAMPLED BY (PRINT) Al Kestler Paul Schoening

SAMPLER SIGNATURE _____

REQUESTED TURNAROUND TIME: ☒ NORMAL ☐ RUSH

DATE NEEDED BY: _____

1027 & 29

ITEM#	SAMPLE DESCRIPTION	DATE	TIME	SAMPLE TYPE	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	MeOH	HCL	H_2SO_4	HNO_3	FIELD FILTERED Y/N	ANALYSIS: C PAHs (Carcinogen list)	Arsenic & Copper	REMARKS
1	B-1 1-4 ft	7/29/14	9:10	Soil	2	2						X	X	001
2	B-2 1-4 ft	"	9:15	Soil	2	2						X	X	002
3	B-3 1-4 ft	"	9:20	Soil	2	2						X	X	003

NOTE:

ITEM NUMBER	RELINQUISHED BY/AFFILIATION	ACCEPTED BY/AFFILIATION	DATE	TIME
1-3	Paul S.	Brekke	7/29/14	1056

26°C ice

Pace Analytical®	Document Name: Sample Condition Upon Receipt Form	Document Revised: 28Feb2014 Page 1 of 1
	Document No.: F-MN-L-213-rev.09	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: American Engineering Testing

Project #: WO# : 10275627

10275627

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☒ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:_____

Tracking Number: NA

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other:_____ **Temp Blank?** ☐ Yes ☒ No

Thermom. Used: ☐ B88A9130516413 ☒ B88A912167504 ☐ B88A9132521491 **Type of Ice:** ☒ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 3.6 **Cooler Temp Corrected (°C):** 3.6 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** TRUE **Date and Initials of Person Examining Contents:** CMB 7/29/14

				Comments:
Chain of Custody Present?	☒ Yes	☐ No	☐ N/A	1.
Chain of Custody Filled Out?	☒ Yes	☐ No	☐ N/A	2.
Chain of Custody Relinquished?	☒ Yes	☐ No	☐ N/A	3.
Sampler Name and/or Signature on COC?	☒ Yes	☐ No	☐ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No	☐ N/A	5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No	☐ N/A	6.
Rush Turn Around Time Requested?	☐ Yes	☒ No	☐ N/A	7.
Sufficient Volume?	☒ Yes	☐ No	☐ N/A	8.
Correct Containers Used?	☒ Yes	☐ No	☐ N/A	9.
-Pace Containers Used?	☒ Yes	☐ No	☐ N/A	
Containers Intact?	☒ Yes	☐ No	☐ N/A	10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11.
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: SL	☒ Yes	☐ No	☐ N/A	12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH ☐ HCl Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, HCl<2; NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC	☐ Yes	☒ No		Initial when completed:_____ Lot # of added preservative:_____
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):_____				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted:_____ Date/Time:_____

Comments/Resolution:_____

Project Manager Review: Beth Kadler **Date:** 7/30/14

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

Appendix C
MID's Calculations

Stantec

Memo

To:	Chris Long	From:	Brad Schleeter
File:	193802816	Date:	August 26, 2014

Reference: Northwood Lake – Water Quality Treatment Calculations

This memo provides the technical background information on the water quality treatment calculations summarized in the Northwood Lake Storm Water Improvements Feasibility Report [Report]. The Report includes three concept alternatives for water quality improvements for discharges to Northwood Lake. Each concept alternative is described below:

Concept A – This concept combines the water quality benefits of multiple Best Management Practices (BMPs), including a structural treatment device, a stormwater re-use system, and a series of biofiltration basins. See Figure 10 in the Report for the location of these BMPs. Concept A details are as follows:

- Total drainage area to the proposed Re-use System = 89.1 acres
- Total impervious area tributary to the proposed Re-use System = 19.9 acres
- Two existing water quality ponds (BC-P2.6A and BC-P2.6B) provide water quality treatment to 73.2 acres, prior to routing flows to the Proposed Re-use System
    - The treatment performance of existing ponds BC-P2.6A and BC-P2.6B was calculated using a PondNET model. The PondNET model spreadsheet is attached for reference
    - The treatment performance percentages shown on the PondNET model spreadsheet separate the particulate and dissolved fractions of phosphorus to match the input requirements in the MIDs calculator for Concepts A and B
    - The existing pond treatment performance percentages were directly input as "Other" BMPs in the MIDs calculator for Concepts A and B to best match the estimated pond performance
- Concept A will redirect flows in the existing 36-inch trunk stormsewer from the intersection of Boone Avenue an Hopewood Lane south to the intersection of Boone Avenue and Ensign Avenue
- A structural treatment device at the intersection of Boone Avenue and Ensign Avenue is proposed to provide pre-treatment of runoff prior to discharging into the stormwater re-use system
- A flow splitter in conjunction with the structural treatment device is being considered to route low flows into the stormwater re-use system and divert high flows into the adjacent proposed biofiltration basins

Reference: Northwood Lake – Water Quality Treatment Calculations

- The proposed stormwater re-use system includes a 160,000 gallon underground storage tank, pump system, and distribution system to irrigate 6.4 acres of existing ball fields with 1.5 inches of water per week from May to October
- The City is considering the incorporation of additional treatment measures into the stormwater re-use system which could include: screening, filtration, chemical addition, and disinfection
- The existing public water supply connection to the existing ball field irrigation system will remain connected to supplement the stormwater re-use system during dry times
- A backflow preventer is proposed within the stormwater re-use system to eliminate the possibility of cross contamination of the public water supply
- Overflows from the Boone Avenue trunk stormsewer and the re-use system tank, and local drainage from Drainage Area BC-2.9B (1.7 acres) are proposed to be routed to a series of biofiltration basins along Ensign Avenue
- The proposed biofiltration basins will be planted with native vegetation and connected by overland swales, ultimately discharging into Northwood Lake
- Drainage Area BC-2.9A will continue to discharge directly to Northwood Lake. This drainage area is routed to stormsewer that is too low to be routed into the proposed Concept A BMPs

Concept B – This concept proposes a water quality pond in Northwood Park. See Figure 11 in the Report for the location of this pond. Concept B details are as follows:

- Total drainage area to proposed Concept B Pond = 107.9 acres
- Total impervious area tributary to the proposed Concept B Pond = 26.8 acres
- The existing water quality ponds (BC-P2.6A and BC-P2.6B) treating 73.2 acres are included in the MIDs calculator as stated in the Concept A description
- Flow in the existing 36-inch south of Ensign Avenue will be redirected into proposed Concept Pond B
- The proposed Concept B Pond is represented in the MIDs calculator as a Design Level 1 constructed stormwater pond

Concept C – This concept proposes a water quality pond West of Jordan Avenue in Northwood Park. See Figure 12 in the Report for the location of this pond. Concept C details are as follows:

- Total Drainage Area to Proposed Concept C Pond = 19.4 acres
- Total impervious area tributary to the proposed Concept C Pond = 5.8 acres

Reference: Northwood Lake – Water Quality Treatment Calculations

- Flow in the existing stormsewer in Jordan Avenue will be redirected into proposed Concept C Pond
- The proposed Concept C Pond is represented in the MIDs calculator as a Design Level 1 constructed stormwater pond

The following is a summary of the MIDs calculator outputs for phosphorus and runoff volume for each of the proposed concepts as provided by the attached MIDs calculator summaries:

Runoff Volume Reduction Table

Concept	Total Drainage Area in System	Total Annual Runoff Volume	Proposed Total Annual Runoff Volume Removed	Proposed Percent Annual Runoff Volume Removed
	(acres)	(acre-feet)	(acre-feet)	(%)
Concept A	90.8	74.3	10.2	14%
Concept B	107.4	93.7	0.0	0%
Concept C	19.4	20.4	0.0	0%

Total Phosphorus Reduction Table

Concept	Total Drainage Area in System	Total Annual Phosphorus Load	Proposed Total Annual Phosphorus Removed	Proposed Percent Annual Phosphorus Removed
	(acres)	(pounds)	(pounds)	(%)
Concept A	90.8	60.6	16.3	27%
Concept B	107.4	76.4	15.4	20%
Concept C	19.4	16.6	5.7	34%

Stantec Consulting Services

Bradley P. Schleeter P.E.
Phone: (651) 604-4801
brad.schleeter@stantec.com

Attachment: MIDs Calculator Summary – Concept A
MIDs Calculator Summary – Concept B
MIDs Calculator Summary – Concept C
PondNET Calculations

Project Information

Calculator Version:	Version 2: June 2014
Project Name:	Northwood Lake Water Quality Improvements - Concept A
User Name / Company Name:	Stantec
Date:	August 22, 2014
Project Description:	Stormwater reuse system and biofiltration cells

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55428
Annual Rainfall (inches):	30.5
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				23.18	23.18
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				47	47
				Impervious Area (acres)	20.61
				Total Area (acres)	90.79

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				23.18	23.18
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				47	47
				Impervious Area (acres)	20.61
				Total Area (acres)	90.79

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	82295	ft3
Volume removed by BMPs towards performance goal:	16235	ft3
Percent volume removed towards performance goal	**20**	**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	74.3174	acre-ft
Annual runoff volume removed by BMPs:	10.1573	acre-ft
Percent annual runoff volume removed:	**14**	**%**
Post development annual particulate P load:	33.35	lbs
Annual particulate P removed by BMPs:	25.63	lbs
Post development annual dissolved P load:	27.29	lbs
Annual dissolved P removed by BMPs:	7.88	lbs
Percent annual total phosphorus removed:	**55**	**%**
Post development annual TSS load:	11017	lbs
Annual TSS removed by BMPs:	9284	lbs
Percent annual TSS removed:	**84**	**%**

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	Percent Retained (%)
Biofiltration Basins adjacent to Ensign Ave	1300	67360	1300	66060	2
Concept A - Re-use chamber	14935	79620	14935	64685	19
BC-P2.6A	0	48435	0	48435	0
BC-P2.6B	0	55982	0	55982	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
Biofiltration Basins adjacent to Ensign Ave	2.0222	63.1817	1.0437	64.1602	2
Concept A - Re-use chamber	18.6122	53.683	9.1135	63.1817	13
BC-P2.6A	35.0811	0	0	35.0811	0
BC-P2.6B	18.602	35.0811	0	53.6831	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Biofiltration Basins adjacent to Ensign Ave	0.91	13.35	6.54	7.72	46
Concept A - Re-use chamber	8.35	6.92	1.92	13.35	13
BC-P2.6A	15.74	0	11.69	4.05	74
BC-P2.6B	8.35	4.05	5.48	6.92	44

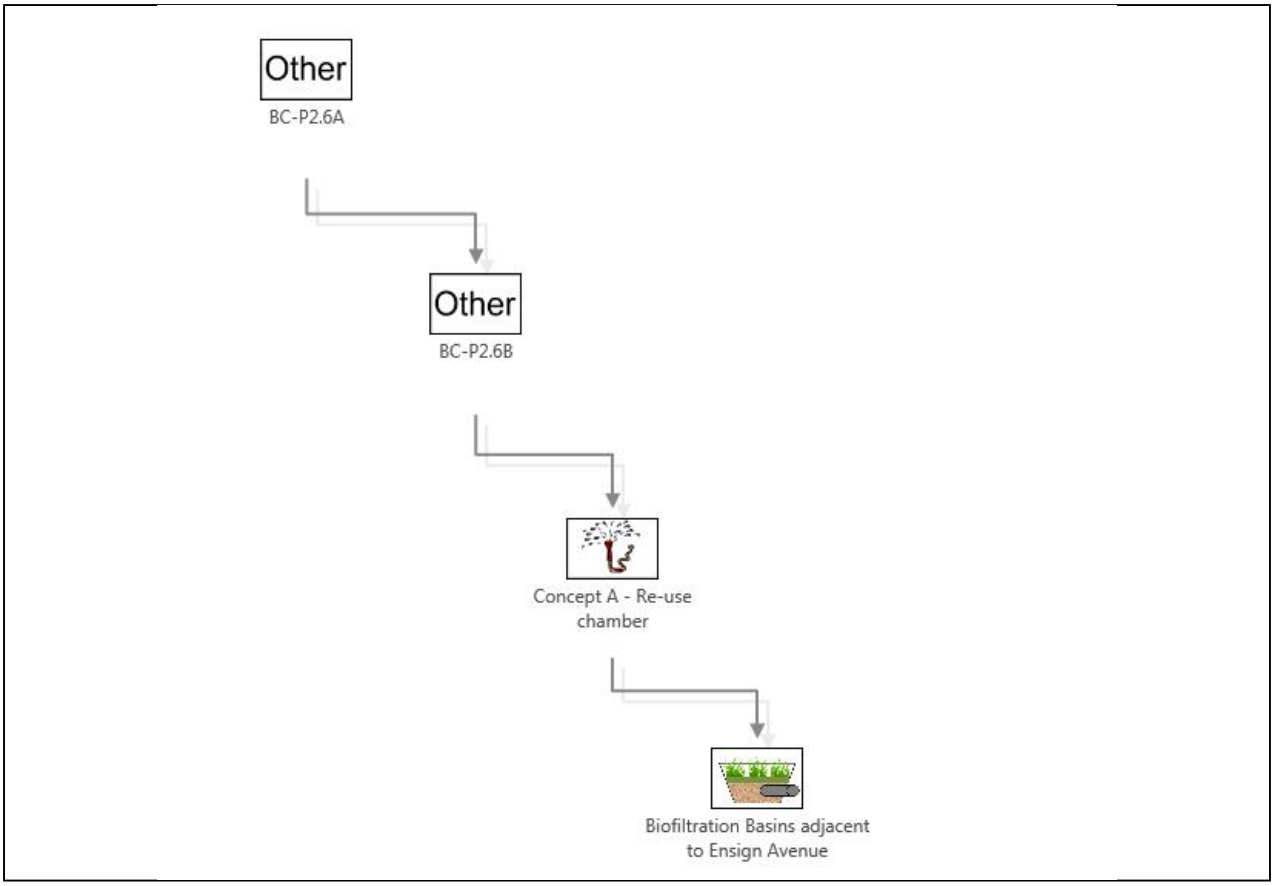
Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Biofiltration Basins adjacent to Ensign Ave	0.74	23.19	4.53	19.4	19
Concept A - Re-use chamber	6.83	19.71	3.35	23.19	13
BC-P2.6A	12.88	0	0	12.88	0
BC-P2.6B	6.83	12.88	0	19.71	0

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Biofiltration Basins adjacent to Ensign Ave	300	4103	2670	1733	61
Concept A - Re-use chamber	2759	1936	592	4103	13
BC-P2.6A	5200	0	4550	650	88
BC-P2.6B	2758	650	1472	1936	43

BMP Schematic


Other
BC-P2.6A
Other
BC-P2.6B
Concept A - Re-use chamber
Biofiltration Basins adjacent to Ensign Avenue

Project Information

Calculator Version:	Version 2: June 2014
Project Name:	Northwood Lake Water Quality Improvements - Concept B
User Name / Company Name:	Stantec
Date:	August 22, 2014
Project Description:	Water quality pond in park

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55428
Annual Rainfall (inches):	30.5
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				23.18	23.18
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				57.4	57.4
				Impervious Area (acres)	26.77
				Total Area (acres)	107.35

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				23.18	23.18
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				57.4	57.4
				Impervious Area (acres)	26.77
				Total Area (acres)	107.35

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	106892	ft3
Volume removed by BMPs towards performance goal:		ft3
Percent volume removed towards performance goal		**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	93.6514	acre-ft
Annual runoff volume removed by BMPs:	0	acre-ft
Percent annual runoff volume removed:	**0**	**%**
Post development annual particulate P load:	42.03	lbs
Annual particulate P removed by BMPs:	32.58	lbs
Post development annual dissolved P load:	34.39	lbs
Annual dissolved P removed by BMPs:	0	lbs
Percent annual total phosphorus removed:	**43**	**%**
Post development annual TSS load:	13883	lbs
Annual TSS removed by BMPs:	10739	lbs
Percent annual TSS removed:	**77**	**%**

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	Percent Retained (%)
Concept B Pond	0	106893	0	106893	0
BC-P2.6A	0	48435	0	48435	0
BC-P2.6B	0	55982	0	55982	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
Concept B Pond	39.9683	53.683	0	93.6513	0
BC-P2.6A	35.0811	0	0	35.0811	0
BC-P2.6B	18.602	35.0811	0	53.6831	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Concept B Pond	17.94	6.92	15.41	9.45	62
BC-P2.6A	15.74	0	11.69	4.05	74
BC-P2.6B	8.35	4.05	5.48	6.92	44

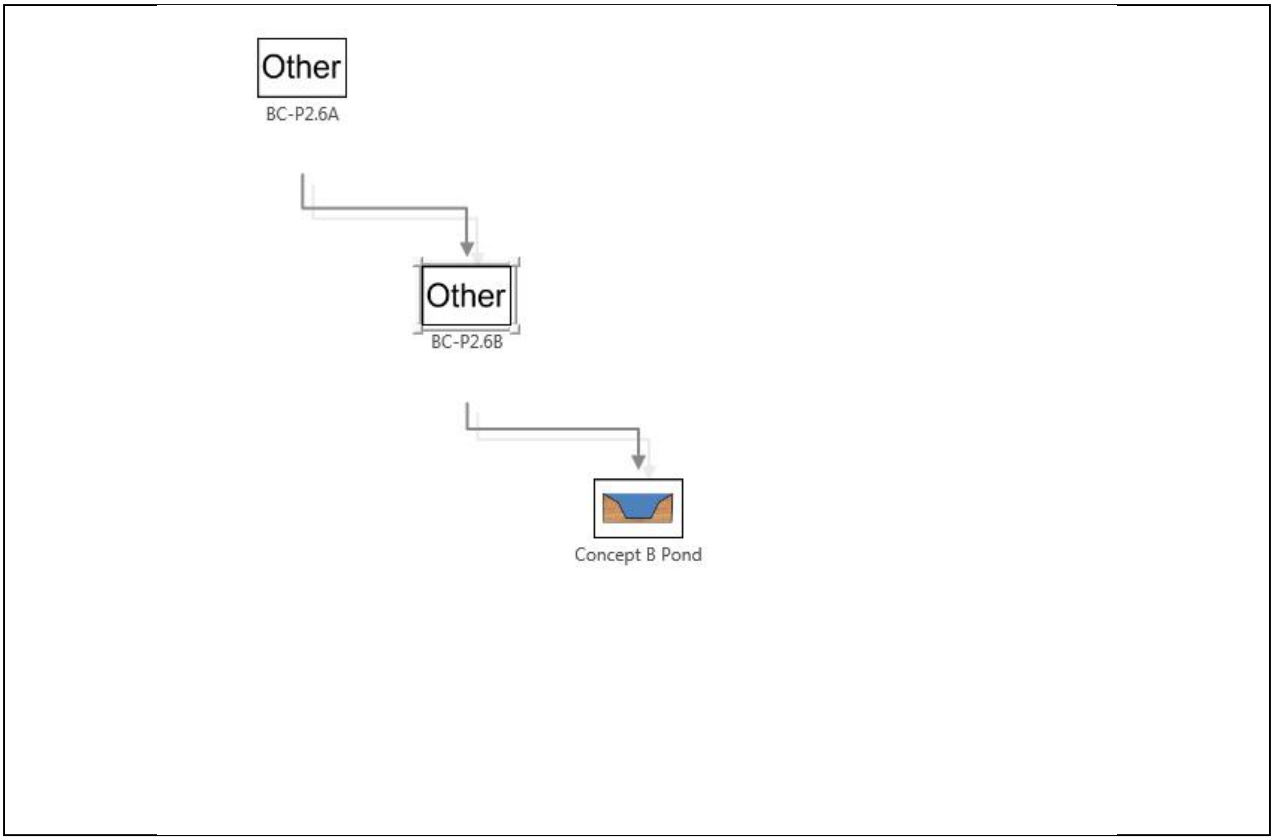
Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Concept B Pond	14.68	19.71	0	34.39	0
BC-P2.6A	12.88	0	0	12.88	0
BC-P2.6B	6.83	12.88	0	19.71	0

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Concept B Pond	5925	1936	4717	3144	60
BC-P2.6A	5200	0	4550	650	88
BC-P2.6B	2758	650	1472	1936	43

BMP Schematic


Other
BC-P2.6A
Other
BC-P2.6B
Concept B Pond

Project Information

Calculator Version:	Version 2: June 2014
Project Name:	Northwood Lake Water Quality Improvements - Concept C
User Name / Company Name:	Stantec
Date:	August 22, 2014
Project Description:	Water quality pond in park

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55428
Annual Rainfall (inches):	30.5
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				13.57	13.57
				Impervious Area (acres)	5.81
				Total Area (acres)	19.38

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				13.57	13.57
				Impervious Area (acres)	5.81
				Total Area (acres)	19.38

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	23199	ft3
Volume removed by BMPs towards performance goal:		ft3
Percent volume removed towards performance goal		**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	20.3862	acre-ft
Annual runoff volume removed by BMPs:	0	acre-ft
Percent annual runoff volume removed:	**0**	**%**
Post development annual particulate P load:	9.15	lbs
Annual particulate P removed by BMPs:	5.67	lbs
Post development annual dissolved P load:	7.49	lbs
Annual dissolved P removed by BMPs:	0	lbs
Percent annual total phosphorus removed:	**34**	**%**
Post development annual TSS load:	3022	lbs
Annual TSS removed by BMPs:	1813	lbs
Percent annual TSS removed:	**60**	**%**

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	Percent Retained (%)
Concept C Pond	0	23199	0	23199	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
Concept C Pond	20.3862	0	0	20.3862	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Concept C Pond	9.15	0	5.67	3.48	62

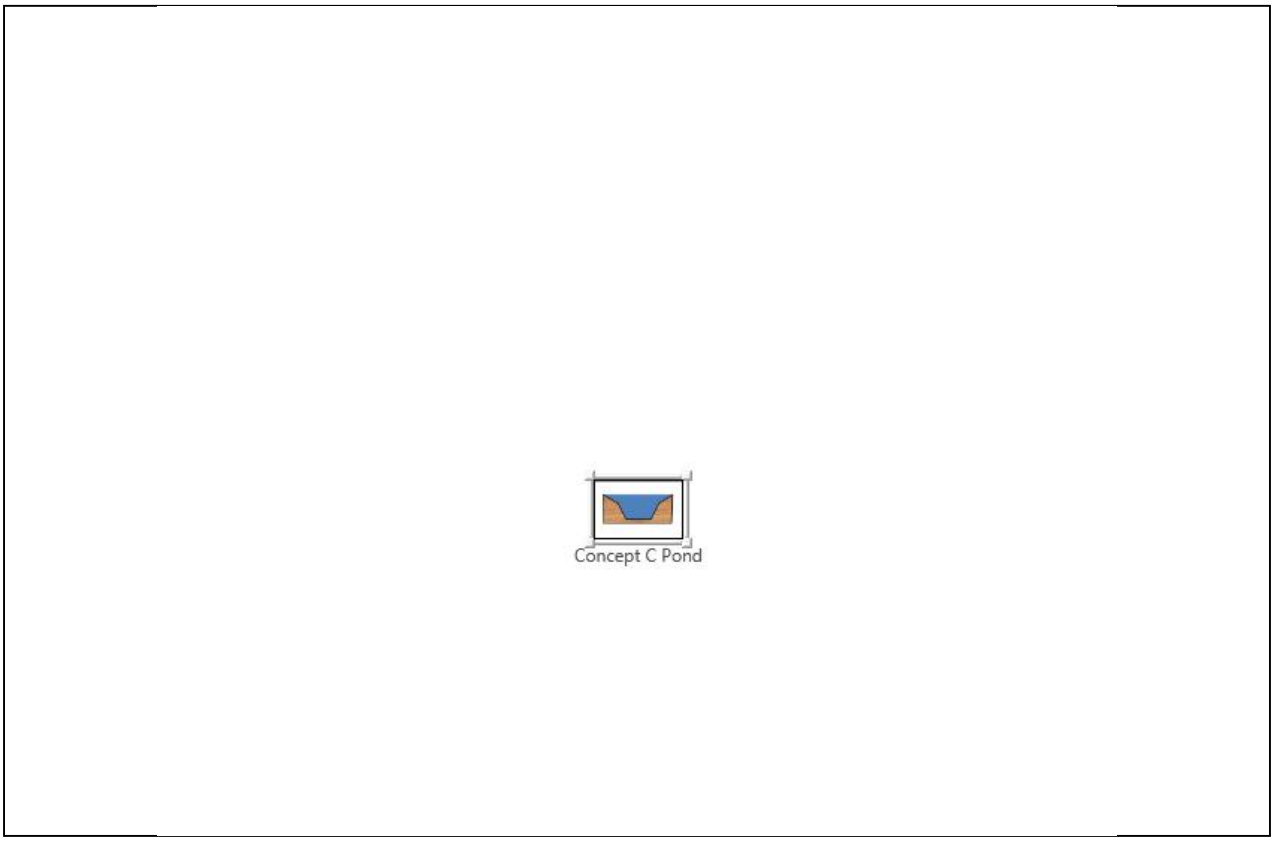
Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Concept C Pond	7.49	0	0	7.49	0

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Concept C Pond	3022	0	1813	1209	60

BMP Schematic



Northwood Lake WQ Improvements
193802816
PondNet Model
8/22/2014

Existing Pond Performance

		BC-P2.6A	BC-P2.6B	To Chamber
		A - BC-P2.6A	**A - BC-P2.6B**	**A - Concept A East**
Routed TO:		A - BC-P2.6B	A - Concept A East	A - Park
INPUT VARIABLES	UNITS			
case label	-			
Total watershed area	acres	27.4	45.8	16.0
basin area	acres	0.31	0.68	0.00
basin volume	ac-ft	0.88	0.79	0.00
Agricultural		0%	0%	0%
Commercial		0%	0%	0%
Golf		0%	0%	0%
High Density Residential		0%	0%	0%
Industrial		0%	0%	0%
Institutional		0%	0%	0%
Low Density Residential		100%	0%	100%
Medium Density Residential		0%	0%	0%
Parks and Open Space		0%	100%	0%
Quarries		0%	0%	0%
ROW		0%	0%	0%
Rural Residential		0%	0%	0%
	Total	100%	100%	100%
WATERSHED-WIDE ACCOUNTING				
tributary land area	ac	27.07	72.17	88.14
tributary water area	ac	0.31	0.99	0.99
direct and ponded area	ac	27.38	73.16	89.13
ASSUMED EXPORT FACTORS				
season length	yrs	1	1	1
season precipitation	inches	31.4	31.4	31.4
runoff total p	ppb	450.00	250.00	450.00
runoff ortho p/total p	-	0.30	0.50	0.30
unit runoff	in/yr	8.28	2.20	8.28
unit export	lbs/ac-y	0.84	0.12	0.84
POND WATER BUDGETS				
runoff	ac-ft/yr	18.89	8.39	11.02
upstream pond	ac-ft/yr	0.00	18.89	27.27
total inflow	**ac-ft/yr**	**18.89**	**27.27**	**38.29**
outflow	ac-ft/yr	18.89	27.27	38.29
POND PHOSPHORUS BUDGETS				
runoff	lbs/yr	23.03	5.68	13.43
upstream pond	lbs/yr	0.00	11.05	13.14
total inflow	**lbs/yr**	**23.03**	**16.73**	**26.57**
net sedimentation	lbs/yr	11.98	3.59	0.00
outflow	lbs/yr	11.05	13.14	26.57
p removal efficiency	%	52.03	21.48	0.00
upstream w-shed p load	lbs/yr	23.03	28.71	42.15
total removal %	%	52.03	54.25	36.96
HYDRAULIC PARAMETERS				
pond mean depth	feet	2.82	1.15	1.00
relative volume	inches	1.45	2.94	0.00
residence time	years	0.05	0.03	0.00
residence time	days	16.91	10.51	0.00
overflow rate	ft/yr	60.93	40.11	3828904.57
inflow phos conc	ppb	448.68	225.69	255.31
outflow phos conc	ppb	215.23	177.21	255.30
p reaction rate	-	2.26	0.35	0.00
1-rp	-	0.48	0.79	1.00
vlawmo pond volume	acre-ft	1.50	0.67	0.88
LAND USE PARAMETERS				
runoff total P calc	ppb	450.00	250.00	450.00
runoff coefficient		0.26	0.07	0.26
dissolved/total P		0.30	0.50	0.30
runoff TSS conc	ppm	140.00	216.00	140.00
POND TSS BUDGETS				
runoff	lbs/yr	7084.61	4836.04	4179.38
upstream pond	lbs/yr	0.00	885.58	3249.06
total inflow	**lbs/yr**	**7084.61**	**5721.62**	**7428.44**
p removal efficiency (no inf)	%	53.00	22.00	0.00
tss removal efficiency (no inf)	%	87.50	43.21	0.00
net sedimentation	lbs/yr	6199.03	2472.56	0.00
outflow	lbs/yr	885.58	3249.06	7428.44
tss removal efficiency (inf)	%	87.50	43.21	0.00
upstream watershed tss load	lbs/yr	7084.61	11920.65	16100.03
tss total removal efficiency	%	87.50	72.74	53.86
INFILTRATION BMP/POND				
Annual runoff infiltrated	%	0%	0%	0%
Adjusted outflow	**ac-ft/yr**	**18.89**	**27.27**	**38.29**
Adjusted TP outflow	**lbs/yr**	**11.05**	**13.14**	**26.57**
Adjusted TSS outflow	**lbs/yr**	**885.58**	**3249.06**	**7428.44**
Developed Area		27.38	0.00	15.97
Upstream Developed Area		27.38	27.38	43.34

Existing Pond Performance - Particulate and Dissolved Phosphurus

Pond	Watershed Particulate Phosphorus Load	Watershed Dissolved Phosphorus Load	Total Particulate Phosphorus Load	Total Dissolved Phosphorus Load	Particulate Phosphorus Load Removed	Dissolved Phosphorus Load Removed	% Particulate Phosphorus Removed	% Dissolved Phosphorus Removed
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(%)	(%)
BC-P2.6A	16.1	6.9	16.1	6.9	12.0	0.0	74.4%	0.0%
BC-P2.6B	4.0	1.7	8.1	8.6	3.6	0.0	44.4%	0.0%

Existing Pond Performance - TSS

Pond	Watershed TSS Load	Total TSS Load	TSS Load Removed	% TSS Removed
	(lbs)	(lbs)	(lbs)	(%)
BC-P2.6A	7085	7085	6199	87.5%
BC-P2.6B	4836	5722	2473	43.2%

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Appendix D
Northwood Lake Information

February 6, 2014

Mr. Dave Callister, City Manager
City of Plymouth
3400 Plymouth Blvd.
Plymouth MN 55447-1448

Subject: Northwood Lake Information

Dear Dave:

I am writing in follow up to a recent conversation we had regarding the Four Seasons/Northwood Lake water quality improvement project. You indicated it would be helpful if the Plymouth City Council had more information regarding what the city of New Hope and residents residing around Northwood Lake had done to improve the water quality of the lake. I am enclosing some general information about Northwood Lake, a listing of past projects and activities that have been completed to improve water quality, information about the Lake Association, general city maintenance activities that impact water quality, and potential future projects to be completed. The location of both the projects completed in past years and proposed to be completed in the future are denoted on the attached map. As you will note, a number of projects have been completed to help improve the water quality around Northwood Lake.

I hope this information is useful to the city of Plymouth as you move forward with the Four Seasons/Northwood Lake water quality improvement project. Please contact me, 763-531-5112 or kmcdonald@ci.new-hope.mn.us if you have any questions.

Sincerely,

Kirk McDonald
City Manager

Attachments: Northwood Lake information

Cc: New Hope City Council
Robert White, Northwood Lake Association

NORTHWOOD LAKE

1. GENERAL INFORMATION

Northwood Lake has a surface area of about 15 acres and has a watershed (drainage area) of approximately 1,340 acres. A total of 824 acres are in the city of Plymouth, and 516 acres are in New Hope. Bassett Creek Watershed Management Commission's management classification is a "Level II" for Northwood Lake; recreational with non-body contact activities.

Northwood Lake is on the state's impaired water list for excessive nutrients and will need a "Total Maximum Daily Load" (TMDL) study completed. In 2009, the level of phosphorous concentration in the lake was four (4) times higher than the Bassett Creek Watershed Management Commission's goal of 45 ug/L.

Working with the MPCA and the Bassett Creek Watershed Management Commission, the TMDL study will identify Best Management Practices (BMPs) to reduce the concentration of phosphorous in the lake. An example of a BMP would be a water quality pond improvement project.

2. PAST PROJECTS/ACTIVITIES COMPLETED
Please note: Letters in parenthesis next to an item denotes location on attached map

1970 – 1980

Material from the bottom of Northwood Lake was pumped out in the mid-70s, and in 1979-1980 the west end was dredged as a city/county project to remove sediment buildup in the lake from County Road 18 improvements.

1996

City adopts phosphorous free fertilizer ordinance to regulate commercial lawn fertilizer application companies in the city. The ordinance was adopted to protect water resources in the city, and fertilizer containing phosphorous cannot be applied except in rare circumstances. Fertilizers may not be applied in buffer zones outlined in the wetland ordinance below the ordinary high water lines or within 50 feet of any wetland or water resource. An educational campaign was also implemented to educate residents about the negative impacts of fertilizers containing phosphorous.

1997

(A) New outlet pipe and weir structure installed under Boone Avenue for both water quality and quantity purposes and channel rerouted for more direct flow to help prevent flooding.

In addition to the new outlet pipe structure installed under Boone Avenue similar new pipes were installed under Winnetka Avenue, and under the CP Railroad bridge over 36th Avenue to approximately Nevada Avenue.

(B) Two new water quality cells (NB35A&B) constructed by city south of Northwood Lake for sediment control.

1999

(C) Two new flood and water quality ponds (NB-28A&B) installed at Gethsemane Cemetery east of Boone Avenue for sediment control before entering Northwood Lake.

(D) Construction of two new water quality cells north of Northwood Park trail and south of the wetland between Boone and Winnetka Avenues.

2000-2002

Barley straw was applied during three summers to help alleviate the buildup of filamentous algae on the surface. Neighborhood meetings were conducted to discuss this treatment and the importance of creating buffer zones was discussed with residents. It seemed to help reduce the impact of the algae mats for the first couple of years. The last two years the amount of barley straw was increased. Even with the increase in the amount of straw used, the straw seemed less and less effective, and the applications were discontinued. Although the effectiveness of the barley straw on the filamentous algae decreased, the Secchi Disc depth (clarity of water column) improved.

2002

(E) Three new water quality cells (NB-37A&38A) constructed by city around Hidden Valley Park for sediment control and increased capacity with final restoration completed in the fall of 2003.

2003

(F) Storm water rerouted from Ensign Avenue and 35th Avenue to new pond at St. Joseph's Catholic Church (NB-36A); new 36" pipe installed to limit erosion in ravine near St. Joseph's Church pond; and installed upstream rate control into St. Joseph's pond.

2004

(G) City constructed the regional storm water pond southwest of St. Joseph Catholic Church east of 35th Avenue cul de sac. The project was part of the city's 1996 Surface Water Management Plan and included in the Bassett Creek Watershed Management Commission's capital improvement program and Second Generation Plan. The primary purpose of the project was to provide water quality treatment for 67 acres of property, providing benefit to both Northwood Lake and the north branch of Bassett Creek. Total cost of the project was approximately $183,000 paid from the city's storm water fund, storm water fees from adjacent properties, and from the Bassett Creek Watershed Management Commission.

2008

(H) City completed the construction of Northwood east sediment pond located north of the Northwood Park wetland between Boone and Winnetka Avenues. The project was part of the city's 1996 Surface Water Management Plan and part of the Bassett Creek Watershed Management

Commission's CIP. The pond functions as a sediment trap which provides a water quality benefit by settling out sediments and removing phosphorous, protecting the existing Northwood Creek channel and wetland area. The pond benefits the north branch of Bassett Creek and provides water quality treatment for approximately 22 acres. A total of 2,200 cubic yards were removed to create the pond, and the total project cost was approximately $107,000, which was funded by the Bassett Creek Watershed Management Commission and city's storm water fund.

2009

(I) City completed the Northwood Lake west inlet cleaning project at west end of Northwood Lake. A delta of sediment existed in front of the inlet structure on the northwest corner of the lake, and it was important to remove the sediment so the lake continued to function as originally designed in regards to both water quality/quantity. The project was recommended in the city's 1996 Surface Water Management Plan. A total of 363 cubic yards of sediment was removed. Project cost was approximately $85,000, and was funded primarily from the city's storm water fund.

City coordinates Northwood Lake neighborhood meeting to discuss water quality issues, and encourages formation of lake association by residents (similar to the Meadow Lake Association in north part of city). Northwood Lake Association was formed.

2011

(J) City completed Northwood wetland channel cleaning project between Boone and Winnetka Avenues to clean out accumulated sediment. A total of 2,075 cubic yards of material was removed. Total project cost was approximately $185,000.

2013

City implemented Canada goose egg addling project to reduce the number of geese/feces in Northwood Park and Lake which impact the water quality. Permits were applied for and received from the U.S. Fish & Wildlife Service and the MN Department of Natural Resources to allow the city to conduct the project. A total of 22 nests with 118 eggs were addressed, which resulted in a significant drop in the goose population. Northwood Lake residents supported the project, and the city will continue the program in 2014.

3. LAKE ASSOCIATION

The Northwood Lake Association, acting both independently and in conjunction with the city, has been active in promoting water quality activities and projects around Northwood Lake. Annual meetings are conducted and speakers from the DNR have spoken to educate residents about the importance of buffer strips to improve water quality. Efforts have been made to keep grass clippings and other yard waste out of the lake, and an "adopt a storm drain" program is being pursued and residents actively monitor catchbasin drains around the lake. The association members have also physically removed sediment from the center of the lake, and the city coordinated on the disposal of the material. Annual cleanups around the lake are sponsored by the association.

4. GENERAL MAINTENANCE

Ongoing maintenance includes increased street sweeping activities in the lake's watershed area in addition to the city's regular spring and fall contracted sweeping; the sweeping of debris on Northwood Park trails as time and staffing allow; and removal of future sediment build up at the lake's west inlet by city staff.

Over the past several years, the city has changed snow plowing/application procedures from a salt/sand mixture to the use of clearlane salt to eliminate the use of most sand from winter operations to help keep sediment out of the city's water bodies.

The city has also actively installed buffer strips around ponds in all areas of the city to prevent erosion and improve water quality.

5. FUTURE PROJECTS

(K) Future BMPs/projects will include the installation of grit chambers upstream from the multiple inlets around the lake. The installation of grit chambers will be coordinated with future street infrastructure improvements to Northwood Parkway, 40½ Avenue, and Ensign Avenue.

(L) The city's Local Water Management Plan and the Bassett Creek Watershed Management Commission's Capital Improvement Plan include the dredging of a large pond on the west side of TH 169, upstream from Northwood Lake's large west inlet in the future. In conjunction with this project, a water quality cell is proposed to be constructed on the vacant property west of Jordan Avenue at the west end of Northwood Lake.

Additional future improvements included in both the city's and commission's plans are additional water quality cells in Northwood Park, north and south of the lake and west of Boone. The commission's plan proposes the construction of these improvements in 2016.


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Appendix E
Local Water Management Plan Excerpts

Major Drainage Area ID	Stormwater Issue	Issue Category	Corrective Action Taken	Year Completed
SC-A4	Channel erosion in Subdistrict SC-A4.9	Water Quality, Erosion	- Additional rate control provided in constructed ponds SC-P4.3, SC-P4.9A and SC-P4.9B.	1998
SC-A4	Insufficient water quality treatment in District SC-A4 tributary to Upper Twin Lake	Water Quality	- Cleaned deposited sediments out of channel adjacent to railroad tracks.	1997
			- Water quality treatment provided in constructed ponds SC-P4.9A and SC-P4.9B.	1998
SC-A5	Insufficient water quality treatment in District SC-A5 tributary to Memory Lake Pond and Upper Twin Lake	Water Quality	- Excavated 1.5 acre-feet of wet ponding volume within the CCI pond (SC-P5.14) and redirected adjacent 33-inch trunk storm sewer into this pond to provide water quality treatment.	1996
SC-A5	Excessive discharge rates out of District SC-A5 discharging to Crystal	Water Quantity	Excavated 10.6 acre-feet of flood storage volume in the CCI pond (SC-P5.14).	1996
SC-A5	Local flooding at the intersection of 45th and Xylon Avenues	Water Quantity	- Rerouted storm sewer flows from 42nd and Winnetka Avenues away from the trunk system serving this intersection.	1999
SC-A6	Untreated stormwater runoff discharge into a DNR Protected Water (SC-P6.8)	Water Quality	- Excavated 1.4 acre-feet of wet ponding volume in the Pet Hospital Pond (SC-P6.7) and 0.6 acre-feet of wet ponding volume in the Collisys Site Pond (SC-P6.19) to provide water quality treatment prior to discharging to SC-P6.8.	2003
SC-A7	Untreated stormwater runoff discharging into Victory Park Pond, a DNR Protected Water (SC-P7.3)	Water Quality	- Excavated 2.7 acre-feet of wet ponding volume as part of the Victory Park Pond Improvements project (SC-P7.7) at the inlets from Boone Avenue.	2005
SC-A7	Local flooding at the intersection of Boone Avenue and East Research Center Road	Water Quantity	- Rerouted 24-inch Boone Avenue storm sewer flows from the south around this intersection to free pipe capacity at the intersection.	2005
			- Upsized the existing 36-inch trunk pipe to a 54-inch trunk pipe in East Research Center Road at the point at which the rerouted flows from Boone Avenue tie into this system.	2005
BC-A1	Local rear-yard flooding east of Independence Circle	Water Quantity	- Provided additional downstream pipe capacity via 27" storm sewer in Independence Circle and 36" storm sewer to the south.	2004
BC-A2	Local flooding location for properties adjacent to Hidden Valley Park pond (BC-P2.2A)	Water Quantity	- Provided an additional 3.2 acre-feet of flood storage within Hidden Valley Park pond (BC-P2.2B-D) *[BCWMC WMP ID# NB-37A, NB-38A].*	2003
BC-A2	Ravine erosion in subdistrict BC-A2.3, contributing excessive Total Suspended Solids load to Northwood Lake	Water Quality, Erosion	- Provided upstream rate control in the St. Josephs Church regional pond (BC-P2.3) to control discharge rates to this ravine.	2003
			- Constructed a 36-inch pipe low flow diversion parallel to the ravine to protect the channel.	2003

Major Drainage Area ID	Stormwater Issue	Issue Category	Corrective Action Taken	Year Completed
BC-A2	Insufficient water quality treatment of flows discharging to Hidden Valley Park pond (BC-P2.2A)	Water Quality	- Excavated an additional 1.4 acre-feet of wet volume within a series of stormwater wetland cells in Hidden Valley Park pond (BC-P2.2B-D) *[BCWMC WMP ID# NB-37A, NB-38A]* to provide water quality treatment for the residential area and grade school draining to this pond. In addition to the wet volume benefit, increased biological uptake by the wetland plantings is expected.	2002
BC-A2	Local flooding location for properties adjacent to Northwood Lake (BC-P2.5A)	Water Quantity	- Provided a total of 5.8 acre-feet of flood storage in the Gethsemane Cemetery pond (BC-P2.6A-B) *[BCWMC WMP ID# NB-28A,B]* to reduce the peak discharge rates to Northwood Lake (BC-P2.5A).	1999
			- Upsized the existing outlet for pond Northwood Lake (BC-P2.5A) to a 3'x7' box culvert.	1997
			- Upsized 36th Ave. N. pipe from 18" to 24" between Flag Ave. N. and Ensign Ave. N.	2002
BC-A2	Untreated stormwater runoff discharging to Northwood Lake (BC-P2.5A)	Water Quality	- Excavated 2.8 acre-feet of wet volume in pond BC-P2.3 (St. Joseph's Church) *[BCWMC WMP ID# NB-36A]* to provide water quality treatment prior to discharging to Northwood Lake (BC-P2.5A).	2005
			- Excavated 1.7 acre-feet of wet volume in the 2-cell pond BC-P2.6A-B *[BCWMC WMP ID# NB-28A-B]* and rerouted flows from Boone Avenue into pond to provide water quality treatment prior to discharging to Northwood Lake.	1999
			- Excavated 1.0 acre-feet of wet volume within a 3-cell pond BC-P2.5B *[BCWMC WMP ID#- NB-35A,B,C]* to provide water quality treatment prior to discharging to Northwood Lake.	1999
			- Rerouted flows from Ensign Ave into St. Joseph's Church pond (BC-P2.3).	2003
BC-A3	Channel erosion between Northwood Lake (BC-P2.5A) and pond BC-P3.15A	Water Quality, Erosion	- Re-aligned channel between Northwood Lake (BC-P2.5A) and pond BC-P3.15A to improve stability.	1997
			- Provided a variety of plantings along the re-aligned channel to improve slope stability, provide a stream buffer, and improve wildlife habitat.	1997
			- Re-aligned channel graded with stable grade and gentle side slopes.	1997
BC-A3	Insufficient water quality treatment prior to discharging to Bassett Creek and Basset Creek Park Pond	Water Quality	- Constructed water quality treatment cell BC-P3.27 immediately southwest of the intersection of 36th Ave N and the railroad.	1996
BC-A3	Local flooding in 36th Ave N between Zealand Ave and Yukon Ave	Water Quantity	-Increased storm sewer pipe size to 21" and routed pipes along 36th Ave N rather than through development south of 36th Ave N.	2002

Major Drainage Area ID	Stormwater Issue	Issue Category	Corrective Action Taken	Year Completed
BC-A3	Untreated stormwater runoff discharging to pond BC-P3.15A	Water Quality	- Constructed water quality treatment cell BC-P3.15B (wet volume = 0.2 acre-feet), immediately adjacent to the re-aligned channel between Northwood Lake (BC-P2.5A) and BC-P3.15A.	1999
			- Constructed water quality treatment cell BC-P3.15D (wet volume = 0.03 acre-feet), adjacent to the re-aligned channel between Northwood Lake (BC-P2.5A) and BC-P3.15.	2002
			- Rerouted untreated upstream flows from Northwood Parkway (east of Boone Avenue) into the excavated water quality treatment cell (0.4 acre-feet of wet volume) BC-P3.15E.	1999

6.2 EXISTING STORMWATER MANAGEMENT ISSUES AND POSSIBLE CORRECTIVE ACTIONS

The following list of items presented in Table 6.2 represent current stormwater management issues or concerns as identified by the documents included in Section 4 of this plan. It is not the intent of this list to include all of the current stormwater management issues identified in the watershed documents in Section 4, only those issues with a possibly corrective action that directly affects the City. The implementation of the possible corrective actions will be addressed in the Implementation Section (Section 8).

Table 6.2 - Current Stormwater Management Issues and Possible Corrective Actions[19]

Major Drainage Area ID	Stormwater Issue	Issue Category	Issue Identified by:	Possible Corrective Actions
SC-A1	Degraded water quality within Meadow Lake (SC-P1.1)	Water Quality	City, SCWMC-WMP	- Pursue golf course fertilizer management education.
				- Install wetland plantings in pond SC-P1.1A to increase biological uptake.
				- Conduct waterfowl management (shoreline plantings).
				- Provide public education regarding stormwater quality, including proper fertilizer application and the disposal of yard and pet waste.
				- Cooperate with the SCWMC to address the nutrient load allocation requirements to be included in the future TMDL Implementation plan.
SC-A1	Flooding issues adjacent to Bass Creek.	Water Quantity	City	- Investigate home low opening elevations adjacent to Bass Creek to identify potential flooding issues.
SC-A2	Insufficient water quality treatment in Major Drainage Area SC-A2 tributary to Upper Twin Lake	Water Quality	City	- Look for opportunities to construct water quality BMPs in the area tributary to the basin adjacent to 60th and Quebec Avenues (SC-P2.6) tributary to Upper Twin Lake.

[19] This stormwater management issues list only includes those issues directly affecting the City of New Hope, as identified by any of the documents listed in Section 4, and is not meant to incorporate all of the stormwater management issues identified in the documents in Section 4.

Major Drainage Area ID	Stormwater Issue	Issue Category	Issue Identified by:	Possible Corrective Actions
SC-A3	Insufficient water quality treatment in the Wincrest pond (SC-P3.4) tributary to Upper Twin Lake	Water Quality	City	- Reroute storm sewer flows from Winnetka Avenue to the west end of Wincrest pond (SC-P3.4), to maximize inflow residence time. - Excavate additional wet ponding volume in the Wincrest pond (SC-P3.4) to improve water quality treatment efficiency.
SC-A3	Insufficient trunk storm sewer capacity along Bass Lake Road	Water Quantity	City	- Provide additional pipe capacity in coordination with the City of Crystal.
SC-A3	Possible flooding issues in the apartments adjacent to the Village Golf Course pond (SC-P3.2)	Water Quantity	City	- As redevelopment occurs in this area, investigate potential local flooding issues and address as necessary.
SC-A5	Excessive discharge rates out of District SC-A5 discharging to Crystal	Water Quantity	City	- Expand flood storage and restrict discharge out of the 45th Avenue pond (SC-P5.12). - Provide additional flood storage in Sunnyside Park (SC-A5.19 and SC-A5.21).
SC-A5	Local flooding at the intersection of 45th and Xylon Avenues	Water Quantity	City	- Provide additional trunk storm sewer capacity in 45th Avenue upstream of the 45th Avenue pond (SC-P5.12).
SC-A5	Local drainage problems at the apartments south of Fred Sims Park	Water Quantity	City	- A part of improvements to Fred Sims Park, investigate existing drainage issues in the apartments to the south.
SC-A5	Local flooding at the 42nd Avenue low point at the railroad underpass	Water Quantity	City, SCWMC-WMP	- Provide additional downstream trunk pipe capacity, see the 42nd Ave flood study. - Reroute local storm sewer flows along 42nd Avenues at Winnetka Avenue, Quebec Avenue, Nevada Avenue, and Oregon Avenue away from the trunk system serving this intersection, see the 42nd Ave flood study.
SC-A5	Insufficient water quality treatment in District SC-A5 tributary to Memory Pond	Water Quality	City	- Excavate wet ponding volume in the 45th Avenue pond (SC-P5.12). - Provide appropriate water quality BMPs in Sunnyside Park (SC-A5.19 and SC-A5.21).
SC-A6	Untreated stormwater runoff discharge into DNR Protected Water wetland SC-P6.6A	Water Quality	City	- Excavate wet ponding volume at the wetland inlets adjacent to Erickson Drive (SC-P6.6B).
SC-A6	Untreated stormwater runoff discharge into DNR Protected Water wetland SC-P6.8	Water Quality	City	- Construct ponds SC-P6.14 and SC-P6.16.
SC-A6	Degraded wetland habitat in DNR Protected Water wetlands SC-P6.6A and SC-P6.8	Water Quality	City	- Provide habitat restoration including vegetation management and diversification, and excavation. - Public education regarding protecting wetland habitat.
SC-A6	Local flooding at the intersection of 47th and Flag Avenues North	Water Quantity	City	- Lower the overland EOF from this intersection, see 47th and Flag Avenues flood study. - Minimize upstream catch basin bypass. - Provide additional downstream trunk pipe capacity in Flag Avenue.

Major Drainage Area ID	Stormwater Issue	Issue Category	Issue Identified by:	Possible Corrective Actions
SC-A7	Insufficient water quality treatment in subdistrict SC-A7.4 and SC-A7.5 tributary to Bass Creek	Water Quality	City	- Public education to include proper fertilizer application and the disposal of yard and pet waste.
				- Focus frequent street sweeping efforts in area.
SC-A7	Local flooding at the intersection of Boone Ave and E Research Cntr Rd	Water Quantity	City	- Provide additional trunk pipe capacity immediately downstream of the intersection.
SC-A1-A7	Increased impervious surface as watershed becomes fully developed will increase the duration and frequency of bank full conditions and should be addressed and monitored	Water Quantity	SCWMC-WMP	-Encourage the reduction of impervious surface by promoting low impact development principles and strategies for new development and redevelopment projects.
SC-A1-A7	Standards that have prevented flooding potential as the Shingle Creek watershed has developed should be continued or enhanced as development is completed	Water Quantity	SCWMC-WMP	- New development or redevelopment projects shall not increase the existing 100-year peak rate from the site.
				- Seek opportunities to provide additional rate control to reduce the 100-year peak discharge rate from New Hope.
SC-A1-A7	Water quality and stability of Shingle Creek should be improved	Water Quality	SCWMC-Shingle Creek Corridor Study, WMP	- Improvement projects or management strategies shall not increase the 100-year elevation of Shingle Creek nor its tributaries or floodplain storage areas.
				- Any fill that impacts flood storage in wetlands or floodplains shall be mitigated with compensating storage within the same subreach or reach.
				- Enact and enforce standards specifying buffer maintenance adjacent to Shingle Creek and its tributaries.
				-Work with the SCWMC to develop a Shingle Creek Management Plan.
				-Construct or encourage the construction of streambank stabilization and habitat restoration projects.
SC-A1-A7	Excessive chloride levels in Shingle Creek	Water Quality	Shingle Creek Chloride TMDL	- Calibrate salt spreaders annually.
				- Use the Road Weather Information Service and other sensors to improve salt application decisions.
				- Evaluate new technologies on an annual basis, such as prewetting and anti-icing as equipment needs replacement.
				- Investigate and adopt new salt products, such as Clear Lane, where feasible and cost effective.
				-Maintain good housekeeping practices associated with the handling of road salt to minimize the potential for wash-off.
				- Provide operator training.
				- Stockpile snow away from sensitive areas.
				- Sweep City streets in late winter to remove as much residual salt as possible.
				-Track and report activities in annual NPDES report, provide a copy to the Commission.

Major Drainage Area ID	Stormwater Issue	Issue Category	Issue Identified by:	Possible Corrective Actions
SC-A1-A7	General water resource water quality degradation	Water Quality	SCWMC-WMP	-Work with SCWMC to develop management plans for affected water resources.
SC-A1-A7	Water quality in Twin Lake, especially Upper Twin Lake should be improved	Water Quality	SCWMC-WMP	-Work with SCWMC to develop a Twin Lake Management Plan.
				-Promote good housekeeping practices amongst property owners in Twin Lake subwatershed.
SC-A1-A7	Wetland protection and restoration	Water Quality	SCWMC-WMP	- Wetland mitigation should be provided within the same subwatershed.
				-Prioritize wetlands and complete wetland functions and values assessment.
				-Establish buffer strip requirements adjacent to wetlands and watercourses.
				-Identify wetland restoration possibilities and construct or encourage the construction of restoration projects.
BC-A1-A4	Insufficient water quality treatment tributary to and degraded water quality in Medicine Lake, Northwood Lake (BC-P2.5), and Bassett Creek and Bassett Creek Park Pond	Water Quality	City, BCWMC-WMP	- Construct appropriate water quality BMP(s) in Jaycee Park (BC-A1.2).
				- Excavate wet ponding volume in Northwood Park (BC-P2.5C) - BCWMC WMP ID# NB-29A-B.
				- Require wet detention, or other techniques that provide equal degrees of treatment, for all new or redeveloped properties, where applicable.
				- Provide public education to residents and lake users on practices that would reduce pollutants.
				- Enforce City ordinances regarding disposal of litter, yard waste, and animal waste.
				- Place additional garbage cans adjacent to waterbodies to provide more convenience for disposal of garbage.
				- Promote stormwater retention and runoff volume reduction (e.g. reduced impervious surfaces) where feasible.
				- Encourage vegetated buffer strips between maintained lawns and waterbodies.
				- Excavate bottom sediment to remove a nutrient source.
BC-A2	Local flooding location for properties adjacent to pond BC-P2.2A (Hidden Valley Park pond)	Water Quantity	City	- Increase the downstream pipe capacity in Boone Avenue out of pond BC-P2.2A.
BC-A3	Untreated stormwater runoff discharging to pond BC-P3.15A	Water Quantity	City	- Excavate wet ponding volume in pond BC-P3.15C.
BC-A4	Local flooding at the low point east of Winnetka Avenue on Terra Linda Drive	Water Quantity	City	- Lower and/or widen the existing overland overflow from both Terra Linda Drive and Medicine Lake Road, see the Terra Linda flood study.
BC-A4	Local flooding at the low point at the intersection of Medicine Lake Road and Rhode Island Avenue	Water Quantity	City	- Work with the City of Golden Valley to provide additional downstream trunk pipe capacity in Rhode Island Avenue.