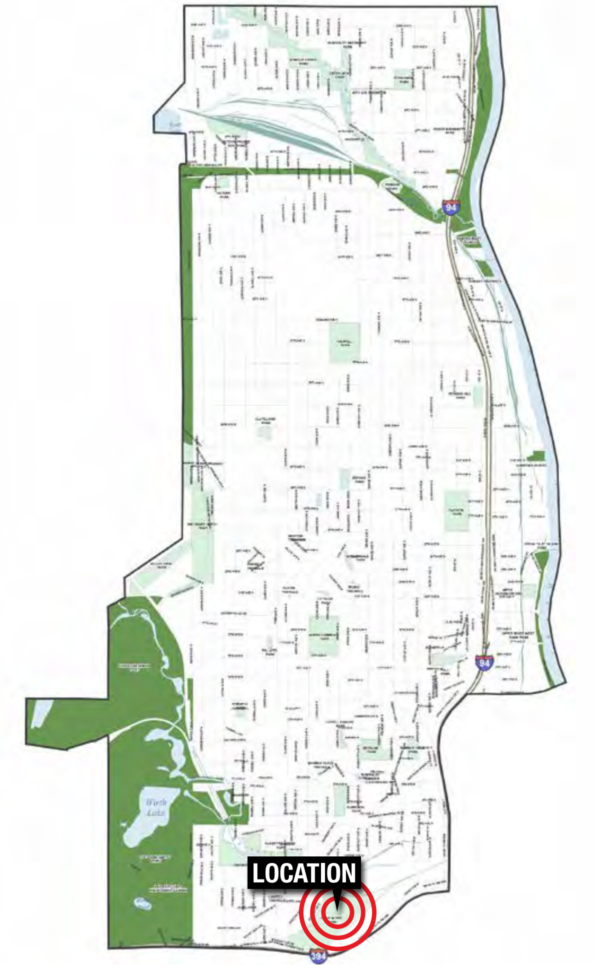
Appendix A

Minneapolis Park and Recreation Board Preferred Master Plan Alternatives

BRYN MAWR PARK



LOCATION AND HISTORY

Bryn Mawr Meadows Park is located just north of I-394 in its namesake neighborhood. It is a large park with many athletic fields and diamonds. Bryn Mawr takes its name from John Oswald's farm, which once occupied that region of the city. Bryn Mawr means "great hill" in Welsh. As early as the 1860s, Oswald grew tobacco on his farm and also produced fruit wines there. Oswald was a commissioner on the first park board created by the legislature in 1883. In 1910 Oswald's heir offered to sell part of Oswald's estate to the park board, but Theodore Wirth's assessment of the property at the time was that it did not offer any "special advantage" except as part of a parkway to connect The Parade and Loring Park to Glenwood (Wirth) Park through Bassett's Creek Valley. He stated that compared with other needs in the park system it was of "little importance." Nevertheless, in 1911 the park board purchased 39 acres (leaving out the far western end that would have connected Bryn Mawr to Glenwood Park) without a promise to improve the land. The cost of the purchase was assessed on property in the neighborhood.

The first suggestions for improvement of the land were made in 1915 when Wirth recommended converting the land into an equestrian center, complete with horse-riding park and polo grounds. The park board did build a baseball field in 1922, but never moved ahead with the equestrian center. In 1929 Wirth presented a plan to improve the 39 acres of "almost useless" land. The plan included the improvement of Bassett's Creek from Glenwood to Bryn Mawr. The Bassett's Creek Valley land was acquired in 1934.

The first building constructed at Bryn Mawr was a combined toilet building and storage shed to serve the athletic fields in 1953. In addition about 7,000 yards of clay were removed from the playing field areas and replaced with a good grade of back fill. A small part of Bryn Mawr was lost to freeway construction in 1966, but freeways ultimately resulted in the enlargement of the park. Seven athletic fields at The Parade were lost due to freeway expansion and the park board replaced some of that loss by expanding Bryn Mawr and building more playing fields there. Important renovations were made to Bryn Mawr's playing fields in 1992. Bryn Mawr was connected to the Luce Line bicycle trail in 2005, which connected paths from Wirth Park with the Cedar Lake Trail and links to downtown Minneapolis.

EXISTING CONDITIONS AND CHARACTER

Bryn Mawr Park today is bounded by active rail lines on the north and southeast, the freeway to the south, and Morgan Avenue to the west. It is one of the city's primary athletic complexes, along with Northeast, Bossen Field, Lake Nokomis, and Nieman. As such, it is home to 12 ball diamonds of varying quality, lighting, and sizes. Most are arranged so their outfields overlap, so not all can be utilized at once. Several soccer fields can also be found here, and cricket is avidly played—though the pitches overlap ball diamonds, paths, and trees. Batting cages used by cricket players are located in the northeastern portion of the park. A large parking lot adjacent to Morgan and Laurel serves the entire site, but parking spills out onto surrounding streets.

Near the center of the park is a grouping of more neighborhood oriented facilities: wading pool, play ground, and basketball and tennis courts. A restroom and storage building in this area also serves as a warming house for the significant broomball program at this park. In winter, the lighted ball diamonds near the warming room are flooded for broomball rinks.

Trails wind throughout the park, but it is difficult to make interconnected walking loops. The Luce Line passes through the northern portion of the park and connects to an overpass of the railroad, which then connects to the Cedar Lake Trail. Another connection to the Cedar Lake Trail (albeit rather convoluted) passes under I-394, up a helix ramp and along the freeway, then down to the trail.

A variety of trees are scattered throughout the park, some large, though overall the park is an open field. A more forested hillside is found in the eastern end of the park, where it comes to a point between railroads. In general, the park tends to be wet, and some fields are hard to keep from getting regularly soggy. For this reason and to improve Bassett's Creek water quality, the Bassett's Creek Watershed Management District is collaborating with MPRB and the City of Minneapolis on a feasibility study for a major stormwater management facility in the park. That study took place in concert with the NSAMP planning effort, to ensure environmental and recreational goals are aligned.

THE PROPOSED DESIGN

The design for Bryn Mawr seeks to recalibrate the balance between neighborhood amenities and city-wide athletic facilities. This is a profound change for the park, and will undoubtedly take place over many years and implementation phases. The primary change is to reduce the number but improve the quality of ball diamonds in the park. Six diamonds are arranged at the outer edge of the park, with outfields facing the railroad and freeway. The diamonds would have outfields that do not overlap, and, in order to accommodate the current softball program at the park, at least four of them are lit. In the outfields are full-size soccer fields. A new cricket pitch overlaps the northernmost diamond, but its entire extent is free of ball infields, trees, and pathways. By moving these fields to the outer edge of the park, they will have a reduced impact on neighbors.

On the inner half of the park (nearer Morgan), a new arrangement of neighborhood focused amenities will both buffer the athletics from the neighborhood and provide enhanced options for non-athletic park use. These amenities center around a large grassy oval open for picnicking and impromptu play. A new and unique park building curves around the eastern edge of the oval. This small glassy conservatory-like building will provide for extended year-round use of the park and offer a unique facility in the area. It also integrates closely with other park amenities, and allows for a phased approach to implementation. A new play area is located within the building footprint and could be built prior to the building construction. At the other end of the building, a basketball court could also be at first outdoors and then enclosed. In between, a vegetated, open area creates a lush atmosphere in winter for relaxing, play, reading, or indoor winter picnicking. It will also serve as the warming house for broomball and expanded free skating on the oval, which is flooded and lit in winter. At the play end of the building is an outdoor nature play area with water, possibly with spray jets and misters and running rivulets. Perhaps a large garage door at that end of the building could connect indoor and outdoor in summer. Perhaps the building is built in stages. Perhaps everything happens at once, creating a truly one-of-a-kind amenity for the park system. This conservatory is one of the four “big moves” identified in this plan and as such can only be implemented through significant collaboration, including financial. This new building cannot be implemented with MPRB funding alone, but will need investment from other community or private interests. It is for this reason that the play area and basketball court, which are critical elements of the park, can be built in place regardless of building implementation.

The parking lot is relocated farther into the park, between the athletic fields and conservatory. This location moves this heavy use away from adjacent neighbors, while still allowing visibility from Morgan Avenue. Access to the park remains at the intersection of Morgan and Laurel, though MPRB will take a more active role in traffic calming and management activities in the neighborhood.

NOTE: The final recommendation of the Community Advisory Committee requested that the public comment period no the NSAMP document be used to explore an alternative parking lot and access option. Under this option park access enters directly from Cedar Lake Road immediately adjacent to Morgan Avenue. A long entry drive connects to a parking lot near the northern edge of the park. The conservatory-like building sits just south of the parking lot, between the lot and the oval of lawn. A single bicycle training area occupies the easternmost portion of the park. The primary concern with this arrangement is the new entrance from Cedar Lake Road, which is extremely close to Morgan Avenue and may not be allowed by the City of Minneapolis due to clear intersection safety issues. This alternate concept would also slightly enlarge the lawn oval and reduce the size of the building.

A major stormwater feature including narrow channels and larger open ponds, all with naturalized edges, winds through the park between the conservatory and parking lot and near Morgan Avenue. This feature helps keep fields dry and improves water quality entering Bassett's Creek. By surrounding the conservatory, it contributes to a seamless indoor-outdoor experience in both summer and winter. The remainder of the non-sport area includes open air picnic shelters, paths through groves of trees, and naturalized landscapes.

Though the Luce Line no longer passes through the park, trails at the northern end of Bryn Mawr still connect to Bassett's Creek Park and on to Wirth Park. New trails connect throughout the park, creating a variety of walking loops of varying distances. Fitness stations create a training circuit through the park. Mountain bike training areas in the northern and eastern forested sections of the park create another unique draw to the park. The intent of these areas is to provide beginner options for learning the sport, and areas to practice tricks and stunts. These new bike play areas connect to Wirth Park's many mountain biking options via the Luce Line Trail.

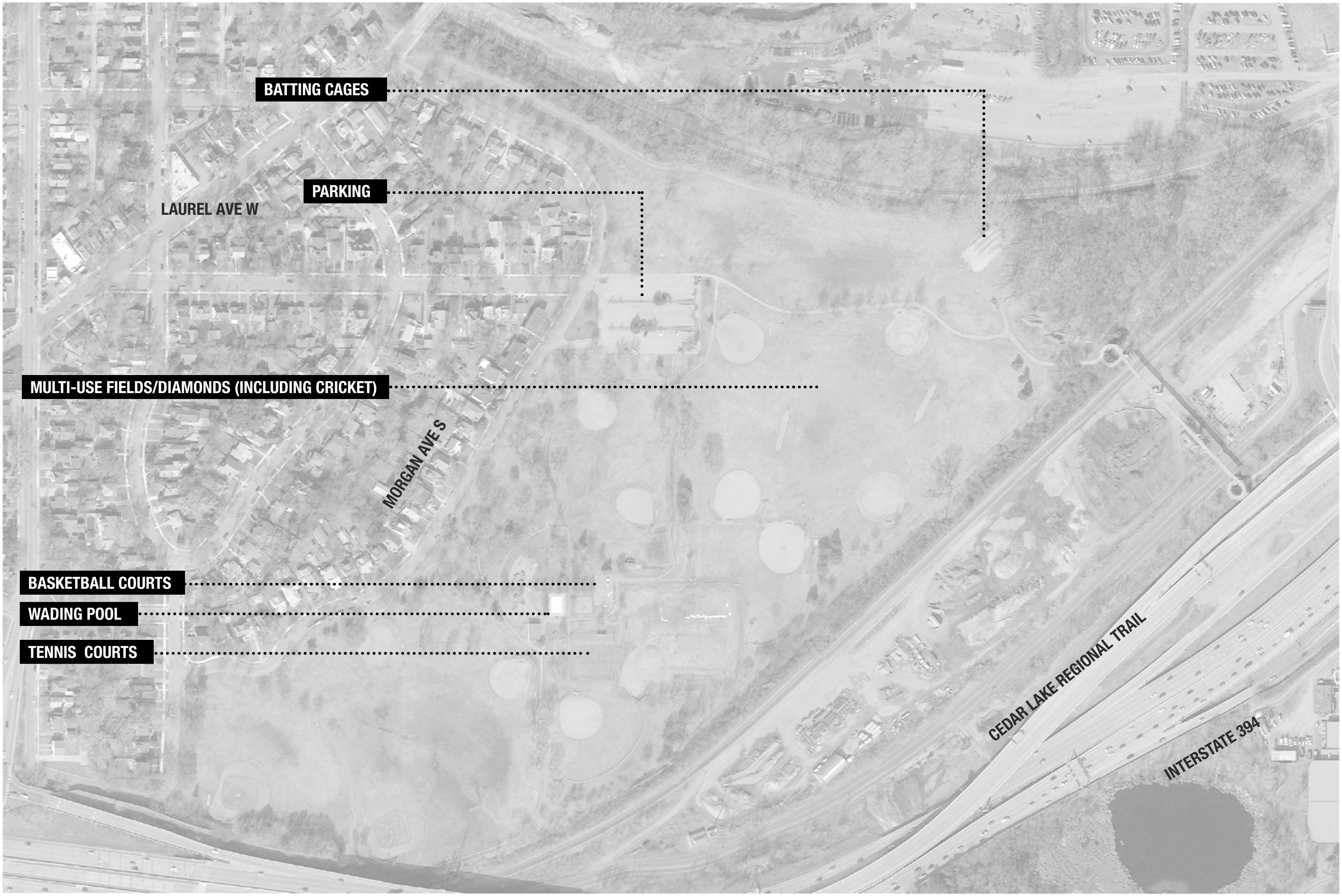
By shifting the balance between athletics and other activities in the park, Bryn Mawr will actually be used more frequently. With the reduction in ball diamonds, the current programs can still be accomplished—on higher quality facilities—while allowing space for exciting new developments. Parking and access may remain an issue without a perfect solution, but it is important to recognize that most Minneapolis parks—even athletic fields—are located within neighborhoods and surrounded by low-density residential areas. The proposed design mitigates some impact and encourages greater neighborhood use by moving athletics farther into the park and creating green buffers with neighborhood benefit.

CONNECTIONS BETWEEN PARKS

Though the Luce Line Trail is proposed to no longer pass through Bryn Mawr, a proposed trail connection from the northern corner of the park links to that trail, which travels westward through Bassett's Creek Valley to Wirth Park. City of Minneapolis proposed bikeway facilities on Cedar Lake Road connect northeasterly to Harrison Park and the trails along Van White Boulevard and southwesterly to Wirth Park via the I-394 frontage road.

KNOWN LAND USE AND COORDINATION ISSUES

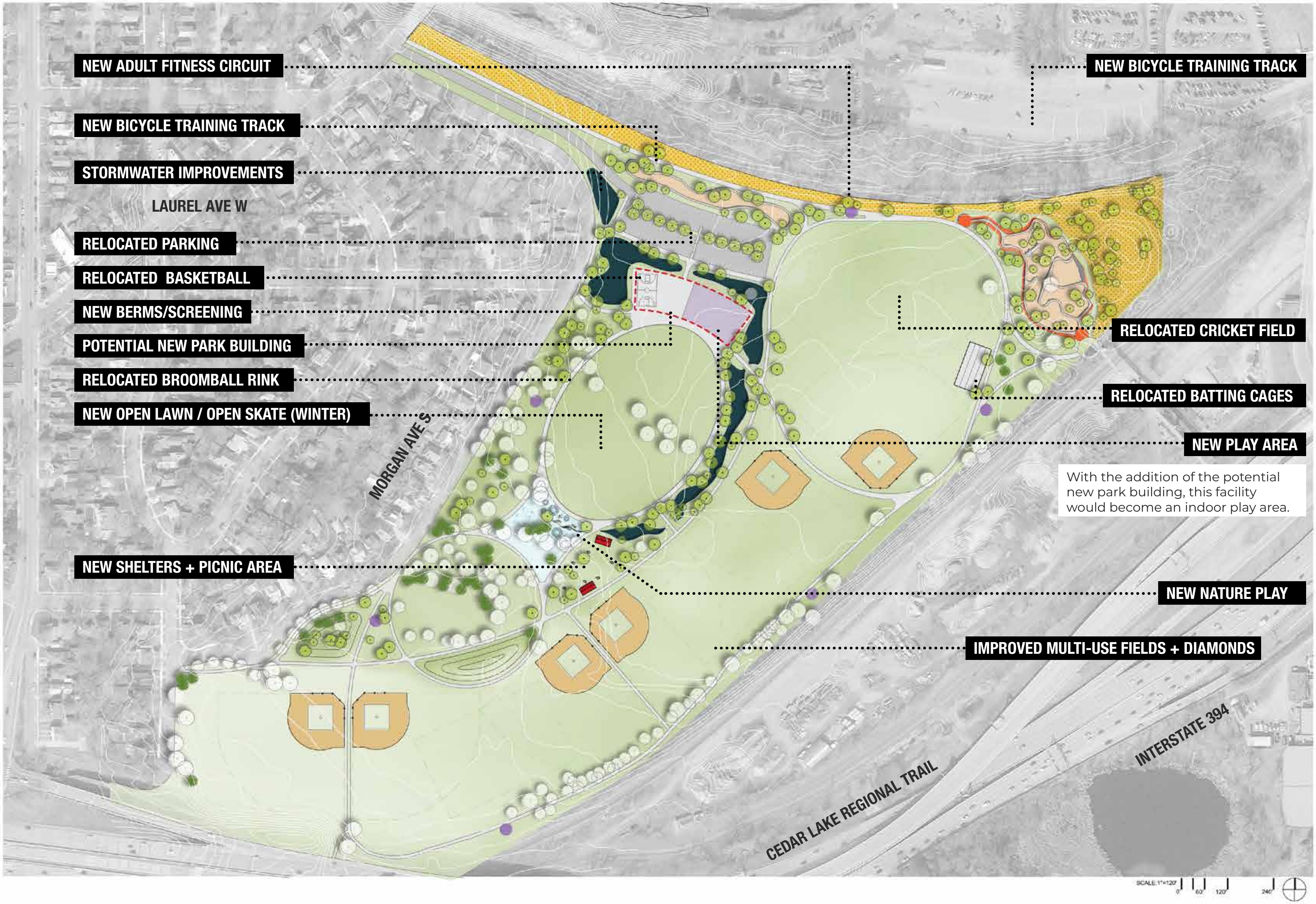
No known land use issues exist at Bryn Mawr Park.



EXISTING CONDITIONS: BRYN MAWR PARK

With the addition of the potential new park building, this facility would become an indoor play area.

PROPOSED PLAN: BRYN MAWR PARK



With the addition of the potential new park building, this facility would become an indoor play area.

PROPOSED ALTERNATE PLAN: BRYN MAWR PARK

PROCESSES

	1: General Input **Spring-Fall 2017** *Input themes prior to initial concepts*	**2: Initial Concepts** **Winter 2018** *Input themes on initial concepts*	**3: The Preferred Concept** **Now** *Key elements of the concept*
aquatics	Wading pool is in poor condition and needs upgrade	Water play areas need shade Splash pad preferred to wading pool	New water play / nature play area in community zone near building
play	Play areas in poor condition	Support for play structure with climbing wall	New water play / nature play area in community zone near building New play area with climbing within possible conservatory building (indoor year-round play)
athletics	Community and work group generally field there are too many ball diamonds in the park Ball diamonds are in poor condition, though they are important for recreational leagues Need for improved facilities for field sports like soccer and cricket	Community tended to prefer concept with fewer ball diamonds Baseball fields (at western end) are not used, consider removing them Need more soccer and multi-use fields, ideally with lighting Support for one large field to accommodate Australian rules football and cricket	Number of ball diamonds reduced to 6 from 13: elimination of three baseball, no overlapping outfields on 6 diamonds, lighting on at least 4 diamonds, all diamonds located along I-394 side of site Large and youth soccer fields overlap softball outfields, allowing for lighted fields New large-scale multi-use field (cricket and Australian football)
courts	no comments	Need basketball hoops	New basketball court located adjacent to or inside conservatory building
winter	Desire for general skating for the community in addition to broomball rinks	no comments	Broomball and skating relocated to large grass oval. Lighting designed to be extreme cut-off to light only the ice. New opportunity for ice skating near building and neighborhood. *RELOCATION OF ALL ICE ACTIVITIES TO BASSETT'S CREEK PARK IS BEING CONSIDERED DURING THE PUBLIC COMMENT PERIOD.*

PROCESSES

	1: General Input **Spring-Fall 2017** *Input themes prior to initial concepts*	**2: Initial Concepts** **Winter 2018** *Input themes on initial concepts*	**3: The Preferred Concept** **Now** *Key elements of the concept*
landscape	Desire for more varied natural environment, including groves, forests, wetlands,a nd grasslands, to enhance character of park	Water feature generally supported, along with other naturalized areas and tree plantings	New stormwater wetland and ponds incorporated into design as natural habitat and to help keep fields dry Existing forested area near Morgan retained, new trees planted throughout park
		Maintain large open green area for unprogrammed play (neighborhood-focused)	New large open oval near neighborhood, and associated picnic lawn with shelters
other	Interest in winter use indoor facility, like a conservatory: something unique for this park	General support for a conservatory-like building, once understood by the community Concern about placement of conservatory building in viewshed of neighbors	New glassy conservatory-like building to serve as indoor play area, seating/gathering area among tropical gardens, and warming/storage area for winter and summer sports
	Desire for more walking trail loops throughout park	Like walking path around outside of diamonds	Extensive walking loops throughout park
	Significant concern about parking, traffic, and after-hours adult use of park	Opposition to additional parking at western end of park Remaining concern about parking access from Morgan/Laurel, including suggestions to move entrance to Van White or diectly off Cedar Lake Road	*TWO ACCESS AND PARKING OPTIONS ARE BEING CONSIDERED DURING THE PUBLIC COMMENT PERIOD* : 1) Parking moved farther into interior of park and shielded from neighbors by building and natural areas; entrance retained off Morgan/Laurel. 2) Parking located at the northerly edge of the park, with acess from Cedar Lake Road on a driveway parallel to Morgan.
		Support for the bike park and mountain bike trails	New mountain bike trails and training area along northern edge of park and in eastern woods

COST ESTIMATE

Park Name	Asset Type	Project	2019 ESTIMATED COST/PROJECT	NOTES
Bryn Mawr	**Play**	**Nature Play area with some water (mini splash pad)**	**$ 806,809**	
Bryn Mawr	**Play**	**Traditional Play Structure in new container** (possibly indoor, if building implemented)	**$ 806,809**	
Bryn Mawr	**Athletics**	**Athletic Field renovation:** 6 premier diamonds (at least 4 lit) with fields in outfield, additional multi-use field space for cricket	**$ 5,278,694**	
Bryn Mawr	**Courts**	**Basketball Court (1)** (possibly indoor if building implemented)	**$ 123,394**	
Bryn Mawr	**Landscape**	**Naturalized areas**	**$ 249,636**	
Bryn Mawr	**Landscape**	**Stormwater management water feature**	**$ -**	To be implemented by Bassett's Creek Watershed
Bryn Mawr	**Landscape**	**New parking lot**	**$ 923,183**	
Bryn Mawr	**Landscape**	**Open Lawn with lit skating and broom ball in winter**	**$ 631,209**	
Bryn Mawr	**Other**	**Adult Fitness Stations**	**$ 47,459**	
Bryn Mawr	**Other**	**Conservatory-like Building**	**$ -**	Final building design and size not determined under NSAMP; will require collaboration for implementation
Bryn Mawr	**Other**	**Group picnic shelters**	**$ 208,821**	
Bryn Mawr	**Other**	**New walking paths**	**$ 2,095,805**	
Bryn Mawr	**Other**	**Bicycle Training Track (2)**	**$ 949,187**	
Bryn Mawr	**Other**	**Miscl. signs, trees, furniture**	**$ 223,436**	
Bryn Mawr		**TOTAL**	**$ 12,344,444**	

OPERATIONS ESTIMATE

BRYN MAWR			
FACILITIES	**Total Per Unit Operations Cost**	△ Qty	△ Cost
Wading Pool	$ 15,000	-1	$ (15,000)
Splash Pad	$ 35,000	1	$ 35,000
Nature Play	$ 7,500	1	$ 7,500
Adult Fitness	$ 2,500	1	$ 2,500
Multi-use Diamond	$ 20,000	-7	$ (140,000)
Tennis Court	$ 1,500	-2	$ (3,000)
Half Court Basketball	$ 1,000	-1	$ (1,000)
Skating Rink	$ 30,000	1	$ 30,000
Bicycle Facilitiy/Training Track	$ 5,000	2	$ 10,000
Group Shelter	$ 4,000	2	$ 8,000
Difference			**$ (66,000)**

Appendix B

Site Topographic Survey

0 100 200
SCALE IN FEET

SURVEY LEGEND

SURVEY MONUMENT
FOUND IRON PIPE
△ GPS CONTROL POINT
⊕ VERTICAL BENCHMARK
□ CONTROL HUB \ LATH

○ POWER POLE
LIGHT POLE
HYDRANT
⋈ GATE VALVE
¤ SIGN POST
DECIDUOUS TREE
✱ CONIFEROUS TREE
○ SANITARY MANHOLE
◎ STORM SEWER MANHOLE
□ FIBER OPTIC BOX
☒ ELECTRICAL BOX
⊞ COMMUNICATIONS BOX

⊕ MONITORING WELL
○ SOIL BORING
⊕ STAFF GAGE
⊕ PIZOMETER

PROPERTY LINE
X X FENCE LINE
BACK OF CURB LINE
FLOW LINE
CENTER LINE

GAS GAS GAS LINE
OE OE OVERHEAD ELECTRIC
UE UE UNDERGROUND ELECTRIC
UT UT UNDERGROUND TELEPHONE
CATV CATV UNDERGROUND TV
FO FO FIBER OPTIC LINE
SAN SAN SANITARY SEWER LINE
SS SS STORM SEWER LINE
CW CW CITY WATER
PW PW IRRIGATION SYSTEM

BATHYMETRIC POINTS
800 MAJOR CONTOUR
801 MINOR CONTOUR
WATER'S EDGE
GRID LINES

BASIS OF DRAWING FILE:

DATE OF SURVEY: **09-2017**

ORIGIN/DATE OF BASE: **09-2017**

COORDINATE SYSTEM: **HENNEPIN COUNTY**

HORIZONTAL DATUM: **NAD83(2011) REF. VRS**

VERTICAL DATUM: **NAVD88 REF. VRS**

ADDITIONAL FILE INFORMATION:

CADD USER: Josh Phillips FILE: M:\DESIGN\23270051.41\DRAFT_MEMO_APPENDIX_B.DWG PLOT SCALE: 1:2 PLOT DATE: 10/10/2018 5:17 PM
jhs M:\Design\Survey\2327005141\2327005141_BASE_SUR_SURVEY_2017_Bryn Mawr Meadows.dwg Plot at 100 02/26/2018 13:35:10

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

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.

PRINTED NAME ____________
SIGNATURE ____________
DATE ________ LICENSE #________

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DATE RELEASED							

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Scale	AS SHOWN
Date	
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Designed	
Approved	

BASSETT CREEK WATERSHED
MINNEAPOLIS, MINNESOTA

BRYN MAWR MEADOWS
MINNEAPOLIS, MINNESOTA

UTILITY SURVEY
09-2017

BARR PROJECT No.
23/27-0051.41
CLIENT PROJECT No.

DWG. No.
REV. No.

Appendix C

Preliminary Geotechnical Report

Preliminary Geotechnical Engineering Report Bryn Mawr Meadows Water Quality Improvement Project

Minneapolis, Minnesota

Prepared for
Bassett Creek Watershed Management Commission

May 2018

Preliminary Geotechnical Engineering Report
Bryn Mawr Meadows Water Quality Improvement Project

Minneapolis, Minnesota

Prepared for
Bassett Creek Watershed Management Commission

May 2018

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952.832.2600

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Certifications

I hereby certify that this 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.

DRAFT FOR REVIEW

Robert H. Osburn, PE
Minnesota License No. #: 46194

May 09, 2018

Date

1.0 Introduction

Barr Engineering Company, under authorization and contract with Bassett Creek Watershed Management Commission (BCWMC), is completing a feasibility study for the Bryn Mawr Meadows Water Quality Improvement Project, which includes wetland delineations, geotechnical borings, topographic survey, tree survey, cultural resources and endangered species reviews. This report describes the preliminary geotechnical investigation and testing performed, presents the results of this work, and provides information about site conditions and preliminary geotechnical analyses for design and constructability.

The Bryn Mawr Meadows Water Quality Improvement Project is a proposed BCWMC capital improvement project that incorporates stormwater best management practices (BMP) in the Bryn Mawr park area. The proposed project will treat stormwater runoff from surrounding residential areas that currently flows untreated into Bassett Creek. The improvement project will reconfigure the park area and likely include new parking areas, pavilions, picnic shelters, and and possibly a warming house for a skating area.

1.1 Site Location

Bryn Mawr Meadows Park is located at 601 Morgan Avenue South in the city of Minneapolis, Minnesota. The water quality improvement project area includes the Bryn Mawr Meadows Park, residential areas to the west, with connection to Bassett Creek to the north through the City of Minneapolis vehicle impound lot. The impound lot is the site of the former Irving Avenue Dump, a closed Minnesota state superfund site, where dump debris and contaminated soil remains. Based on review of the Hennepin County Environmental Data Access Tool, environmental contamination associated with the Bryn Mawr Park property has not been identified, but the site was filled in during the early 1900’s and the content and source of the fill is unknown.

The topography of Bryn Mawr Park slopes down from towards Basset Creek from an elevation of approximately 820 to 810 feet.

1.2 Site Geology

A review of regional geology and geotechnical borings indicates the site conditions generally consist of approximately 6 to 14 feet of fill materials immediately below the topsoil. The fill predominantly consists of sand and clay with various amounts of gravel and organic material.

The underlying native soils consist of organic and lacustrine fat clays underlain by glacial till (Meyer and Hobbs, 1989). The lacustrine deposits consist of fine-grained sediment with organic-rich layers and in places overlain by muck or peat.

Glacial till soils were encountered below the lacustrine deposits and extended to the termination depth of the geotechnical borings. The glacial till soils generally consisted of lean clay with sand and sandy lean clay with varying amounts of sand and gravel. Layers of glacial outwash consisting of sand with varying fines content were also encountered in all of the geotechnical borings within the glacial till.

The upper bedrock unit of the site is generally considered Middle Ordovician age sandstone of the St. Peter Sandstone formation (Hennepin County, 1989). The bedrock surface, which was not encountered during drilling operations, is estimated to be 200 to 250 feet below existing grade and generally dips from southeast to northwest across the project Site.

The Quaternary hydrogeology map (Hennepin County, 1989) for Hennepin County's water-table system indicates that the project site is located near the edge of the surficial/bedrock aquifer contact. This contact represents the approximate surface outline for the elevation where groundwater in the soils intersect with bedrock groundwater. The groundwater contour lines show gradually decreasing total head with an eastward flow gradient towards the Mississippi River. During this investigation, groundwater was generally encountered at depths of approximately 3 to 6 feet below existing grade. Localized shallow groundwater flow is likely influenced by Bassett Creek, located north of the park. Based on the available information to date, groundwater is anticipated to be a factor in the design and construction of any stormwater infrastructure.

1.3 Previous Investigation

No previous geotechnical engineering reports associated with the Bryn Mawr park area were known or provided at the time of this report.

2.0 Geotechnical Exploration Methods

The preliminary geotechnical investigation consisted of geotechnical borings, standard penetration tests (SPT) and split spoon sampling, undisturbed soil sampling, and laboratory testing. Figure 1 shows the plan location of all geotechnical borings completed for the project and Table 1 summarizes the associated GPS coordinates and elevations. The primary site investigation and laboratory testing was conducted in March and April of 2018, respectively.

The boring locations were staked and identified in the field by Barr staff with the use of a handheld GPS unit with the accuracy of approximately 15 to 20 feet.

2.1 Field Work

2.1.1 Geotechnical Borings

A total of four geotechnical borings were completed as part of this preliminary geotechnical investigation (Figure 1). Each boring was completed along the proposed stormwater infrastructure or within the footprint of other proposed infrastructure for the project area. Geotechnical boring SB1 was extended to a depth of approximately 75 feet below existing grade, while the remaining three borings (SB2, SB3, and SB4) were extended to a depth of approximately 100 feet.

Under subcontract to Barr, the geotechnical borings were completed by STS Enterprises, LLC (STS) of Maple Plain, Minnesota. A buggy-tired drill rig was used to conduct the geotechnical borings using hollow stem auger and mud rotary drilling techniques. Standard penetration tests (SPTs) were performed as the geotechnical borings were advanced in accordance with ASTM D1586. Standard penetration tests were completed at 2.5 foot intervals to a depth of 15 feet below existing grade, and then at 5 foot intervals to the termination depths of the borings. Penetration resistances measured in blows-per-foot (bpf), otherwise known as the SPT N value, provide an empirical means of estimating the soil relative density, consistency, and strength. Three-inch diameter thinwall samples were collected at selected locations in accordance with ASTM D1587.

During drilling, Barr field staff screened fill soils for signs of environmental impacts, including odors, discoloration, sheen, and headspace organic vapors using a photoionization detector (PID) equipped with a 10.6 eV lamp. Field screening indicated that PID readings were less than 10 ppm and in the range of background readings. No sheen, odors or discoloration indicative of petroleum or chemical impacts were observed. PID readings from the preliminary investigation are provided in Table 2.

All samples were sealed in the field in order to preserve the in-situ moisture content. Samples were delivered to Soil Engineering Testing Inc. (SET) in Bloomington, Minnesota for laboratory testing. Copies of the geotechnical boring logs are included as Appendix A to this report.

2.2 Laboratory Testing

A program of general laboratory testing was performed by SET to aid in characterizing the soil properties. The results of the laboratory tests can be found in Appendix B.

- Moisture content tests were performed in accordance with ASTM D2216, “Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass”

- Dry unit weight tests were performed in accordance with ASTM D7263, “Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens”

- Atterberg Limit tests in accordance with ASTM D4318, “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils”

- Sieve analysis in accordance with ASTM D422, “Standard Test Method for Particle-Size Analysis of Soils”

- Consolidation tests in accordance with ASTM D2435, “Standard Test Methods for One Dimensional Consolidation of Soil Using Incremental Loading”

- Unconsolidated-undrained triaxial compressive strength tests in accordance with ASTM D2850, “Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils”

- Soil pH tests in accordance with ASTM D4972 “Standard Test Method for pH of Soils”

- Determination of chloride and sulfate content of soils in accordance with EPA Method 9056A “Determination of Inorganic Anions by Ion Chromatography”

3.0 Results

Section 2 describes the field and laboratory investigation procedures. Section 3 presents the data from testing and investigation and provides further analysis of these results.

3.1 Soil Stratigraphy

The results of the geotechnical borings (Appendix A) and laboratory tests (Appendix B) were compiled to obtain an understanding of the stratigraphy of the study area.

The existing conditions, as determined from field data, consist of fill materials overlying organic and lacustrine clays, and underlain by glacial till soils. Bedrock was not encountered during the preliminary geotechnical investigation.

Topsoil was encountered in four borings with thicknesses ranging from 1 to 2 feet. The topsoil encountered was classified as lean clay with varying amounts of organics in accordance with the Unified Soil Classification System (USCS).

3.1.1 Fill or Possible Fill

A portion of the project area is covered by an asphalt pavement parking area (near soil boring SB3) and bituminous trails. The remaining project area is pervious grass fields. Fill was encountered in all four soil borings completed during this investigation. The fill was generally observed from immediately below the pavement or topsoil to depths ranging from 6 to 14 feet below existing grade. The greatest depths of fill were noted within and around the existing parking area. The SPT *N* values ranged between 1 and 12 bpf within the fill soils. The SPT *N* values are not considered a reliable measure of fill relative density and consistency, due to the potential variability in which the material may have been placed.

The fill as observed in the borings consists of poorly graded sand with silt, clayey sand, and lean clay with various amounts of gravel and organic inclusions. Debris was not encountered in the preliminary borings. Laboratory testing was not completed on the fill soils.

3.1.2 Lacustrine Soil

3.1.2.1 Organic Clays

Organic clay soils were encountered below the fill materials in borings SB2 and SB3. The thickness of the organic clay soils ranged from approximately 7 to 14 feet (where encountered).

The SPT *N* value results ranged from weight of hammer to 2 bpf. These results indicate that the organic clays typically have a very soft consistency. Pocket penetrometer values were typically less than 0.25 tsf. The organic clay soils had moisture contents ranging from 85 to 147 percent.

3.1.2.2 Fat Clays

Fat clays soils (lacustrine soils) were encountered below the organic clays or fill soils and extended to depths of 28 to 53 feet below existing grade based on the soil borings. The thickness generally increased from south to north across the project site.

The SPT *N* value results ranged from less than 1 to 2 bpf. These results indicate that the fat clays typically have a very soft consistency. Pocket penetrometer values were typically less than 0.25 tsf.

A total of 10 moisture content tests were run on soil samples collected from the borings. The soil had moisture contents ranging from 51 to 90 percent with an average of 79 percent, indicating the soils are generally in a wet condition. Two Atterberg limits tests were conducted on selected samples from the borings. Results indicate the fat clays have liquid limits ranging from 117 to 121 percent and plastic limits ranging from 27 to 30 percent. These results correspond to plasticity indices varying between 90 and 91 percent, classifying the soils as fat clay (CH) in accordance with the Unified Soil Classification System (USCS). Three dry unit weight tests were conducted and results ranged from 49 to 57 pcf. Two laboratory UU triaxial compressive strength test results on a Shelby tube samples collected from various depths indicated undrained shear strengths of 280 and 390 psf.

3.1.3 Glacial Till

Glacial till soils were encountered below the lacustrine fat clays. The glacial till was largely comprised of poorly graded sand with silt (SP-SM; likely associated with glacial outwash layers within the till), clayey sand (SC), and sandy lean clay to lean clay (CL), though fat clay (CH) was also present on a limited basis.

The SPT *N* values in the glacial till ranged between 5 to over 50 bpf, indicating loose to dense relative density and medium stiff to hard consistency. Pocket penetrometer values ranged from less than 0.25 to 3 tsf.

A total of 10 moisture content tests were run on samples of the glacial till collected from the borings. The till had moisture contents ranging from 15 to 36 percent, with an average of 25 percent, indicating the soils are generally in a moist to wet condition. Two Atterberg limits tests were conducted on selected samples from the borings. Results indicate the glacial till soils have liquid limits ranging from 49 to 55 percent and plastic limits ranging from 19 to 33 percent. These results correspond to plasticity indices varying between 16 and 36 percent, classifying the soils as lean clay (CL) and fat clay (CH) in accordance with the Unified Soil Classification System (USCS). Grain size analyses was performed on one sample collected in boring SB2. The percent fines (percent by weight passing the number 200 sieve) was approximately 13 percent in the sample tested. Two dry unit weight tests were conducted on samples of glacial till and results ranged from 85 to 86 pcf. Two laboratory UU triaxial compressive strength test results on a Shelby tube samples collected from various depths indicated undrained shear strengths of 1,160 and 1,220 psf.

3.2 Groundwater Conditions

Groundwater was observed in each of the four borings completed as part of this preliminary geotechnical investigation at depths between 3 and 6 feet below existing grade. The shallowest groundwater encountered at soil boring (SB4) was at a depth of 3 feet. Groundwater levels encountered during the field investigation are summarized in Table 3.

Many factors contribute to water level fluctuations, such as heavy rainfall events, dry periods, etc., and the measurements noted during this investigation may not represent the long term groundwater levels present at the site. It is the responsibility of the designer to prepare a foundation design that takes into account the groundwater level.

3.3 Chemical Testing

Chemical tests, consisting of soil pH, soluble chlorides, and soluble sulfates, were performed on two soil samples. Soil samples were composites of soil collected between 5 and 10 feet below existing grade to represent the characteristics of the potential backfill material along proposed stormwater infrastructure. The results of the chemical tests indicate that the materials have a pH level ranging from 6.8 to 7.3. The soils contain from 49 to 66 mg/kg soluble chloride (dry weight) and less than 50 to 55 mg/kg soluble sulfate (dry weight). Chemical test results are included in Appendix B and summarized in Table 4.

3.4 Shear Strength

3.4.1 Undrained Shear Strength

The undrained shear strength of the cohesive soils was estimated from SPT results, field pocket penetrometers, and laboratory unconsolidated-undrained (UU) triaxial compressive strength tests.

A number of pocket penetrometer tests were conducted on split-spoon samples collected during drilling with the results shown on the boring logs (Appendix A). Pocket penetrometer values in the lacustrine clays ranged from less than 0.25 to 0.5 tsf. In glacial till soils, pocket penetrometer measurements ranged from less than 0.25 to 3 tsf.

The UU triaxial compressive strength test results on four samples collected from soil boring locations indicate undrained shear strengths range from 280 to 390 and 1,160 to 1,220 psf for lacustrine clay and glacial till soils, respectively. Laboratory strength test results are summarized in Table 5 and provided in Appendix B.

3.4.2 Drained Shear Strength

Granular soils were encountered in each soil boring. The shear strength of these soils was estimated through correlations from SPT results (NAVFAC, 1982) collected at 2½- and 5-foot intervals during sampling in the boreholes. The lowest average SPT value obtained for a cohesionless soil (excluding fill) was SPT = 15 at soil boring SB2. An average SPT value of 15 in clayey sand correlates to a friction angle of approximately 32 degrees (Das, 2007).

The drained shear strength of the cohesive soils was estimated from a relationship of plasticity index to friction angle for normally consolidated, saturated clays (Coduto, et al., 2011). The lacustrine fat clays had a maximum plasticity index of 91 correlating to a minimum friction angle of 21 degrees. The drained shear strength of the clayey glacial till soils was not directly measured. However, it is estimated at 26 degrees based on correlations to the plasticity index (maximum value of 36) from Terzaghi et al. (1996). In all cases, the drained shear strength of cohesive soil was based on the maximum plasticity index for each layer resulting in a lower bound friction angle.

3.5 Consolidation Testing

Compressibility characteristics of soil at the site were evaluated during the preliminary geotechnical investigation through consolidation testing on two samples of lacustrine clay collected from the soil borings. The tests were performed according to ASTM D2435 using the incremental loading test procedure. The void ratio versus effective stress relationship results are included in Appendix B.

Table 6 summarizes the consolidation test results in terms of the preconsolidation pressure, compression index C_c, recompression index C_r, and initial void ratio e_o. The test results indicated that the samples had preconsolidation pressures ranging from 0.5 to 0.67 tons per square foot (tsf), corresponding to overconsolidation ratios (OCRs) ranging from approximately 1 to 1.2 (normally consolidated to slightly overconsolidated). The initial void ratio of the samples ranged from 2.547 to 2.892. The calculated compression index ranged from 0.98 to 1.20, while the recompression index ranged from 0.27 to 0.36.

4.0 Evaluation and Analysis

Results of the field and laboratory investigation have been presented in Section 3. Based on these results, Section 4 provides analysis, conclusions and recommendations for the design and construction of potential building foundations, stormwater infrastructure, as well as general construction considerations.

4.1 Final Grades

Proposed final grades were not available at the time of this report, however it is anticipated that only minor grade changes would occur across the park area.

4.2 Building Support

Building details for the picnic shelters, warming house, and pavilions, including size, location, structural loading, and configuration, were not provided at the time of this report.

4.2.1 Subgrades

Pending further investigation and later phases of design, the above grade structures will likely need to be supported on deep foundations with a structural slab. Limited, if any, subgrade improvement will be necessary for pile caps and structural slabs.

If grade-support is determined to be feasible, foundations and floor slabs should not be supported on topsoil, existing fill material, and any loose or soft native soils. All elements of existing structures (including foundations) or pavements within the proposed building footprints should be removed. Following removal of the unsuitable material and existing foundation elements (if any), it may be necessary to replace these soils/voids with compacted engineered fill material to attain final bottom-of-footing and bottom-of-slab grades. Any loose sands at the excavation bases should be surface compacted prior to footing construction or placement of compacted engineered fill.

4.2.2 Foundation Types

The results of this preliminary geotechnical evaluation indicate the presence of 6 to 14 feet of fill materials, some of which contains gravel and organics. Underlying the fill materials are very soft organic and lacustrine clays, followed by glacial till at estimated depths of approximately 30 to 60 feet below existing grade.

Based on the soils encountered in the borings and the results of the laboratory testing, it is recommended the proposed structures be supported on a deep foundation system with a structural slab. Shallow foundations or floor slabs could be considered, but will likely be subject to significant amounts of settlement over the life of the facility and this is generally undesirable.

Ultimately, the specific building details (size, location, structural loading and configuration) will dictate the type of foundations selected for final design. Once final design details are available, a final geotechnical investigation should be completed.

4.3 Stormwater Infrastructure

The stormwater sewers are anticipated to consist of PVC or HDPE pipe with diameters up to 48 inches. Manholes are anticipated to consist of concrete structures with an inner diameter of 6 feet or less. No additional details were provided regarding the stormwater infrastructure.

The results of the preliminary geotechnical investigation indicate that consideration could be given to supporting the stormwater infrastructure on existing or engineered fill and be designed to accommodate significant settlement. Further investigation, testing, and analysis, should be performed to design a system that is within the risk tolerance of the owner. Alternatively, the stormwater infrastructure could be supported on a deep foundation system which would significantly reduce the long-term settlement and likelihood for maintenance over time.

4.4 Parking Lot

The improvement project will likely include new parking areas. Traffic in the parking area is anticipated to consist of both passenger vehicles (standard-duty pavement) and occasional tractor trailers. A traffic frequency for the facility has not been provided. A medium duty pavement section has been assumed for preliminary purposes in this report.

4.5 Reuse of On Site Material

The existing clayey sand fill soils may be suitable for reuse as engineered fill, provided they are debris-free and free of organic material. Based on the color of fill encountered in the soil borings, organic material may be present at some locations in the fill, especially near the ground surface. Topsoil and existing fill that contain debris or organic material should not be reused as engineered fill.

4.6 Preliminary Design Parameters

The existing conditions, as determined from field data, consist of fill materials overlying organic and lacustrine clays, and underlain by glacial till soils. Subsurface profiles were developed for the purpose of preliminary geotechnical analysis to support preliminary design. The generalized soil profiles are provided in Table 7. Division of the layers was estimated based on visual classification by a geotechnical engineer, trends in SPT N-values, undrained shear strength from field tests, and laboratory test results.

A design value for the undrained shear strength of each clay layer was derived from the approximate lower bound of strength data from unconsolidated-undrained laboratory testing as well as field hand penetrometer tests within the corresponding layer. The drained shear strength for the sand layers were estimated from correlations with SPT results, relative density, and soil classification (NAVFAC, 1982). The drained shear strength of the cohesive and cohesionless soils were estimated from index property correlations as further described in Section 3.4.2. Moist unit weights for foundation and settlement analyses correspond to the average moist unit weight from laboratory testing.

For settlement analyses, the upper bound of consolidation coefficients and corresponding void ratio and preconsolidation pressures were matched to the clay layers of the generalized soil profile. For immediate settlement, the undrained modulus of elasticity was estimated from the overconsolidation ratio (OCR) and index properties of the clayey soils (Fang, 2007). The drained modulus of elasticity was estimated from correlations with SPT results (Fang, 2007).

Recommended soil parameters for use in preliminary design of foundations to support the building and stormwater infrastructure, including density and strength, are included in Table 7. Of the recommended design parameters, the majority follow directly from the stratigraphy, groundwater conditions, and laboratory test results presented in Section 3.0, while those for use in pile design follow from published references as listed in Table 7.

5.0 Preliminary Geotechnical Recommendations

Section 5.0 provides preliminary general recommendations for foundation construction. These recommendations should be updated as the proposed plans are finalized and additional geotechnical investigations are performed.

5.1 Subgrade Preparation

5.1.1 Excavations

Based on the results of the test borings completed as part of this preliminary geotechnical investigation, the excavation depths required to reach competent native soils suitable for support of the proposed construction range from 5.5 to 14 feet below existing grade. The anticipated excavation depths included in this report are based on the results of the preliminary soil borings completed across the project site and actual excavation depths will vary from the values presented in this report. Further, some of the material encountered in the borings was identified as possible fill and should be further evaluated prior to construction. Even if deemed to be native soil during excavations, the fill and possible fill material was generally in a loose state and is not suitable for direct foundation support. A geotechnical engineer should be present during excavation to observe and document that all excavations are extended to sufficient depths to remove all unsuitable material.

Estimated excavation depths should be considered the minimum necessary to provide a stable platform on which to spread and compact replacement backfill. Depending on construction conditions, excavations may have to be extended locally to remove wet, loose, soft, or otherwise unstable soils that become disturbed during the excavation process and lose strength.

5.1.2 Groundwater and Dewatering Considerations

The subsurface investigation indicates that shallow groundwater exists across the site (Section 3.2). Depending on the depth of excavations, the effects of groundwater may need to be incorporated into the design and construction of foundations and utilities. Temporary groundwater management could consist of a standard sump and pit for excavations less than 3 feet below existing grade. More aggressive dewatering systems consisting of well points, or similar, may be required if excavations deeper are necessary. Excavations that extend into one or more sand or silt layers below the groundwater table will likely require more aggressive dewatering.

The groundwater levels generally vary from 3 to 6 feet below existing grade. Based on the information collected as part of this preliminary geotechnical investigation, it is recommended that the foundation design and stormwater infrastructure account for the presence of groundwater at a depth of approximately 3 feet below existing grade. It is important to note that existing grade may not correlate to final grade.

5.2 Recommendations for Building Construction

Based on the soils encountered in the borings and the results of the laboratory testing, it is recommended that the proposed structures be supported on a deep foundation system with a structural slab. Depending on timing, building loads, final grades, and other factors, there is a slight possibility that ground improvement could be considered in order to support shallow foundations (see Section 5.2.2), although some risk of significant foundation settlement may still exist with this approach.

5.2.1 Shallow Foundations

Based on the soil borings, slabs on grade or shallow foundations will likely be subject to significant amounts of settlement over the life of the facility and this is generally undesirable. Due to the fact that loads and specific details regarding these foundation systems are not available at this time, it is recommended that the designers evaluate the feasibility of shallow foundations during final geotechnical design.

5.2.2 Ground Improvement Considerations

5.2.2.1 Surcharge

The long-term settlement can be partially reduced, though not completely eliminated, by surcharging the building area over an extended period of time, then removing the surcharge prior to final grading and construction. The amount of settlement to occur after surcharging the soils beneath the proposed embankment will be dependent on the height and duration of the surcharge. It should be noted that the surcharge duration would likely require multiple years to remove enough long term consolidation to make a shallow foundation system viable.

5.2.2.2 Lightweight Fill

The building footprint could be excavated and subgrade soils could be replaced with lightweight fill, such as tire chips or geofoam. The lightweight fill will reduce the increase in stress exerted on the soils at depth developed by the building. The lighter weight of the tire chips or geofoam will lower the increase in stress applied to the highly compressible soils at depth. The shallow groundwater and buoyancy of the lightweight fill would need to be considered if this design approach was implemented.

5.2.2.3 Vertical Wick Drains

When the rate of settlement beneath a surcharge is too low, the installation of vertical wick drains (also known as prefabricated vertical drains or vertical strip drains) can help expedite the consolidation process. Vertical wick drains typically consist of a central plastic core, which functions as a free-draining water channel, surrounded by a thin geotextile filter jacket. Vertical drains introduce a preferential (shorter) drainage path and should penetrate through the highly compressible layer(s). The spacing of wick drains will influence the rate of consolidate, where closely spaced drains will speed up the consolidation process. Depending on the surcharge height and wick drain spacing, this approach can reduce the surcharge duration from years to months.

5.2.3 Deep Foundations

In the absence of structural loads, specific recommendations for axial and lateral pile capacity cannot be provided. Closed end steel pipe piles with a diameter of 12-¾-inch should be feasible for support of new buildings. Piles of this type and size are generally available and are commonly used for the anticipated design capacities.

The final geotechnical investigation should include deeper borings and laboratory testing to further characterize the subgrade soils at depth. The depth of borings will be dependent on final building design (size, structural loading and configuration).

5.2.3.1 Pile Capacity

A pile foundation system will develop capacity through a combination of end bearing and skin friction. Lateral capacity is also taken into consideration in the design.

Due to limited presence of debris in the fill material (and generally small debris), closed end steel pipe piles with a diameter of 12-¾-inch should be feasible for support of the building. The closed end of the pile should include a thickened steel plate (ideally 3/4-inch or greater) to protect against small debris in the fill and should be no larger in diameter than the outside pile diameter. Piles should be spaced no closer than three times the pile diameter (on center).

APILE 2015 was used to estimate the ultimate pile capacity in compression for the selected pile. APILE 2015 is a software program that can compute the axial capacity as a function of depth for driven piles in clay, sand, or mixed-soil profiles. Using the design parameters recommended in Table 7, the total pile capacity versus depth was calculated and are presented in Figures 4a and 4b. Total pile capacities are provided using the U.S. Federal Highway Administration (FHWA, 1993), U.S. Army Corps of Engineers (USACE, 1993), and American Petroleum Institute (API, 1993) design methods. If an alternative pile is selected for the project, Barr should be notified so that the analysis can be revised.

Note that the values presented in Figures 4a and 4b are ultimate capacities and an appropriate factor of safety must be applied for design purposes. In the absence of load testing, a factor of safety of 3 is recommended, however this may be reduced with specialty testing (PDA/CAPWAP or static load tests). It is recommended that a limited scope of pile load testing (e.g., two to three piles) should be performed during construction to verify capacity. The pile installation contractor should be prepared to demonstrate that their proposed hammer will provide sufficient energy to drive the piles without causing inadvertent damage during installation.

5.2.3.2 Downdrag

Settlement of the ground in a downward direction relative to the pile will create a force that acts as an additional downward load on the pile (i.e., downdrag). Because the organic and fat clay layers are thick in some portions of the site and subject to settlement over the full depth, the magnitude of the downdrag force can be substantial.

The downdrag force is a function of design pile load and length which are unavailable at the time of this report. When the individual pile loads and lengths become finalized, the downdrag analysis should be completed.

5.2.3.3 Resistance to Uplift

Design of piles for uplift should be based on a combination of the skin friction and the weight of the pile. As is standard, skin friction should not be assumed to contribute to uplift resistance throughout the frost zone and the weight of the pile should be taken as the buoyant weight at depths below the water table. It is recommended that the skin friction contributing to uplift resistance should be taken as 75 percent of the skin friction used in compression (FHWA, 1999) applied to account for the potential loss of lateral earth pressure in uplift

5.2.3.4 Settlement

Due to the fact that individual pile loads are not available, it is recommended that settlement of the soils under foundation loading be evaluated during final design. Elastic settlement will be governed by the section properties of the piles, which should be sized accordingly to accommodate the anticipated structural loading. Long-term pile settlement is a function of pile load and can be estimated using the computer software program APILE 2015 during final design.

The calculated pile top deflection should consider both dead and downdrag loading (Section 5.2.1.3).

5.2.3.5 Exterior Slabs

It is anticipated that exterior slabs will not be structurally supported. This practice will lead to long-term settlement of the slabs, though it is much less costly than pile support. The total settlement of exterior slabs exerting an applied bearing pressure of 150 psf is estimated to range from 3 to 6 inches over the first 20 years. Additional settlement will occur beyond the initial 20 years of facility operation. Other options, such as the use of lightweight fill beneath slabs could be considered to limit long term settlement, but the applicability of this method will be limited by the presence of shallow groundwater.

Exterior slabs founded on soil should be supported by engineered fill with the further caveat that the material should not be prone to frost heave as discussed below. Poorly graded sand with silt is typically considered moderately frost susceptible. The silty sand is considered highly frost susceptible. Saturation and freezing of these soils could potentially cause unfavorable heaving of the slabs to occur. There are several options to reduce the risk of frost heave beneath exterior slabs.

The risk of frost heave can be reduced by placing a minimum of 2 ½ inches of extruded polystyrene foam insulation beneath the slabs and extending the insulation approximately 5 feet beyond the slabs as per the insulation manufacturer’s recommendations. A leveling course consisting of 12 inches of clean sand with less than 5 percent fines content is generally required to seat the insulation panels. Granular fill with a minimum thickness of 12 inches is recommended to be placed over the panels to protect them during and after construction. The practice of using insulation may have long-term implications if the insulation shears due to long-term settlement of the slab.

Another method of reducing frost heave is to remove the frost-susceptible soils to below the frost depth and replace with non-frost-susceptible material. Sands with less than 5 percent passing the number 200 sieve are considered non frost-susceptible. This approach would include significant landfill disposal cost as it is assumed that all excavated fill materials would need to be transported off-site to a landfill due to the presence of environmental contaminants and the limitations to keep this soil on-site under the project grading constraints. With this method, a drain system may be required in clayey subgrades to prevent pooling water within the sand from below the foundation, though this scenario is not anticipated in the fill soils based on the borings completed for the project site.

5.3 Stormwater Infrastructure

The results of the preliminary geotechnical investigation indicate that the stormwater infrastructure may be placed on a deep foundation system or designed to accommodate settlement as further discussed in Section 5.3.2.

5.3.1 Excavation and Backfill

It is recommended that utility trench backfill placed below the parking lot or greenspaces be compacted to a minimum of 100 percent of the standard Proctor maximum dry density in the upper 3 feet and to minimum of 95 percent of the standard Proctor maximum dry density below the upper 3 feet.

For utility trenches, it is recommended that granular bedding should be placed 4 to 6 inches below pipes (depending on pipe diameter) and conform to the requirements of Mn/DOT Standard Specification 3149.2 F (Mn/DOT, 2017). Note this specification only allows 10 percent fines, which likely requires this material to be imported to the project site.

5.3.2 Foundations

Due to the inherent variable nature of the existing fill materials and subgrade variation along the stormwater alignment, there is some risk of undesirable performance of utilities over the life of the facility. Grade raises are not currently anticipated along the stormwater infrastructure and therefore settlement will be limited to secondary consolidation. Secondary consolidation is defined as volume change that occurs under constant effective stress after all excess pore-water pressure is dissipated. Secondary consolidation typically represents 10 to 20 percent of the overall settlement and significant creep may be associated with organic soils. Preliminary estimates of secondary consolidation are estimated to range from 2 to 4 inches over the first 20 years.

It is recommended that the civil engineer either design the system using steeper slopes and flexible piping to accommodate the settlement or support the system on deep foundations to limit total and differential settlement. The owner should understand and be accepting of this risk prior to final design and construction of the project.

Alternatively, the underground utilities may be placed on a deep foundation system. The pile capacity can be calculated using the methods outlined in Section 5.2.2.1 and the design parameters provided in Table 7. The total pile capacities versus depth were calculated for a pipe pile with a diameter of 12-¾ inches and results are presented in Figures 4a and 4b. Considerations for settlement, downdrag, and construction are provided in Section 5.2.2. If deep foundations proposed, the civil engineer should further evaluate the use of PVC or HDPE conduit in the context of potential downdrag forces that may develop from settlement in between in the pile supports. It is likely that more rigid pipe will be necessary to tolerate the stresses that develop in between pile supports.

5.4 Pavements

It is recommended that all topsoil and existing fill be removed from proposed pavement areas. The resulting exposed subgrade should be scarified and moisture conditioned to within 2 percent of optimum moisture and re-compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

If deeper deposits (in excess of 3 feet deep) of existing granular fill are encountered, it may be possible for these soils to remain in place provided the risk of potential settlement, cracking, and distress of the overlying pavement is acceptable to the BCWMC.

5.4.1 Fill

Where fill is required to raise grade in pavement areas, it is recommended to consist of a granular mineral soil with no more than 30 percent passing the number 200 sieve. To reduce the amount of potential frost heave, the fill beneath the aggregate base and within 3 feet of the pavement surface should consist of a sand subbase with no more than 5 percent passing the number 200 sieve. The excavation should be oversized a minimum of 1 foot beyond the perimeter of pavement areas for each foot of fill required to reach final subgrade elevation. A final geotechnical investigation should be performed to determine specific material and compaction requirements for pavement design and support.

5.4.2 Preliminary Design Sections

For feasibility level discussions, a preliminary pavement design section is provided. This should be further evaluated and final recommendations should be provided in a final geotechnical investigation and report.

For the anticipated subgrade and assumed traffic, the pavement section could consist of 4 inches of bituminous surface over 8 inches of gravel base.

6.0 Report Qualifications

6.1 Variations in Subsurface Conditions

6.1.1 Material Viability

The recommendations provided in this report are based on the results of limited quantity of geotechnical borings and testing. It is not standard engineering practice to retrieve material samples from borings continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the boring locations. Although strata boundaries can be determined with continuous sampling, the boundaries apparent at boring locations likely vary away from each boring.

Variations in subsurface conditions present between borings may not be revealed until additional exploration work is completed or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

6.1.2 Groundwater Variability

Groundwater measurements were made under the conditions reported within the report. It should be noted that the observation periods were short, and groundwater can be expected to fluctuate in response to rainfall, snowmelt, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

6.1.3 Precautions Regarding Changed Conditions

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. As we were given limited information, assumptions may have been made based on our experience with similar projects. If we have not correctly presented or interpreted the project details, we should be notified. New or changed information could render our evaluation, analyses, and recommendations invalid.

6.2 Limitations of Analysis

This report is for the exclusive use of the BCWMC. Without written approval by us, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

No established national standards exist for data retrieval and geotechnical evaluations. Barr Engineering Co. has used the methods and procedures described in this report. In performing its services, Barr Engineering Co. used that degree of care, skill, and generally accepted engineering methods and practices ordinarily exercised under similar circumstances and under similar budget and time restraints by reputable members of its profession currently practicing in the same locality. Reasonable effort was made to characterize the project site based on the site-specific field work, but there is always the possibility that conditions may vary from any of the locations at which testing was performed, and careful attention by qualified personnel should be undertaken during the time of construction to verify soil conditions. No warranty, expressed or implied, is made. The test results and recommendations provided herein are for preliminary design purposes and should not be relied upon for final design. Once final design details are available, a final geotechnical investigation should be completed.

7.0 References

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Tables

Table 1
Preliminary Geotechnical Investigation Summary

Investigation ID	Geographic NAD83		Elevation* [feet]	Geotechnical Boring
	Latitude	Longitude		
SB1	44.97260	-93.30217	814.9	X
SB2	44.97347	-93.30161	813.0	X
SB3	44.97394	-93.30226	812.6	X
SB4	44.97429	-93.30223	810.5	X

*Elevation data from Hennepin County 1 Meter LiDAR (2011).

Table 2
Summary of PID Readings

Investigation ID	Depth [ft]	PID Reading [ppm]
SB1	2-4	0.1
	4.5-6.5	0
	7-9	0.5
SB2	2-4	6.7
	4.5-6.5	9.1
	7-9	2.5
	9.5-11.5	4.3
	12-14	2.2
SB3	2-4	0.1
	4.5-6.5	0.7
	7-9	0.1
	9.5-11.5	0.8
	12-14	1.4
SB4	2-4	0.1
	4-6	0.5

Mean	**1.94**
Standard Deviation	**2.7**
Minimum	**0**
Maximum	**9.1**

Table 3
Summary of Groundwater Levels

Investigation ID	Depth to Groundwater During Drilling [feet]
SB1	5.6
SB2	5.5
SB3	5.5
SB4	3

Table 4
Summary of Chemical Test Results

Investigation ID	Depth [ft]	pH	Soluble Chloride[1]	Soluble Sulfate[1]
			[mg/kg]	[mg/kg]
SB2	4.5-9	6.8	49	ND
SB4	6-10	7.3	66	55

[1] Note that some of the test results were below the detection limit. Detection limit for chlorides = 10 mg/kg, sulfates = 50 mg/kg.

Table 5
Summary of Laboratory Test Results

Investigation ID	Depth [ft]	USCS Classification	Moisture Content [%]	Dry Unit Weight [pcf]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	Percent Passing #200 Sieve [%]	U-U Triaxial Compressive Strength [tsf]
SB1	9.5-11.5	CH	89.2		117	27	90		
	24-26	CH	50.6						
	34-36	CH	31	86.1	55.0	19.0	36.0		1.160
	49-51	CL	16.9						
SB2	19-21	OH	147.0						
	29-31	CH	72.5	56.6					
	34-36	CH	89.3						
	44-46	CH	72.8						
	54-56	SM						12.8	
	84-86	CL	19.3						
SB3	12-14	OH	84.9						
	24-26	CH	86.2	50.0	121	30	91		0.390
	44-46	CH	82.1						
	59-61	CH	27.4						
	64-64.5	CL	25.8						
	69-71	CL	36	84.8					1.220
	74-76	CL	21.7						
	89-91	CL	15.3						
SB4	8-10	CH	79.5						
	14-16	CH	89.8	48.8					0.280
	29-31	CH	75.6						
	49-51	CL	24.6						
	69-71	CL	29.9		49	33	16		
Total Number of Tests			22	5	4	4	4	1	4
Mean			57.6	65.3	85.5	27.3	58.3	12.8	0.763
Standard Deviation			35.0	18.7	38.8	6.0	38.1	--	0.496
Minimum			15.3	48.8	49.0	19.0	16.0	12.8	0.280
Maximum			147.0	86.1	121.0	33.0	91.0	12.8	1.220

Table 6
Summary of Consolidation Test Results

Investigation ID	Depth [feet]	Void Ratio, e_o	Compression Index, C_C	Recompression Index, C_r	Overconsolidation Ratio, OCR
SB3	24-26	2.892	1.20	0.36	1.0
SB4	14-16	2.547	0.98	0.27	1.2

Table 7
Preliminary Geotechnical Design Profile

Structure / Location	Investigation ID	Material	Depth to Top of Layer	Depth to Bottom of Layer	Effective Unit Weight	Undrained Loading Conditions		Drained Loading Conditions		Consolidation Parameters			
						Friction Angle[1]	Cohesion	Friction Angle[2]	Cohesion	Void Ratio, e_o	Overconsolidation Ratio, OCR	Compression Index, C_C	Recompression Index, C_r
			feet	feet	pcf	degrees	psf	degrees	psf				
Stormwater Utility Corridor	SB01	Fill (SC)	0	5.5	120	25	0	25	0	N/A	N/A	N/A	N/A
		Organic and Fat Clays (OH/CH)	5.5	38	31.6	0	250	21	0	2.467	1	1.2	0.36
		Till	38	50	51.6	0	1100	26	0	0.398	1.8	0.08	0.01
			50	75	51.6	0	2000	26	0	N/A	N/A	N/A	N/A
	SB02 / SB03 / SB04	Fill	0	5	120	25	0	25	0	N/A	N/A	N/A	N/A
			5	10	57.6	25	0	25	0	N/A	N/A	N/A	N/A
		Organic and Fat Clays (OH/CH)	10	60	31.6	0	250	21	0	2.467	1	1.2	0.36
		Till	60	90	51.6	0	1100	26	0	0.398	1.8	0.08	0.01
			90	100	51.6	32	0	32	0	N/A	N/A	N/A	N/A

1. The drained shear strength of cohesionless soils were estimated from NAVFAC Design Manual 7.1.

2. The drained shear strength of the cohesive and cohesionless soils were estimated from Coduto, et al., 2011 and Terzaghi et al., 1996.

Figures

SOIL BORING LOCATIONS
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 1

◆ Geotechnical Boring

▭ Feasibility Study Area

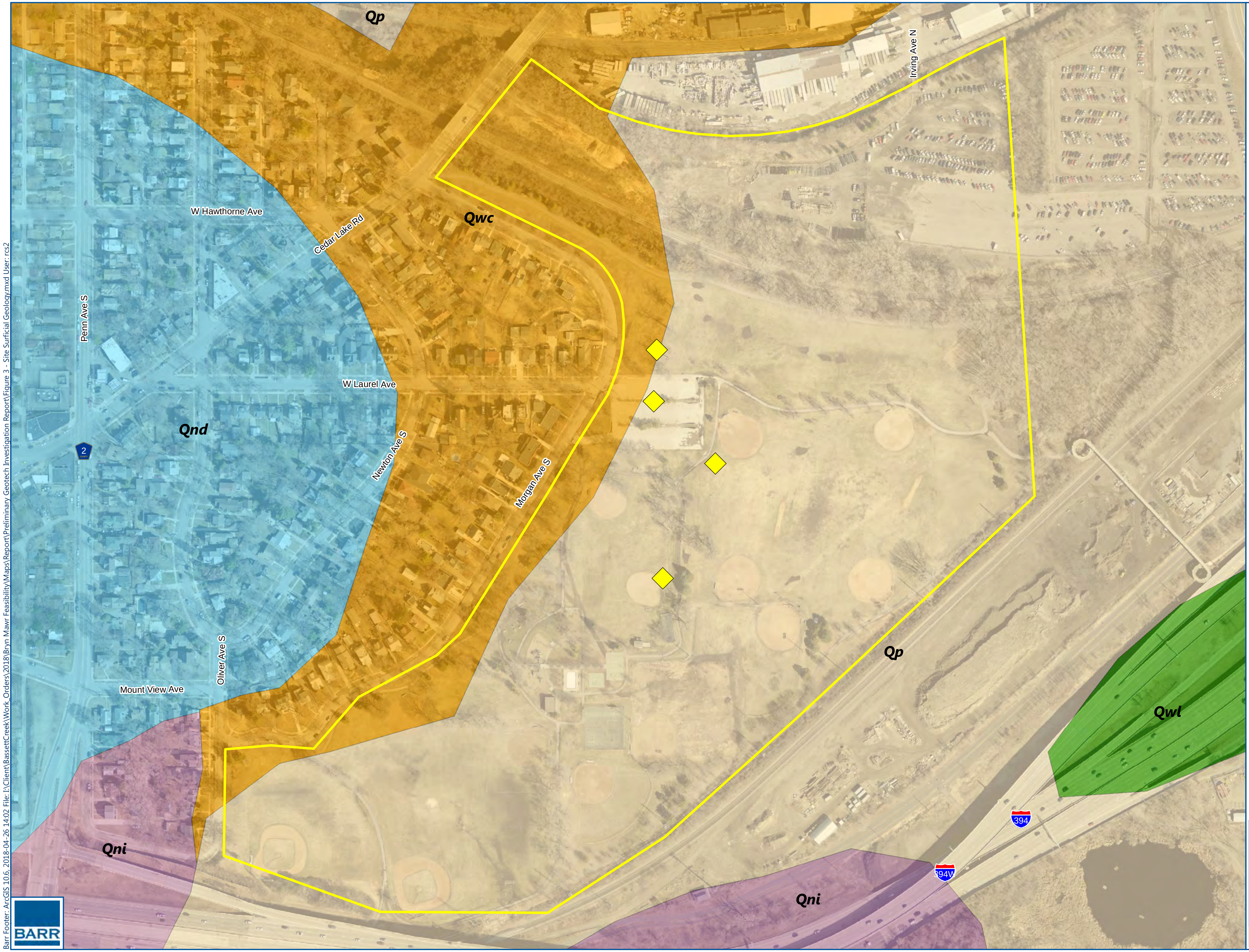
LiDAR Ground Surface Elevation Contours (Spring/Fall 2011)

— 10 ft Contour

— 2 ft Contour

SITE TOPOGRAPHY
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 2



SITE SURFICIAL GEOLOGY
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 3

Figure 4a: Ultimate Pile Capacity vs. Depth for 12-3/4-inch Diameter Close-Ended Pipe Pile (Boring SB1)

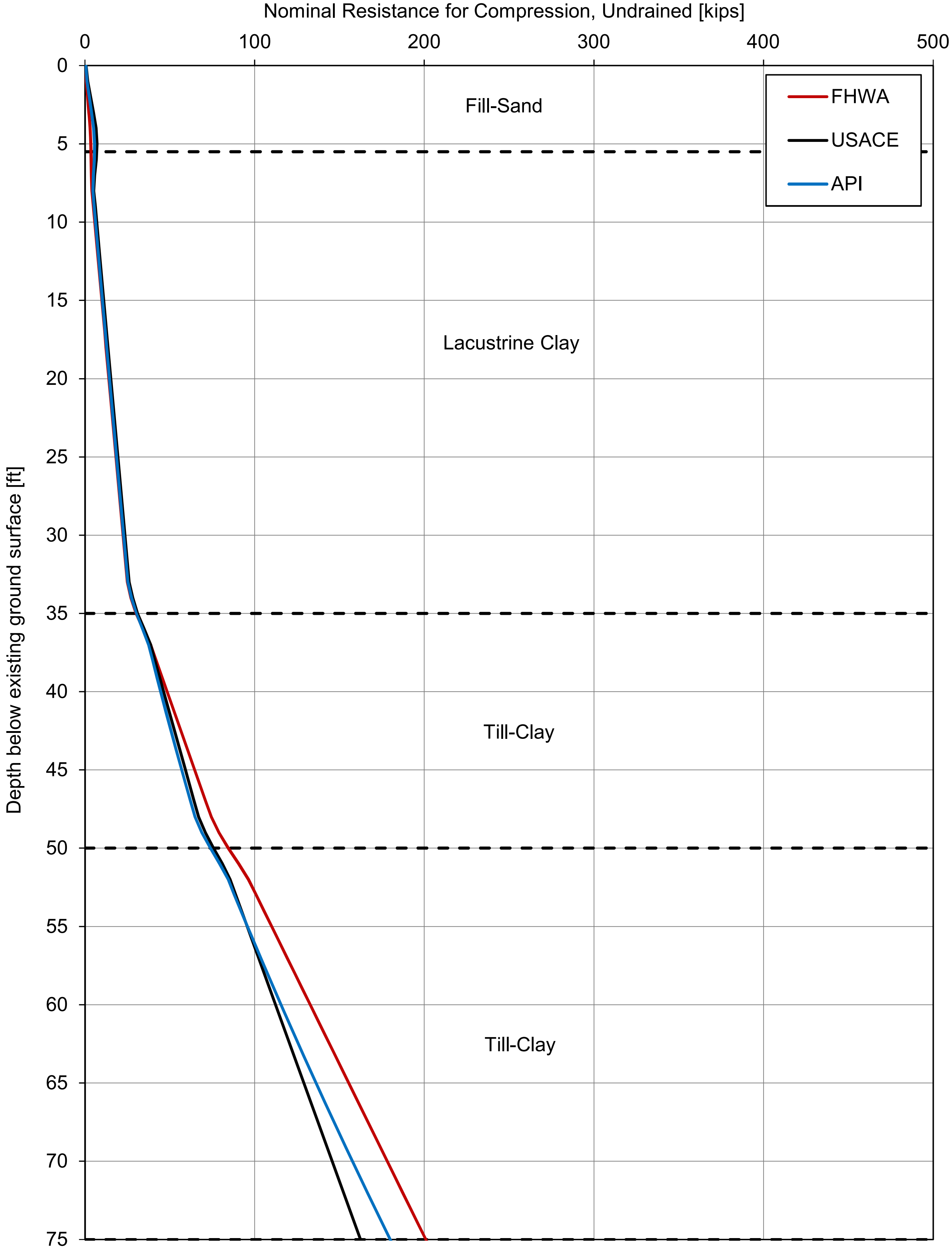
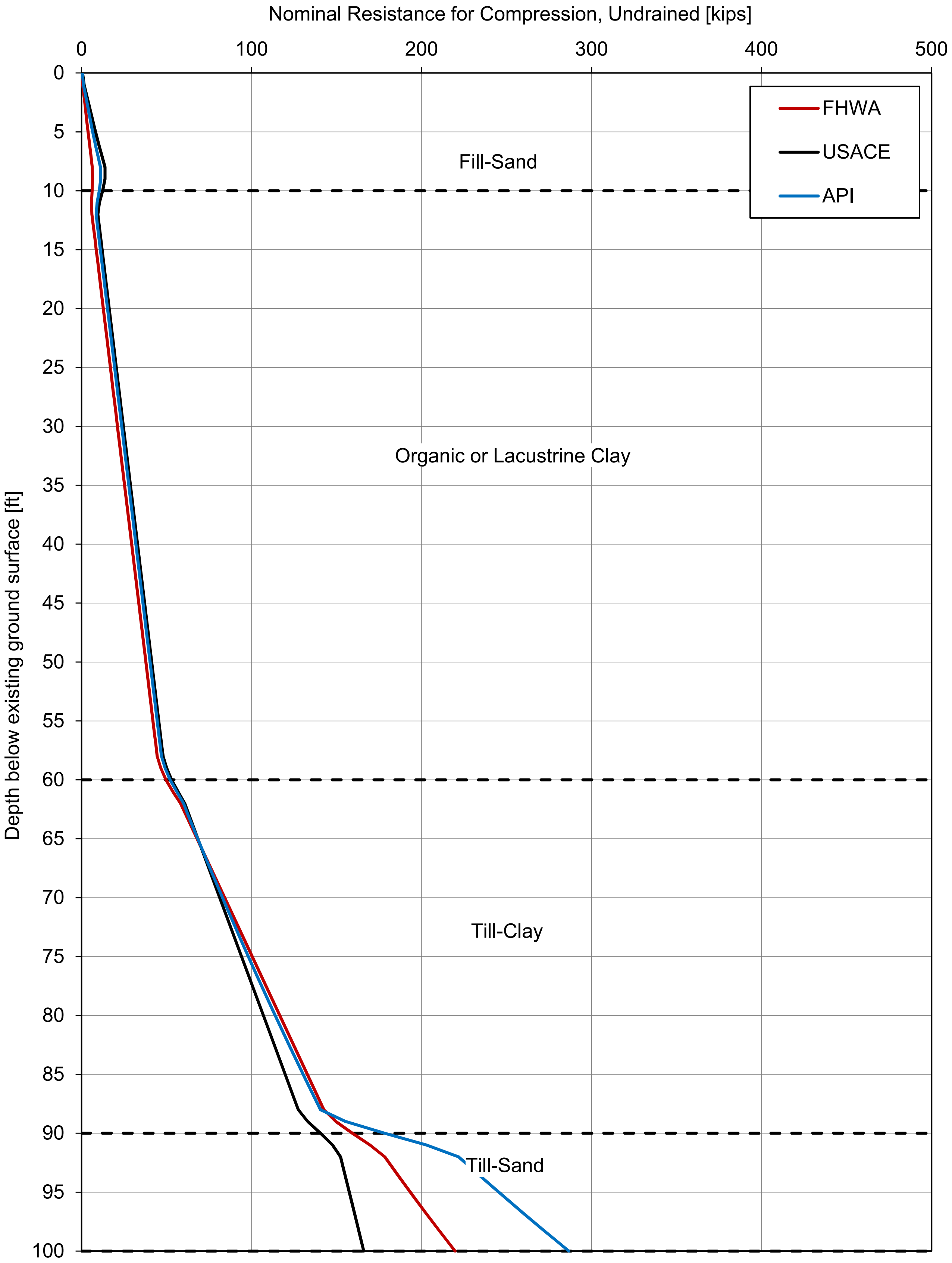


Figure 4b: Ultimate Pile Capacity vs. Depth for 12-3/4-inch Diameter Close-Ended Pipe Pile (Borings SB2, SB3, and SB4)



Appendix A

Soil Boring Logs

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING SB1

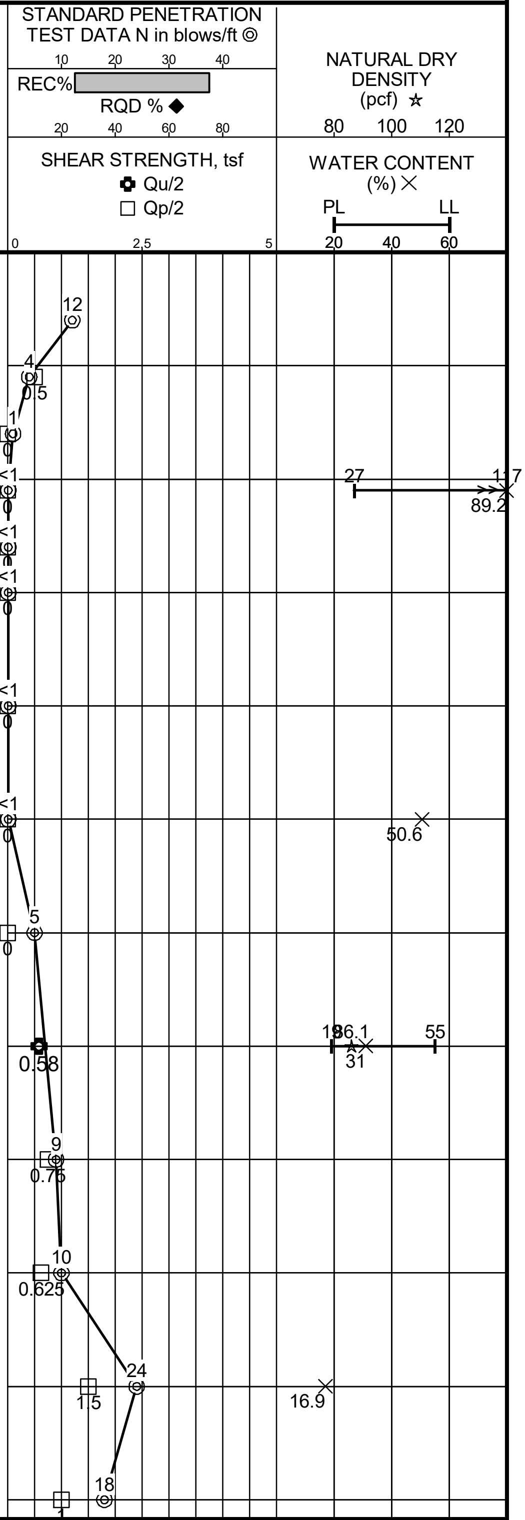
Sheet 1 of 2

Project: Bryn Mawr Meadows Water Quality Improvement
Job No.: 23270051.41
Location: Minneapolis, MN
Coordinates: Lat: 44.97260° Long: -93.30217°
Datum: NAD83

Surface Elevation: 814.9 ft
Drilling Method: HSA/MRO
Sampling Method: Split Spoon, Thinwall Tube
Completion Depth: 76.0 ft

Surface Elev.: 814.9 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Sample No.	% Recovery	SPT, N value or RQD %
	0	TOPSOIL (CL): dark brown; frozen to moist; with sand; trace organics. 813.9 ft — 1.0ft	1	100	
		FILL (SC): fine to medium grained; dark brown; moist; very loose to medium dense; trace black organics.	2	100	12
810 ▽	5	809.4 ft — 5.5ft	3	100	4
		FAT CLAY (CH): dark gray; wet; very soft to soft.	4	100	1
805	10		5	100	WH
			6	100	WH
800	15		7	100	WH
795	20		8	100	WH
		791.9 ft			
		FAT CLAY (CH): dark gray; wet; very soft; trace silt. — 23.0ft			
790	25		9	100	WH
		786.9 ft			
		FAT CLAY (CH): dark gray; wet; medium stiff to stiff; trace to with sand. — 28.0ft			
785	30		10	100	5
780	35		11	100	
		776.9 ft			
		SANDY LEAN CLAY (CL): dark gray; wet; stiff to hard. — 38.0ft			
775	40		12	100	9
770	45		13	100	10
765	50	49': trace gravel.	14	100	24
760	55				



Continued Next Page

Date Boring Started: 3/22/18 7:55 am
Date Boring Completed: 3/22/18 1:00 pm
Logged By: PJH3
Drilling Contractor: STS Enterprises, LLC
Drill Rig: CME 750

Water Levels (ft)
▽ At Time of Drilling 5.5

Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).

Weather: Overcast, 32F

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

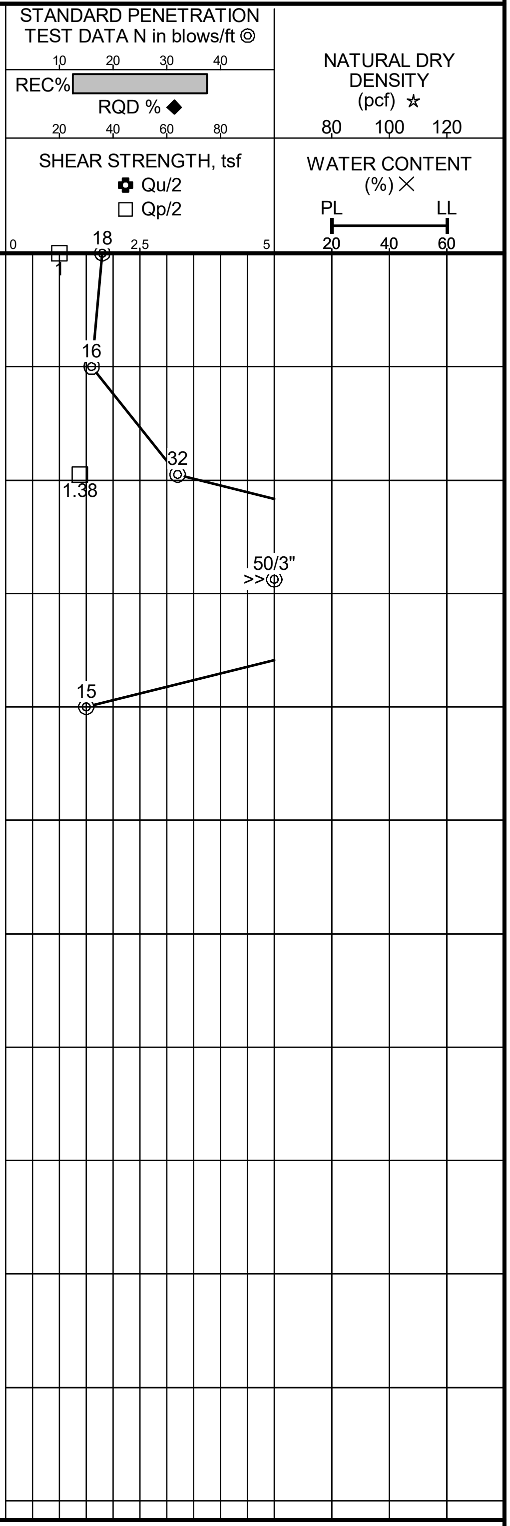
LOG OF BORING SB1

Sheet 2 of 2

Project: Bryn Mawr Meadows Water Quality Improvement
Job No.: 23270051.41
Location: Minneapolis, MN
Coordinates: Lat: 44.97260° Long: -93.30217°
Datum: NAD83

Surface Elevation: 814.9 ft
Drilling Method: HSA/MRO
Sampling Method: Split Spoon, Thinwall Tube
Completion Depth: 76.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Sample No.	% Recovery	SPT, N value or RQD %
	55	SANDY LEAN CLAY (CL): dark gray; wet; stiff to hard. *(Continued)*	15	100	18
755	60		16	100	16
750	65		17	100	32
746.9 ft	68.0ft	SANDY LEAN CLAY (CL): dark brown; wet; hard; trace to with gravel.	18	40	50/ 3"
745	70				
741.9 ft	73.0ft	CLAYEY SAND (SC): fine to medium grained; dark brown; saturated; medium dense.			
740	75		19	100	15
738.9 ft	76.0ft	Bottom of Boring at 76.0 feet			



Date Boring Started: 3/22/18 7:55 am
Date Boring Completed: 3/22/18 1:00 pm
Logged By: PJH3
Drilling Contractor: STS Enterprises, LLC
Drill Rig: CME 750

Water Levels (ft)
At Time of Drilling 5.5

Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).

Weather: Overcast, 32F

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING SB2

Project: Bryn Mawr Meadows Water Quality Improvement
Job No.: 23270051.41
Location: Minneapolis, MN
Coordinates: Lat: 44.97347° Long: -93.30161°
Datum: NAD83

Surface Elevation: 813.0 ft
Drilling Method: HSA/MRO
Sampling Method: Split Spoon, Thinwall Tube
Completion Depth: 101.0 ft

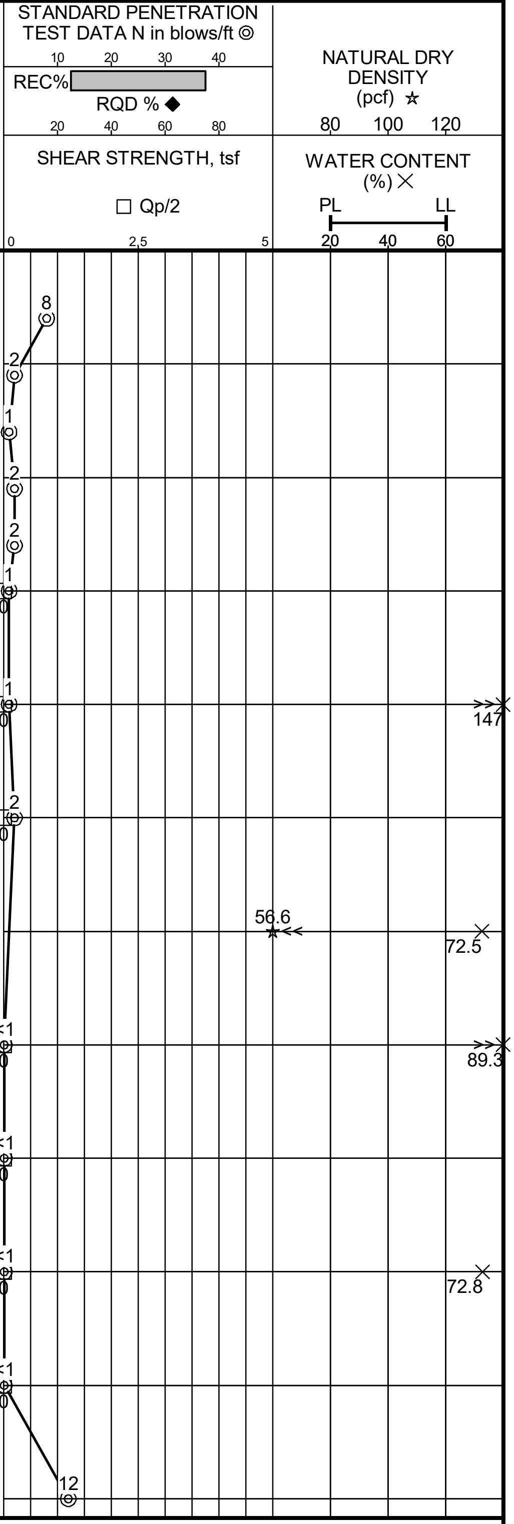
MATERIAL DESCRIPTION

Surface Elev.: 813.0 ft

Elevation, feet	Depth, feet	Material Description
813.0	0	TOPSOIL (CL): brown; frozen to moist; with sand; trace organics.
812.0 ft	1.0ft	FILL (SC): fine to medium grained; brown to dark gray; wet; very loose to loose; trace gravel.
799.0 ft	14.0ft	13.9': 1 inch clay seam; black discoloration; trace organics. ORGANIC CLAY (OH): gray to dark gray; wet; very soft; trace to with shells; trace sand; trace organics.
785.0 ft	28.0ft	FAT CLAY (CH): dark gray; wet; very soft.
765.0 ft	48.0ft	FAT CLAY (CH): dark gray; wet; very soft; trace silt.
760.0 ft	53.0ft	SILTY SAND (SM): fine to medium grained; dark gray; saturated; medium dense; trace gravel.

Water level symbol at 5.6 ft depth.

Sample No.	% Recovery	SPT, N value or RQD %
1	100	
2	50	8
3	100	2
4	75	1
5	75	2
6	75	2
7	100	1
8	100	1
9	100	2
10	100	
11	100	WH
12	100	WR
13	100	WH
14	100	WH



Continued Next Page

Date Boring Started: 3/20/18 8:20 am
Date Boring Completed: 3/20/18 3:00 pm
Logged By: PJH3
Drilling Contractor: STS Enterprises, LLC
Drill Rig: CME 750

Water Levels (ft)
At Time of Drilling 5.6

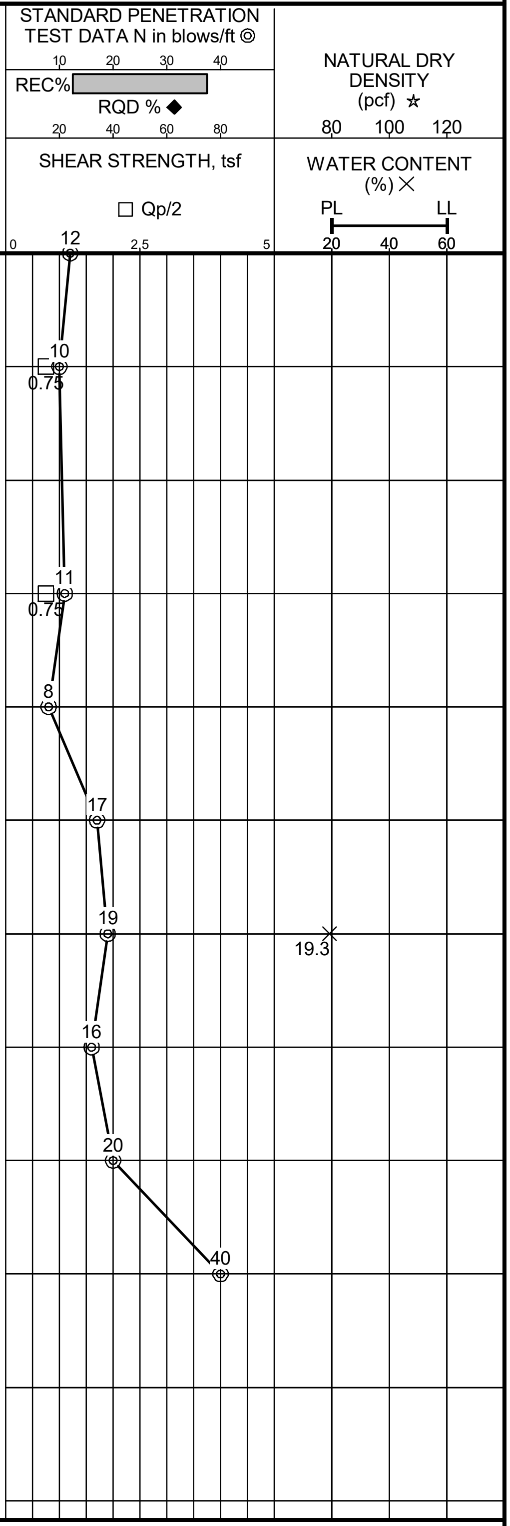
Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).

Weather: Snow, 29F

LOG OF BORING SB2

Project:	Bryn Mawr Meadows Water Quality Improvement	Surface Elevation:	813.0 ft
Job No.:	23270051.41	Drilling Method:	HSA/MRO
Location:	Minneapolis, MN	Sampling Method:	Split Spoon, Thinwall Tube
Coordinates:	Lat: 44.97347° Long: -93.30161°	Completion Depth:	101.0 ft
Datum:	NAD83		

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Sample No.	% Recovery	SPT, N value or RQD %
	55	SILTY SAND (SM): fine to medium grained; dark gray; saturated; medium dense; trace gravel. *(Continued)*	15	100	12
755		755.0 ft / 58.0ft			
		SANDY LEAN CLAY (CL): dark gray; wet; stiff.			
	60		16	100	10
750					
	65		17	100	
745					
	70	69': trace gravel.	18	50	11
		740.0 ft / 73.0ft			
740		CLAYEY SAND (SC): fine to medium grained; dark gray; saturated; loose to medium dense; trace gravel.			
	75		19	100	8
735					
	80		20	50	17
		730.0 ft / 83.0ft			
730		SANDY LEAN CLAY (CL): dark gray; wet; very stiff; trace gravel.			
	85		21	25	19
		725.0 ft / 88.0ft			
725		CLAYEY SAND (SC): fine to medium grained; dark gray; saturated; medium dense to dense.			
	90		22	50	16
720					
	95	94': color change to dark brown; fine grained.	23	75	20
715					
	100	712.0 ft	24	0	40
		Bottom of Boring at 101.0 feet / 101.0ft			



Date Boring Started:	3/20/18 8:20 am
Date Boring Completed:	3/20/18 3:00 pm
Logged By:	PJH3
Drilling Contractor:	STS Enterprises, LLC
Drill Rig:	CME 750

Water Levels (ft)
▼ At Time of Drilling 5.6

Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).

Weather: Snow, 29F

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING SB3

Sheet 1 of 2

Project:	Bryn Mawr Meadows Water Quality Improvement	Surface Elevation:	812.6 ft
Job No.:	23270051.41	Drilling Method:	HSA/MRO
Location:	Minneapolis, MN	Sampling Method:	Split Spoon, Thinwall Tube
Coordinates:	Lat: 44.97394° Long: -93.30226°	Completion Depth:	101.0 ft
Datum:	NAD83		

Elevation, feet | Depth, feet | MATERIAL DESCRIPTION | Graphic Log | Samples | Sample No. | % Recovery | SPT, N value or RQD %

Surface Elev.: 812.6 ft

TOPSOIL (CL): brown; frozen; trace sand; trace organics.
811.6 ft — 1.0ft

FILL (CL): dark brownish gray; frozen to moist; stiff; trace organics.
808.6 ft — 4.0ft

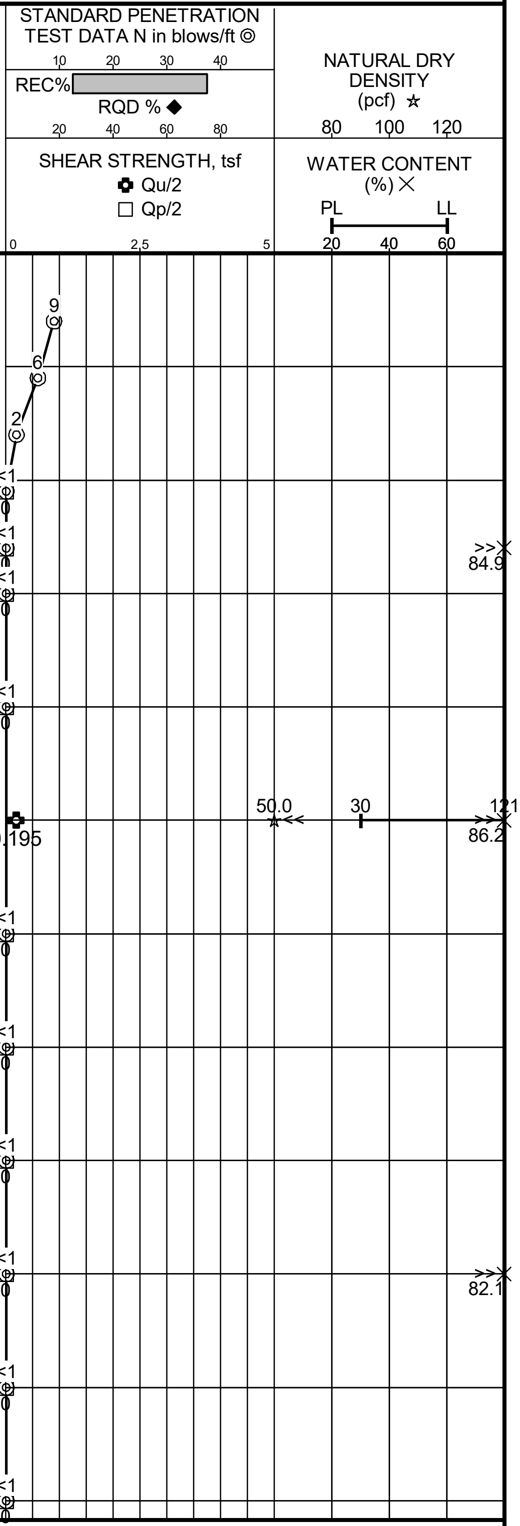
FILL (SC): fine to coarse grained; black to brown; wet; very loose to loose; trace organics; trace silt.
5.5': 2 inch seam of clay; black discoloration; trace organics.
805.1 ft — 7.5ft

ORGANIC CLAY (OH): light gray; wet; very soft; trace sand; trace shells; trace organics.
798.6 ft — 14.0ft

FAT CLAY (CH): gray; wet; very soft.

Sample No.	% Recovery	SPT, N value or RQD %
1	100	
2	50	9
3	75	6
4	100	2
5	100	WH
6	100	WH
7	100	WH
8	100	WH
9	95	
10	100	WH
11	100	WH
12	65	WR
13	75	WR
14	75	WR

Elevation, feet: 810, 805, 800, 795, 790, 785, 780, 775, 770, 765, 760
Depth, feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55



Continued Next Page

		Water Levels (ft)	Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).
Date Boring Started:	3/21/18 7:55 am	▼ At Time of Drilling 5.5	
Date Boring Completed:	3/21/18 2:05 pm		
Logged By:	PJH3		
Drilling Contractor:	STS Enterprises, LLC		
Drill Rig:	CME 750		Weather: Overcast, 24F

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

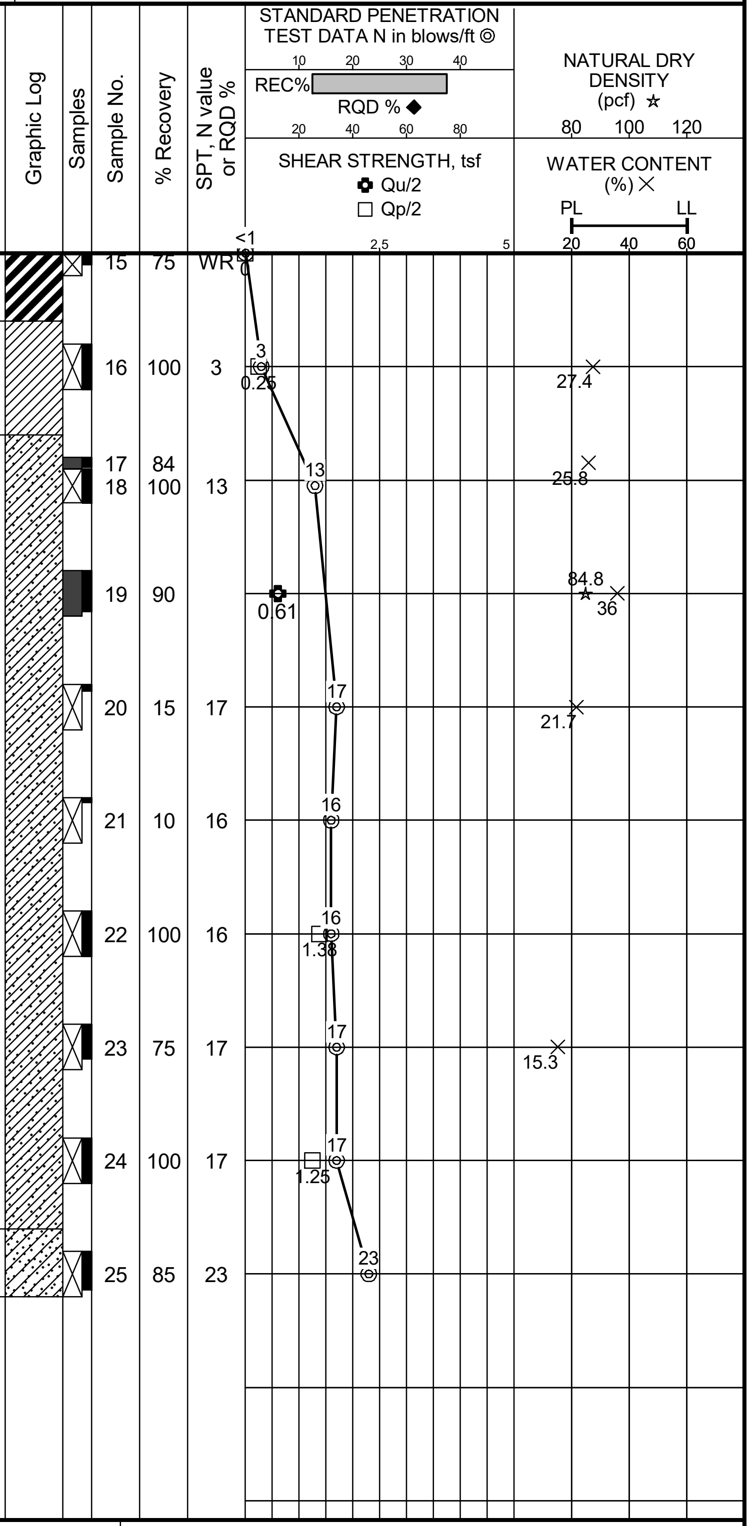
LOG OF BORING SB3

Sheet 2 of 2

Project:	Bryn Mawr Meadows Water Quality Improvement	Surface Elevation:	812.6 ft
Job No.:	23270051.41	Drilling Method:	HSA/MRO
Location:	Minneapolis, MN	Sampling Method:	Split Spoon, Thinwall Tube
Coordinates:	Lat: 44.97394° Long: -93.30226°	Completion Depth:	101.0 ft
Datum:	NAD83		

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION
	55	FAT CLAY (CH): gray; wet; very soft. *(Continued)*
754.6 ft	58.0ft	LEAN CLAY (CL): gray to dark gray; wet; very soft to soft; trace silt; trace sand.
749.6 ft	63.0ft	SANDY LEAN CLAY (CL): dark gray to dark brown; wet; very stiff; trace to with gravel.
714.6 ft	98.0ft	CLAYEY SAND (SC): fine to coarse grained; dark gray to dark brown; saturated; medium dense; trace to with gravel.
711.6 ft	101.0ft	Bottom of Boring at 101.0 feet

Sample No.	% Recovery	SPT, N value or RQD %
15	75	WR
16	100	3
17	84	
18	100	13
19	90	
20	15	17
21	10	16
22	100	16
23	75	17
24	100	17
25	85	23



		Water Levels (ft)		Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).
Date Boring Started:	3/21/18 7:55 am	▽ At Time of Drilling	5.5	
Date Boring Completed:	3/21/18 2:05 pm			
Logged By:	PJH3			
Drilling Contractor:	STS Enterprises, LLC			
Drill Rig:	CME 750			Weather: Overcast, 24F

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING SB4

Sheet 1 of 2

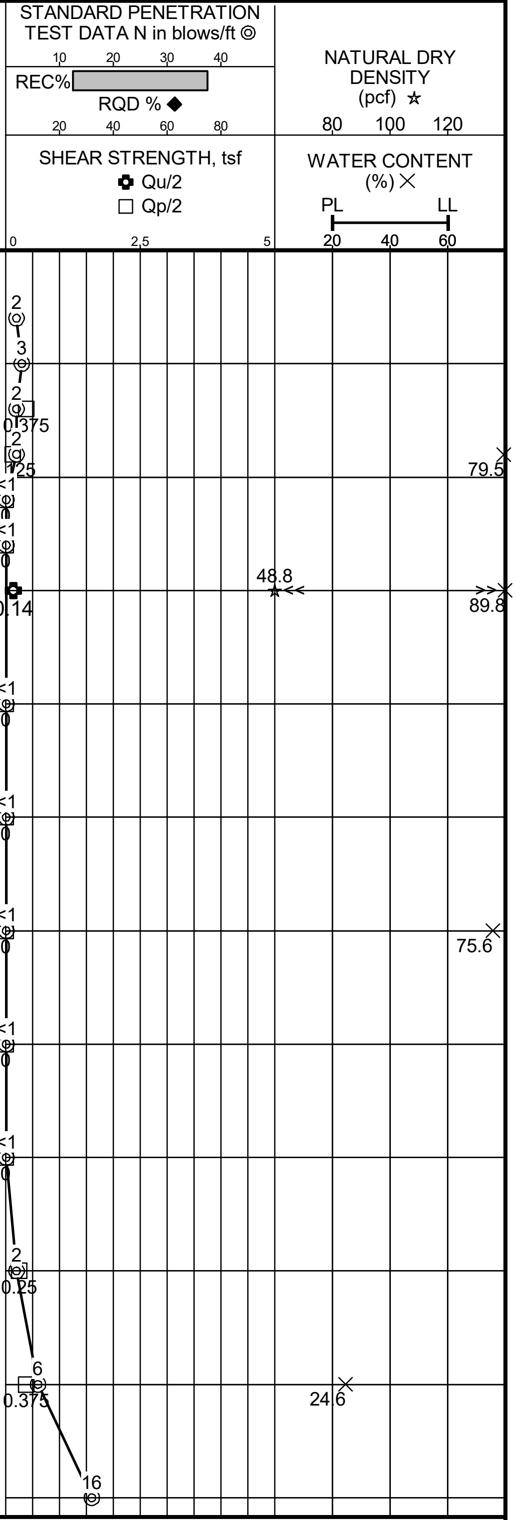
Project: Bryn Mawr Meadows Water Quality Improvement
Job No.: 23270051.41
Location: Minneapolis, MN
Coordinates: Lat: 44.97429° Long: -93.30223°
Datum: NAD83

Surface Elevation: 810.5 ft
Drilling Method: HSA/MRO
Sampling Method: Split Spoon, Thinwall Tube
Completion Depth: 100.5 ft

Surface Elev.: 810.5 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION
810.5	0	TOPSOIL (CL): brown; frozen to moist; with sand; trace organics.
808.5 ft	2.0ft	FILL (SP-SM): fine to coarse grained; brown; moist; very loose; trace gravel.
806.5 ft	4.0ft	FILL (CL): brown to dark brown; moist; soft; with silt.
804.5 ft	6.0ft	FAT CLAY (CH): gray to brownish gray; wet; very soft.
763.5 ft	47.0ft	LEAN CLAY (CL): gray; moist to wet; medium stiff; trace to with sand; sporadic thin layers of sand.
756.5 ft	54.0ft	

Sample No.	% Recovery	SPT, N value or RQD %
1	100	
2	30	2
3	50	3
4	80	2
5	80	2
6	85	WH
7	85	WH
8	100	
9	90	WH
10	95	WH
11	95	WH
12	95	WH
13	95	WH
14	95	2
15	95	6



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Date Boring Started: 3/19/18 9:00 am
Date Boring Completed: 3/19/18 5:15 pm
Logged By: CJS
Drilling Contractor: STS Enterprises, LLC
Drill Rig: CME 750

Water Levels (ft)
▼ At Time of Drilling 3.0

Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).

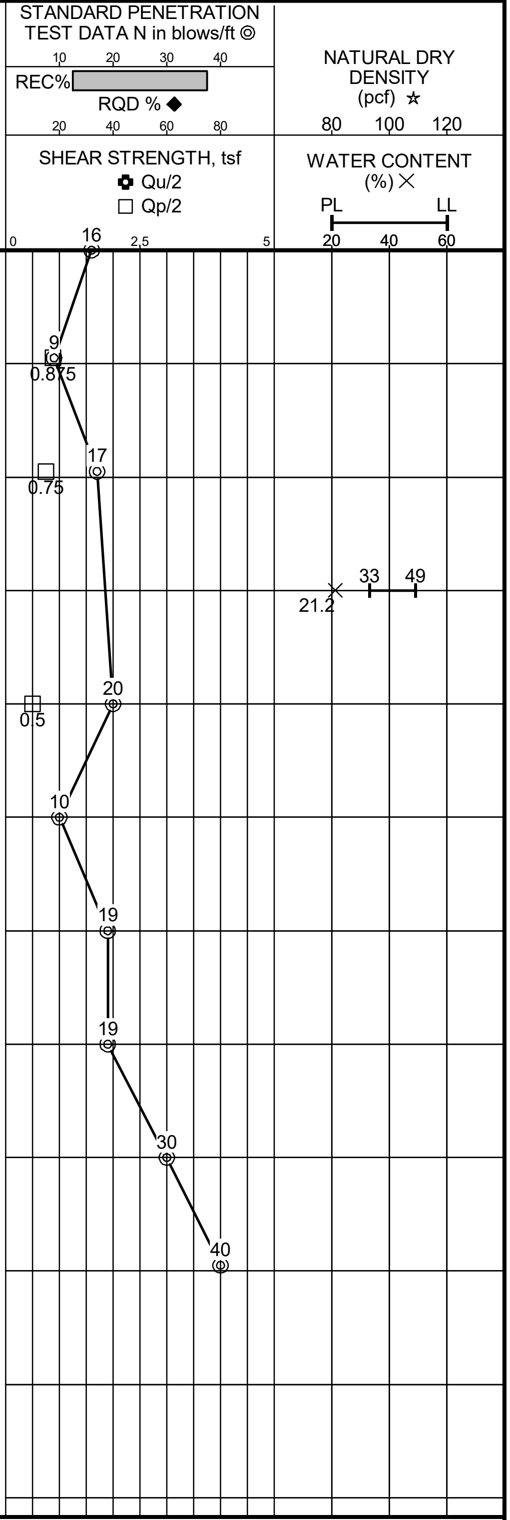
Weather: Overcast, 35F

LOG OF BORING SB4

Sheet 2 of 2

Project:	Bryn Mawr Meadows Water Quality Improvement	Surface Elevation:	810.5 ft
Job No.:	23270051.41	Drilling Method:	HSA/MRO
Location:	Minneapolis, MN	Sampling Method:	Split Spoon, Thinwall Tube
Coordinates:	Lat: 44.97429° Long: -93.30223°	Completion Depth:	100.5 ft
Datum:	NAD83		

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Sample No.	% Recovery	SPT, N value or RQD %
755	55	CLAYEY SAND (SC): fine to medium grained; gray to light gray; wet; medium dense. *(Continued)*	16	90	16
		751.5 ft			
750	60	LEAN CLAY (CL): gray; moist to wet; stiff. 59.0ft	17	93	9
		746.5 ft			
745	65	SANDY LEAN CLAY (CL): gray; moist to wet; stiff to very stiff; trace gravel. 64.0ft	18	60	17
740	70		19	38	
735	75		20	65	20
730	80		21	0	10
725	85		22	0	19
		721.5 ft			
720	90	POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; brown; wet to saturated; medium dense to dense. 89.0ft	23	90	19
715	95	94': trace gravel.	24	20	30
710	100	710.0 ft 99.5': 6 inch seam of clayey sand. 100.5ft	25	100	40
		Bottom of Boring at 100.5 feet			



Date Boring Started:	3/19/18 9:00 am
Date Boring Completed:	3/19/18 5:15 pm
Logged By:	CJS
Drilling Contractor:	STS Enterprises, LLC
Drill Rig:	CME 750

Water Levels (ft)
▼ At Time of Drilling 3.0

Remarks: Elevation data from Hennepin County 1 Meter LiDAR (2011).

Weather: Overcast, 35F

Appendix B

Laboratory Test Results

Water Content Test Summary (ASTM:D2216)

Project: Bryn Mawr Job: 11348

Client Barr Engineering Company Date: 4/4/2018

Sample Information & Classification

Boring #	SB-01	SB-01	SB-01	SB-02	SB-02	SB-02	SB-02	SB-03
Sample #								
Depth (ft)	9.5-11	24-26	49-51	19-21	34-36	44-46	84-86	12-14
Type	Bag	Bag	Bag	Bag	Bag	Bag	Bag	Bag
Material Classification	Fat Clay (CH)	Fat Clay (CH)	Clayey Sand w/gravel (SC)	Sapric Peat w/shells (PT)	Fat Clay (CH)	Fat Clay (CH)	Sandy Lean Clay (CL)	Organic Clay (OH/PT)
Water Content (%)	89.2	50.6	16.9	147.0	89.3	72.8	19.3	84.9

Sample Information & Classification

Boring #	SB-03	SB-03	SB-03	SB-03	SB-04	SB-04	SB-04	SB-04
Sample #								
Depth (ft)	44-46	59-61	74-76	89-91	8-10	29-31	49-51	69-71
Type	Bag	Bag	Bag	Bag	Bag	Bag	Bag	Bag
Material Classification	Fat Clay (CH)	Fat Clay (CH)	Fat Clay w/sand (CH)	Clayey Sand w/a little gravel (CL)	Fat Clay (CH)	Fat Clay (CH)	Lean Clay w/sand seams (CL/CH)	Fat Cay w/sand and trace of gravel (CH)
Water Content (%)	82.1	27.4	21.7	15.3	79.5	75.6	24.6	21.2

Sample Information & Classification

Boring #	SB-03	SB-04						
Sample #								
Depth (ft)	64-64.5	69-71						
Type	TWT	TWT						
Material Classification	Clayey Sand w/gravel (SC/GC)	Sandy Lean Clay w/a trace of gravel (CL)						
Water Content (%)	25.8	29.9						

Sample Information & Classification

Boring #								
Sample #								
Depth (ft)								
Type								
Material Classification								
Water Content (%)								

Laboratory Test Summary

Project: Bryn Mawr　**Job:** 11348

Client: Barr Engineering Company　**Date:** 4/5/18

Sample Information & Classification

Boring #	SB-2						
Sample #							
Depth (ft)	29-31						
Type or BPF	TWT						
Classification	Fat Clay (CH)						

Water Content, Dry Density (ASTM:D7263)

Water Content (%)	72.5						
Dry Density (pcf)	56.6						

Sample Information & Classification

Boring #							
Sample #							
Depth (ft)							
Type or BPF							
Classification							

Water Content, Dry Density (ASTM:D7263)

Water Content (%)							
Dry Density (pcf)							

Sample Information & Classification

Boring #							
Sample #							
Depth (ft)							
Type or BPF							
Classification							

Water Content, Dry Density (ASTM:D7263)

Water Content (%)							
Dry Density (pcf)							

Laboratory Test Summary

Project: Bryn Mawr Job: 11348

Client: Barr Engineering Company Date: 4/4/2018

Sample Information & Classification

Boring #	SB-01	SB-01	SB-03	SB-04				
Sample #								
Depth (ft)	9.5-11	34-36	24-26	69-71				
Sample Type	Bag	TWT	TWT	TWT				
Material Classification	Fat Clay (CH)	Fat Clay w/lenses and laminations of silty sand (CH)	Fat Clay (CH)	Sandy Lean Clay w/a trace of gravel (CL)				

Atterberg Limits (ASTM:D4318)

Liquid Limit	117	55	121	49				
Plastic Limit	27	19	30	33				
Plasticity Index	90	36	91	16				

Sample Information & Classification

Boring #								
Sample #								
Depth (ft)								
Sample Type								
Material Classification								

Atterberg Limits (ASTM:D4318)

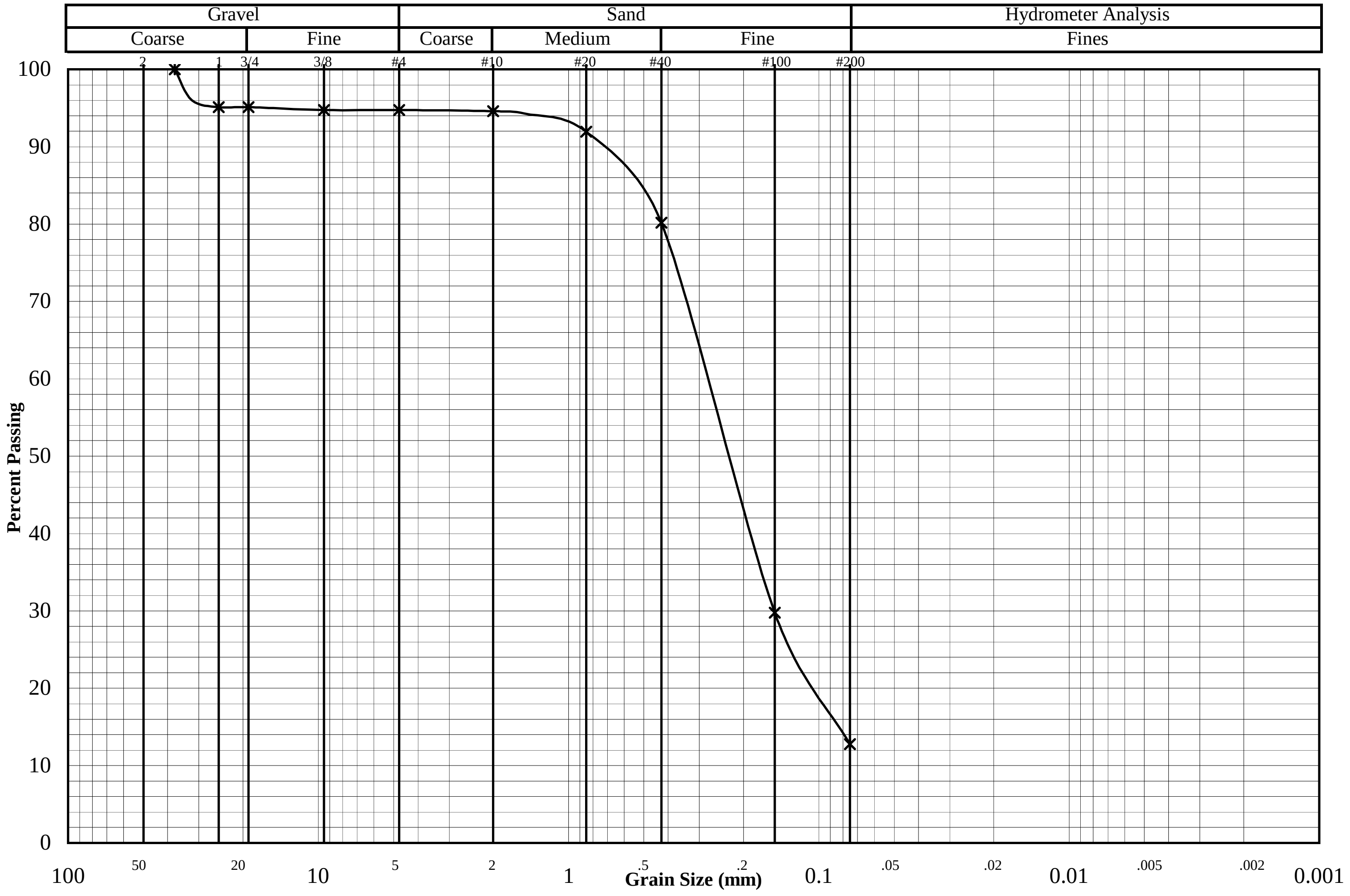
Liquid Limit								
Plastic Limit								
Plasticity Index								

Grain Size Distribution ASTM D422

Job No. : **11348**

Project:	Bryn Mawr	Test Date:	3/26/18
Reported To:	Barr Engineering Company	Report Date:	3/28/18

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
⁎	SB-2		54-56	Bag	Silty Sand w/a little gravel (SM/SP-SM)
●					
◇					



Other Tests

	⁎	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index			
Water Content			
Dry Density (pcf)			
Specific Gravity			
Porosity			
Organic Content			
pH			
Shrinkage Limit			
Penetrometer			
Qu (psf)			

(* = assumed)

Percent Passing

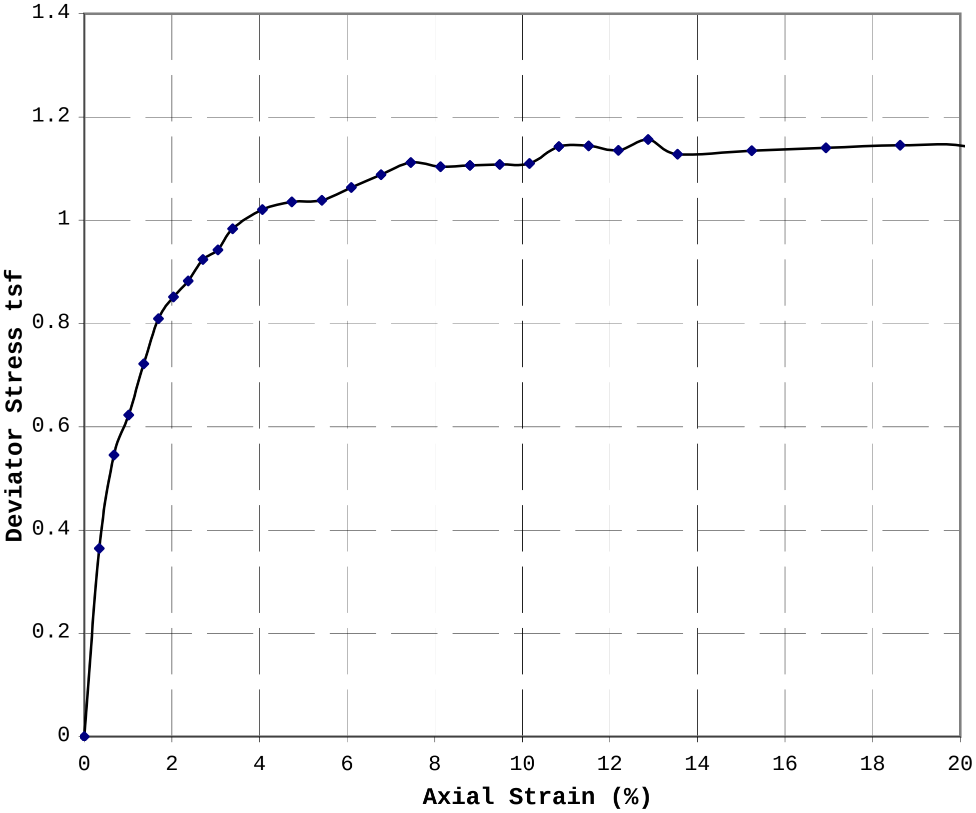
	⁎	●	◇
Mass (g)	546.4		
2"			
1.5"	100.0		
1"	95.1		
3/4"	95.1		
3/8"	94.7		
#4	94.7		
#10	94.6		
#20	91.9		
#40	80.2		
#100	29.8		
#200	12.8		

	⁎	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

Triaxial U-U Stress/Strain Curves (ASTM:D2850)

Project: Bryn Mawr
Job: 11348
Client: Barr Engineering Company
Date: 4/6/18
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



Boring: SB-1
Depth: 34-36
Sample #:
Soil Type: Fat Clay w/lenses and laminations of silty sand (CH)

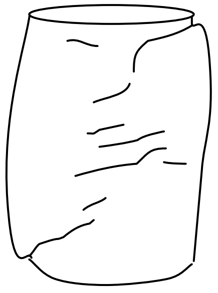
Strain Rate (in/min): 0.060
Sample Type: 3T
Dia. (in) 1.46
Ht. (in) 2.95
Height to Diameter Ratio: 2.02

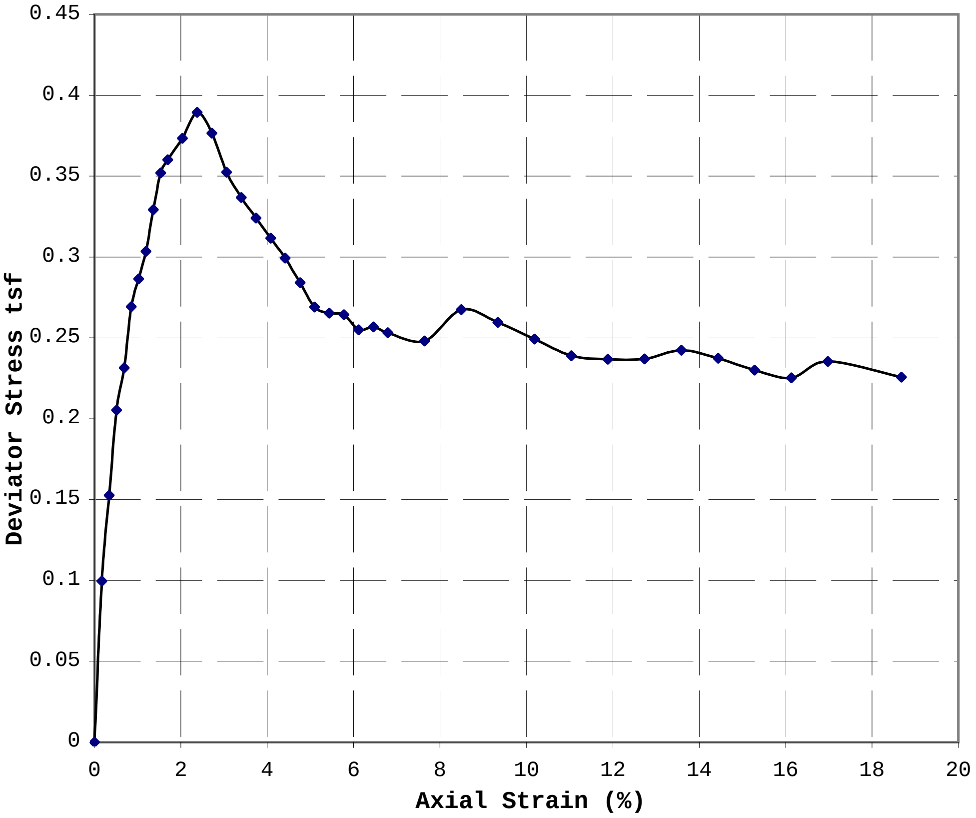
Max Deviator Stress: **1.16** **tsf**
Strain at Failure (%): **12.9**
Confining Pressure: 1.2 tsf

W.C. (%) 31.0
Yd (pcf): 86.1

LL: 55
PL: 19
PI: 36

Sketch of Specimen After Failure





Boring: SB-3
Depth: 24-26
Sample #:
Soil Type: Fat Clay (CH)

Strain Rate (in/min): 0.060
Sample Type: 3T

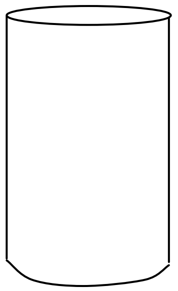
Dia. (in): 2.87
Ht. (in): 5.89
Height to Diameter Ratio: 2.05

Max Deviator Stress: **0.39** **tsf**
Strain at Failure (%): **2.4**
Confining Pressure: 0.9 tsf

W.C. (%): 86.2
Yd (pcf): 50.0

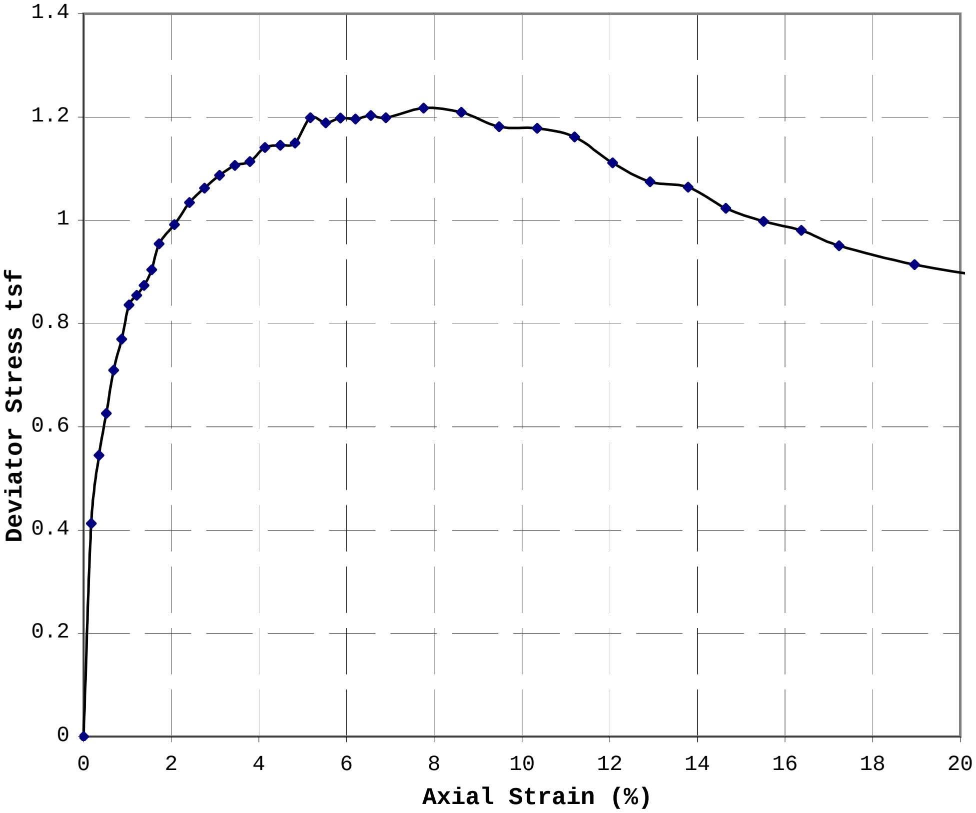
LL: 121
PL: 30
PI: 91

Sketch of Specimen After Failure



Triaxial U-U Stress/Strain Curves (ASTM:D2850)

Project: Bryn Mawr
Job: 11348
Client: Barr Engineering Company
Date: 4/6/18
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.

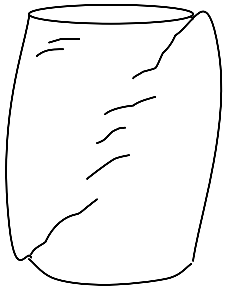


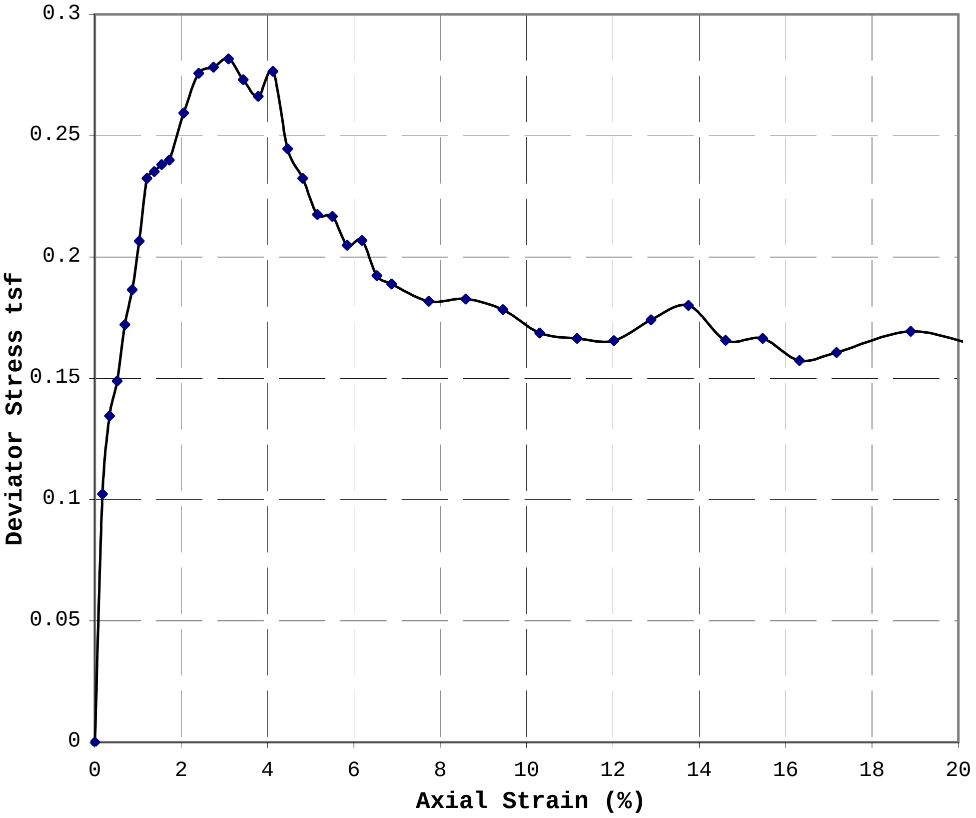
Boring: SB-3
Depth: 69-71
Sample #:
Soil Type: Fat Clay w/laminations of silt (CH)

Strain Rate (in/min): 0.060
Sample Type: 3T
Dia. (in) 2.88
Ht. (in) 5.80
Height to Diameter Ratio: 2.02

Max Deviator Stress: **1.22** **tsf**
Strain at Failure (%): **7.8**
Confining Pressure: 2.3 tsf
W.C. (%) 36.0
Yd (pcf): 84.8

Sketch of Specimen After Failure





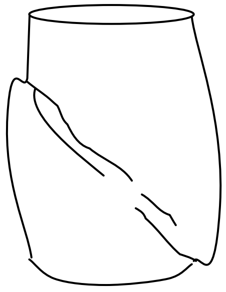
Boring: SB-4
Depth: 14-16
Sample #:
Soil Type: Fat Clay (CH)

Strain Rate (in/min): 0.060
Sample Type: 3T

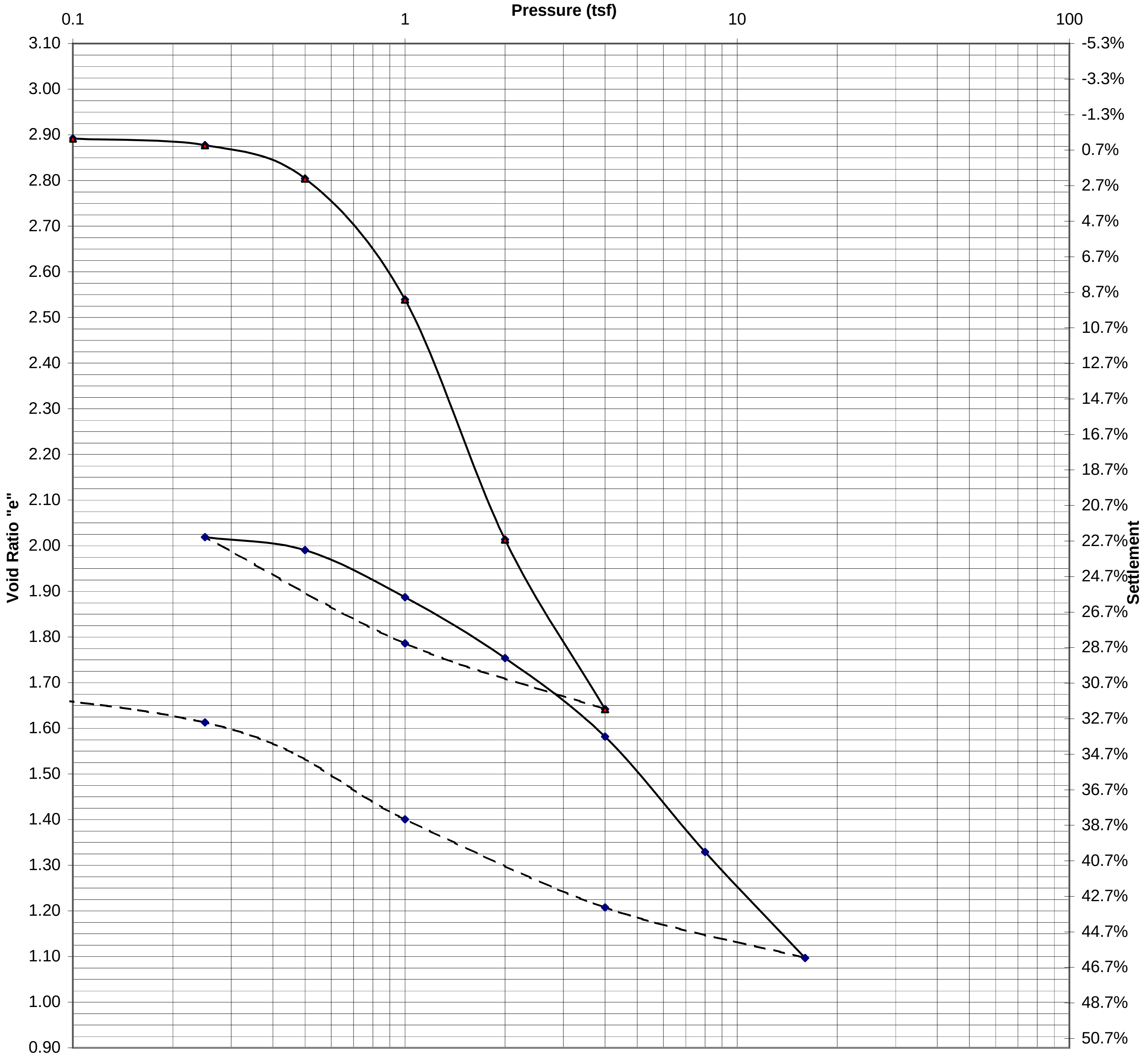
Dia. (in): 2.88
Ht. (in): 5.82
Height to Diameter Ratio: 2.02

Max Deviator Stress: **0.28** **tsf**
Strain at Failure (%): **3.1**
Confining Pressure: 0.6 tsf
W.C. (%): 89.8
Yd (pcf): 48.8

Sketch of Specimen After Failure



Void Ratio and % Settlement vs. Log of Pressure



Project: Bryn Mawr / Barr Engineering Company

Date: 4/24/18

Sample #:

Boring #: SB-3

Depth ft: 24-26

Job #: 11348

Soil Type: Fat Clay (CH)

Initial W/C (%): 104.7

Dry Density (pcf): 44.1

LL: 121

PL: 30

PI: 91

Gs: 2.75 (Assumed)

Organic Content (%):

Initial Height (in.): 0.746

Diameter (in.): 2.505

e_o= 2.892

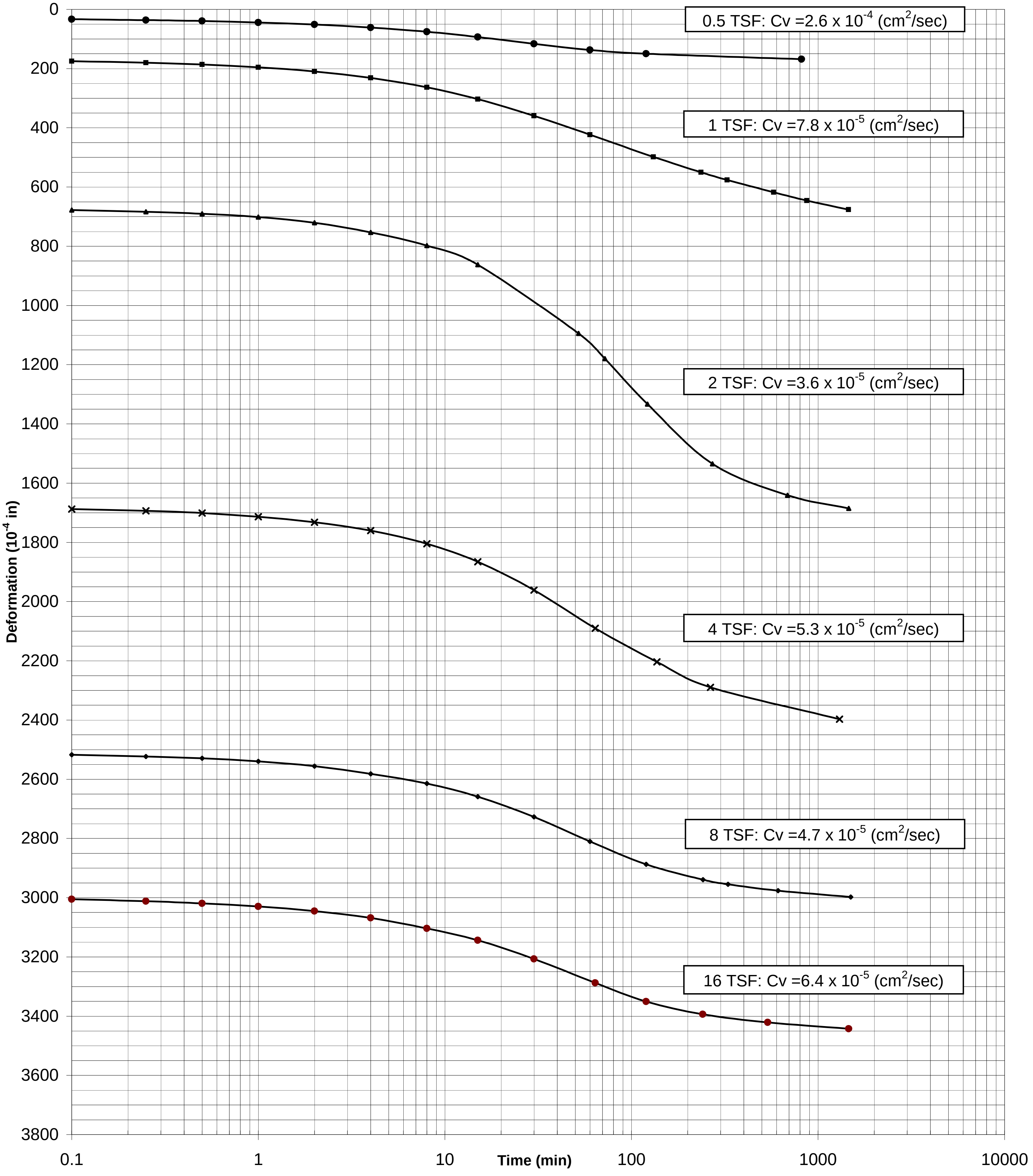
Preconsolidation Pressure (Pc): 0.67 tsf

Compression Index (Cc): 1.20

Recompression Index (Cr): 0.36

Remarks: Testing performed in general accordance with ASTM:D2435

Consolidation Log of Time Curves



Project: Bryn Mawr / Barr Engineering Company	Date: 4/24/18

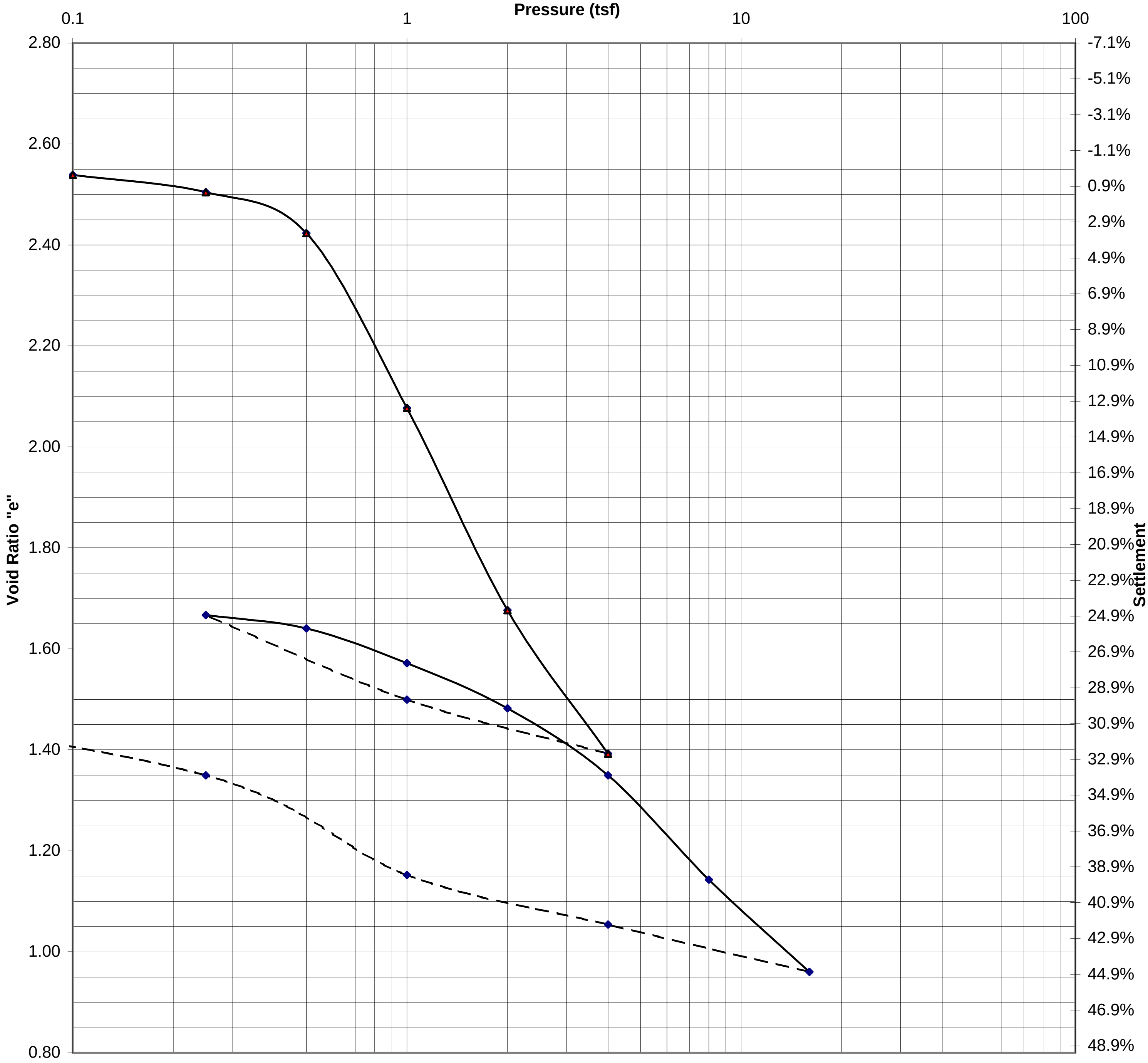
Sample #:	Boring #: SB-3	Depth ft: 24-26	Job #: 11348

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Void Ratio and % Settlement vs. Log of Pressure



Project: Bryn Mawr / Barr Engineering Company

Date: 4/25/18

Sample #:

Boring #: SB-4

Depth ft: 14-16

Job #: 11348

Soil Type: Fat Clay (CH)

Initial W/C (%): 90.5

Dry Density (pcf): 48.9

LL:

PL:

PI:

Gs: 2.78 (Assumed)

Organic Content (%):

Initial Height (in.): 0.743

Diameter (in.): 2.502

e_o= 2.547

Preconsolidation Pressure (Pc): 0.50 tsf

Compression Index (Cc): 0.98

Recompression Index (Cr): 0.27

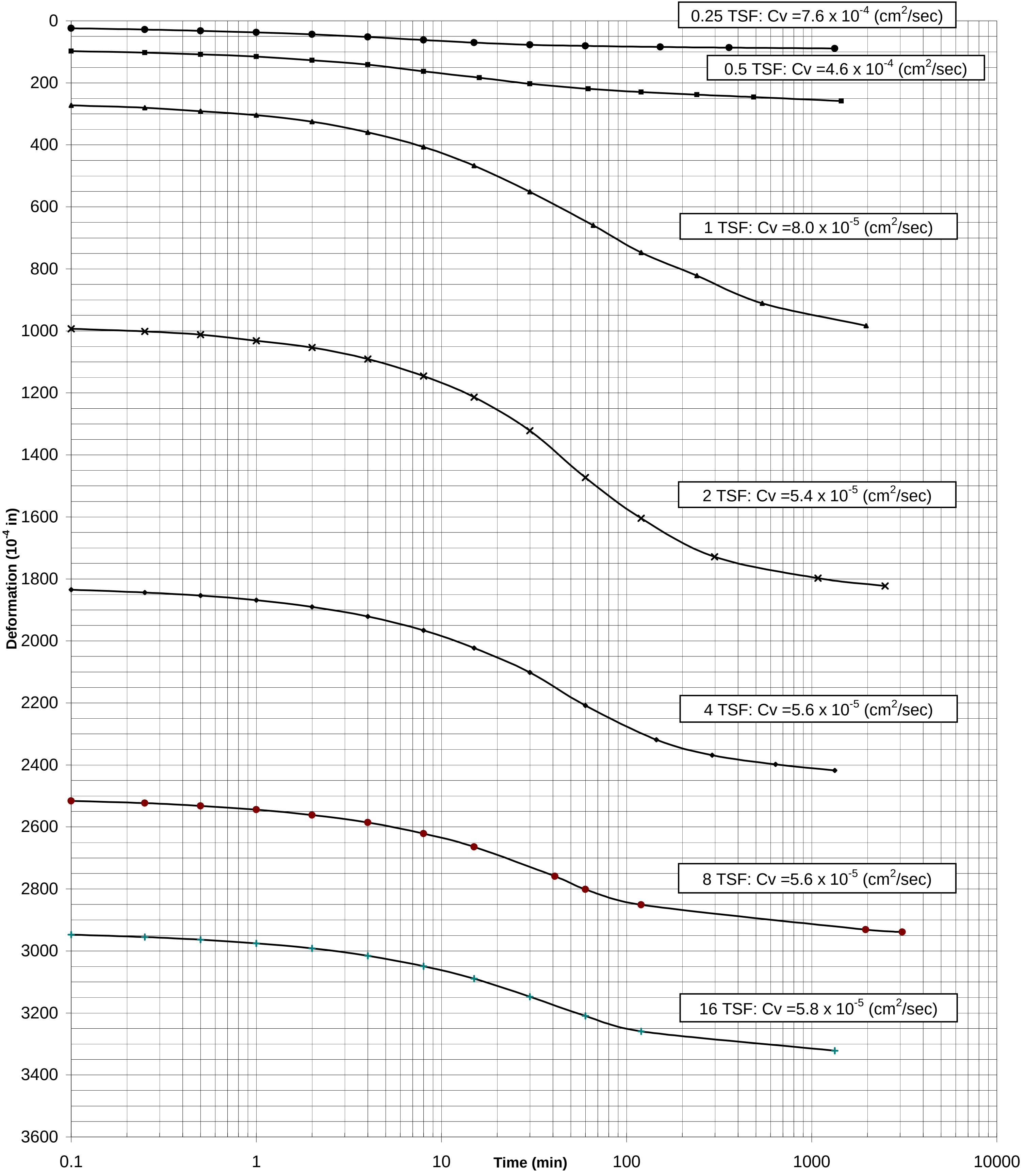
Remarks: Testing performed in general accordance with ASTM:D2435

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Consolidation Log of Time Curves



Project: Bryn Mawr / Barr Engineering Company

Date: 4/25/18

Sample #:

Boring #: SB-4

Depth ft: 14-16

Job #: 11348

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

pH Testing Summary Sheet (ASTM:D4972)

Project: **Bryn Mawr**

Client: **Barr Engineering Company**

Job: **11348**

Date: **4/5/2018**

Boring / Location	Sample	Sample Type	Depth (ft)	pH	Visual Classification
SB-2		**Bags**	**4.5-9**	**6.8**	**Silty Sand w/gravel (SM/SC-SM)**
SB-4		**Bags**	**6-10**	**7.3**	**Fat Clay (CH)**

ANALYTICAL REPORT

March 30, 2018

Soil Engineering Testing, Inc.

Sample Delivery Group:	L980646
Samples Received:	03/27/2018
Project Number:	11348
Description:	Bryn Mawr

Report To:

John Whelan
9530 James Ave. South
Bloomington, MN 55431

Entire Report Reviewed By: John V Hawkins

John Hawkins
Technical Service Representative

TABLE OF CONTENTS

Collected by	Collected date/time	Received date/time
	03/26/18 15:00	03/27/18 08:45

SB-2 L980646-01 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 9056A	WG1090610	1	03/29/18 15:02	03/29/18 18:40	MAJ

Collected by	Collected date/time	Received date/time
	03/26/18 15:00	03/27/18 08:45

SB-4 L980646-02 Solid

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 9056A	WG1090610	1	03/29/18 15:02	03/29/18 18:53	MAJ

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John V Hawkins

John Hawkins
Technical Service Representative

Wet Chemistry by Method 9056A

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Chloride	48.7		10.0	1	03/29/2018 18:40	WG1090610
Sulfate	ND		50.0	1	03/29/2018 18:40	WG1090610

Wet Chemistry by Method 9056A

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/kg		mg/kg		date / time	
Chloride	66.2		10.0	1	03/29/2018 18:53	WG1090610
Sulfate	54.6		50.0	1	03/29/2018 18:53	WG1090610

Method Blank (MB)

(MB) R3297737-1 03/29/18 16:53

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Chloride	0.999	J	0.795	10.0
Sulfate	1.75	J	0.570	50.0

L980648-01 Original Sample (OS) • Duplicate (DUP)

(OS) L980648-01 03/29/18 19:07 • (DUP) R3297737-4 03/29/18 19:47

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	62.3	70.1	1	11.8		15
Sulfate	ND	10.4	1	0.000		15

L981123-01 Original Sample (OS) • Duplicate (DUP)

(OS) L981123-01 03/29/18 21:48 • (DUP) R3297737-5 03/29/18 22:28

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	60.2	71.8	1	17.6	J3	15
Sulfate	77.4	64.1	1	18.7	P1	15

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3297737-2 03/29/18 17:06 • (LCSD) R3297737-3 03/29/18 17:20

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chloride	200	205	206	102	103	80.0-120			0.612	15
Sulfate	200	208	210	104	105	80.0-120			0.815	15

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.

ACCREDITATIONS & LOCATIONS

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1,6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1,4]	2006
Louisiana [1]	LA180010	Texas	T 104704245-17-14
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

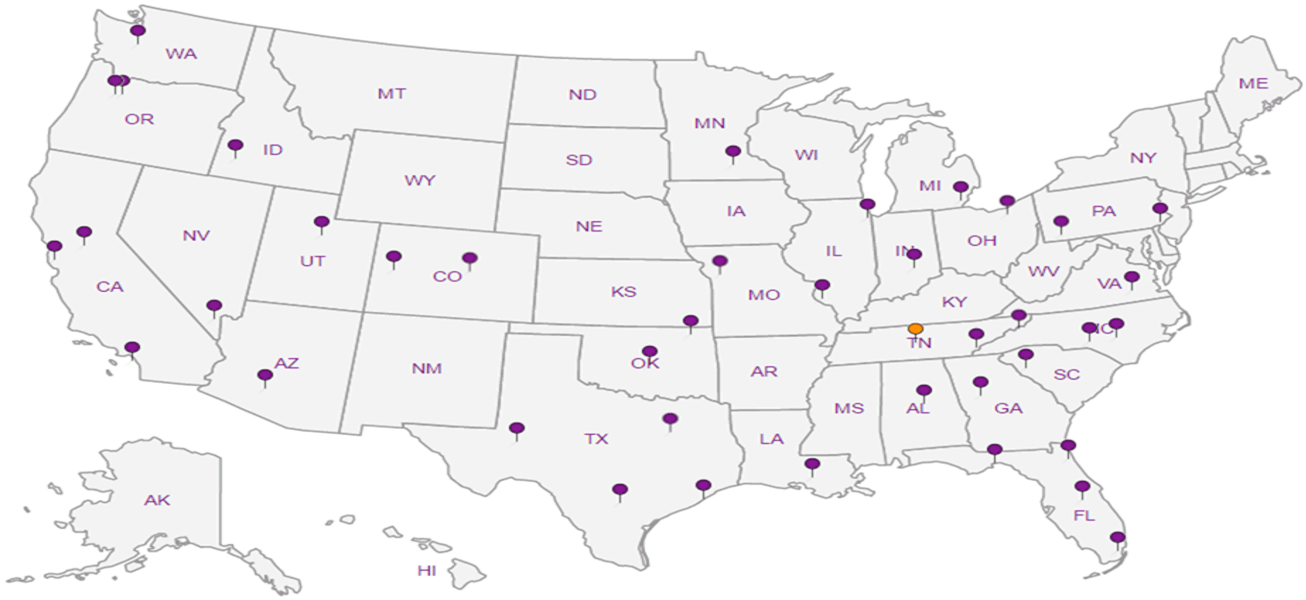
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. ESC Lab Sciences performs all testing at our central laboratory.



Soil Engineering Testing, Inc.

9530 James Ave. South
Bloomington, MN 55431

Billing Information:
John Whelan
9530 James Ave. South
Bloomington, MN 55431

Pres Chk

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

ESC
LAB SCIENCES
a subsidiary of Pace Analytical

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 980646

G128

Ta

Acctnum: **SOIENGBMN**
Template:
Prelogin:
TSR: **341 - John Hawkins**
PB:
Shipped Via:

Report to: John Whelan

Email To: jwhelan@soilengineeringtesting.com

Project Description: Bryn Mawr

City/State Collected:

Phone: 952-884-6833
Fax: 952-884-6923

Client Project # 11398

Lab Project #

Collected by (print):

Site/Facility ID #

P.O. #

Collected by (signature):

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Immediately Packed on Ice N X Y ___

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	SULFATE	CHLORIDE	Remarks	Sample # (lab only)
SB-2		SS	4.5-9	3/26/18	15:00	1	X	X		-01
SB-4		SS	6-10	↓	↓	1	X	X		-02

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other________

Remarks:

pH ______ Temp ______
Flow ______ Other ______

Samples returned via:
__ UPS __ FedEx __ Courier ______

Tracking # 4276 0145 0548

Sample Receipt Checklist
COC Seal Present/Intact: ✓ NP __Y __N
COC Signed/Accurate: ✓ Y __N
Bottles arrive intact: ✓ Y __N
Correct bottles used: ✓ Y __N
Sufficient volume sent: ✓ Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N

Relinquished by : (Signature) Br Daniel
Date: 3/26/18
Time: 15:00

Received by: (Signature)

Trip Blank Received: Yes / [✓ No]
HCL / MeoH
TBR

Relinquished by : (Signature)
Date:
Time:

Received by: (Signature)

Temp: Amb °C
Bottles Received: 2

If preservation required by Login: Date/Time

Relinquished by : (Signature)
Date:
Time:

Received for lab by: (Signature)

Date: 3.27.18
Time: 845

Hold:

Condition: NCF / [✓ OK]

Appendix D

Wetland Delineation Report

Wetland Delineation Report

Bryn Mawr Meadows Water Quality Improvement Project

Prepared for
Bassett Creek Watershed Management Commission

March 2018

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
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Wetland Delineation Report

March 2018

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1.0 Introduction

Bassett Creek Watershed Management Commission (BCWMC) is submitting a Wetland Delineation Report as part of a feasibility study for the Bryn Mawr Meadows Water Quality Improvement Project. The feasibility study area is approximately 64 acres and includes Bryn Mawr Meadows Park (Park) and other Minneapolis Park & Recreation Board (MPRB) properties; a portion of the Minneapolis Impound Lot maintained by the Minneapolis Public Works Department; a linear railroad section of property owned by Burlington Northern Inc. and Chicago & Northwestern railroad companies (Railroad); and other privately owned commercial and industrial properties. The feasibility study area is located in Section 28 of Township 29 North, Range 24 West, Minneapolis, Hennepin County, Minnesota (**Figure 1**).

On October 20, 2017 Barr field delineated five wetlands (Wetlands 1, 2a, 2b, 3 and 4) within the Park. Portions of the feasibility study area located north of the railroad tracks were not investigated during the 2017 site visit. A portion of Bassett Creek is located along the northern boundary of the feasibility study area and was delineated by Barr on November 25, 2015 as a part of a separate study that examined the feasibility of restoring Bassett Creek stream reaches damaged by erosion or affected by sedimentation (Barr, 2016).

This Wetland Delineation Report was prepared in accordance with the U.S. Army Corps of Engineers 1987 Wetland Delineation Manual ("1987 Manual", USACE, 1987), the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (USACE, 2010) and the requirements of the Minnesota Wetland Conservation Act (WCA) of 1991. Barr delineated wetland boundaries and determined wetland types within the feasibility study area of the Park and along the south side of the Railroad on October 20, 2017.

This report includes a general environmental information section (Section 2.0), descriptions of the delineated wetlands (Section 3.0), and a discussion of regulations and the administering authorities (Section 4.0). The Tables section includes the precipitation data. The Figures section includes the Project Location Map, Topography Map, National Wetland Inventory (NWI), Public Waters Inventory (PWI), Soil Survey Map, and the Wetland Delineation Maps. **Appendix A** includes Wetland Data Forms, and **Appendix B** includes site photographs.

2.0 General Environmental Setting

2.1 Site Description

The feasibility study area is located on property owned by the MPRB, Minneapolis Public Works Department, Burlington Northern Inc. and Chicago & Northwestern railroad companies, and other commercial and industrial properties. The feasibility study area is made up of maintained grassed recreational areas that contain interlinking walking paths and parking area to the south; broadleaf deciduous forest lands along the Railroad corridor, Bassett Creek, and within portions of city and private property to the north; and paved parking impoundment area on the northeast end. Medium density housing is located to the west and north of the feasibility study area, and commercial/industrial area is located to the south and east (**Figure 1**).

2.2 Topography

The majority of the feasibility study area maintains a flat topography in recreational and parking lot areas. Forested areas located in the central and northern regions of the feasibility study area have more moderate undulations with steeper slopes along ditches adjacent to Railroad bed and leading into Bassett Creek and wetland areas (**Figure 2**).

2.3 Precipitation

Recent precipitation data were compared to historic data for evaluating annual and monthly deviations from normal conditions. Simulated precipitation data were obtained from the Minnesota Climatology Working Group, Wetland Delineation Precipitation Data Retrieval from a Gridded Database (http://climate.umn.edu/gridded_data/precip/wetland/wetland.asp) for wetlands in Hennepin County, Township 29N North, Range 24 West, Section 28.

In 2017, antecedent moisture conditions were within the normal range based on precipitation for the three months prior to the October 20, 2017 site visit. These data were obtained from a provisional value derived from radar-based estimates (**Table 1**). The warm season, annual, and water year totals have varied between normal and wet for the six years prior to 2017 (**Table 2**).

2.4 National Wetland Inventory

The National Wetland Inventory (NWI) has identified one riverine wetland (Bassett Creek) along the northern boundary of the feasibility study area (**Figure 3**). This portion of Bassett Creek within the feasibility study area was also delineated by Barr on November 25, 2015 (Barr, 2016).

2.5 Water Resources

The Minnesota Department of Natural Resources (MnDNR) Public Waters Inventory (PWI) has identified Bassett Creek as a public water watercourse (**Figure 4**). Bassett Creek is identified by the Minnesota Pollution Control Agency (MPCA) as an impaired water because of the presence of chlorides and fish bioassessment results, with aquatic life as its affected use. Fecal Coliform is also noted as a pollutant with aquatic recreation as the affected use.

2.6 Soil Resources

Soil information located within the feasibility study area and in surrounding areas was obtained from the Natural Resources Conservation Service SSURGO Database (USDA, 2017b) (**Figure 5**). Six soil map units were identified within the feasibility study area:

- Urban land-Bygland, map >25, complex, 1 to 6 percent slopes (D28B)
- Urban land-Lester complex, 2 to 18 percent slopes (L52C)
- Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes (U1A)
- Udorthents, wet substratum, 0 to 2 percent slopes (U2A)
- Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes, rarely flooded (U5A)
- Urban land-Udorthents (cut and fill land) complex, 0 to 6 percent slopes (U6B)

Other soil map units in areas surrounding the feasibility study area include:

- Seelyeville and Markey soils, ponded, 0 to 1 percent slopes (D16A)
- Urban land-Duelm complex, 0 to 2 percent slopes (D31A)
- Urban land-Dorset complex, 8 to 18 percent slopes (D33C)
- Sandberg loamy coarse sand, 6 to 30 percent slopes (D8E)
- Urban land-Lester complex, 18 to 35 percent slopes (L52E)
- Urban land-Moon complex, 2 to 8 percent slopes (L53B)
- Urban land-Dundas complex, 0 to 3 percent slopes (L54A)
- Urban land-Malardi complex, 0 to 8 percent slopes (L55B)
- Udorthents (cut and fill land), 0 to 6 percent slopes (U3B)
- Urban land-Udipsamments (cut and fill land) complex, 0 to 2 percent slopes (U4A)
- Water (W) (identified on the soil survey map but not a soil unit)

There are no hydric soils mapped within the feasibility study area. Seelyeville and Markey soils, ponded is the only hydric soil map unit located in the vicinity of the feasibility study area, approximately 0.12 miles away.

3.0 Wetland Delineation

3.1 Wetland Delineation and Classification Methods

Wetlands within the feasibility study area were delineated and classified during a site visit on October 20, 2017. The wetland delineation was established according to the Routine On-Site Determination Method specified in the U.S. Army Corps of Engineers Wetlands Delineation Manual (1987 Edition) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (USACE, 2010).

The delineated wetland boundaries and sample points were surveyed using a Global Positioning System (GPS) with sub-meter accuracy (**Figures 6, 7 & 8**).

Wetlands were classified using the U.S. Fish and Wildlife Service (USFWS) Cowardin System (Cowardin et al., 1979), the USFWS Circular 39 system (Shaw and Fredine, 1956), and the Eggers and Reed Wetland Classification System (Eggers and Reed, 1977).

Soil borings were placed in and around each wetland, to a depth of at least 20 inches below the ground surface where possible. Representative soil samples from each boring were examined for the presence of hydric soil indicators using Version 8.1 of the Natural Resources Conservation Service (NRCS) Field Indicators of Hydric Soils in the United States guide (USDA, 2017a). Soil colors (e.g., 7.5YR 4/2, etc.) were determined using a Munsell® soil color chart and noted on the Wetland Data Forms **Appendix A**.

Hydrologic conditions were evaluated at each soil boring or sampling location, and this information was also noted on the Wetland Data Forms. The dominant plant species were identified, and the corresponding wetland indicator status of each plant species was determined and noted on the Wetland Data Forms (**Appendix A**). Photographs taken at the time of the site visit are provided in **Appendix B**.

3.2 Wetland Descriptions

Five wetlands were delineated within the feasibility study area of the Park and along the Railroad. See **Figure 6** for an overview of the five delineated wetlands. Wetlands 1 and 4 are depicted in greater detail on **Figure 7**, and Wetlands 2a, 2b and 3 are depicted in greater detail on **Figure 8**. Areas within the feasibility study area located north of the Railroad were not investigated for wetlands during the site visit on October 20, 2017. Descriptions and assessments of each wetland are provided below, with representative photographs in **Appendix B**.

Prior to the site visit aerial photos were reviewed to determine if areas within the Park or Railroad had wetland signature. Areas that appeared to have hydrophytic or drowned out vegetation were investigated in the field along with areas that appeared to be inundated or saturated. Most of the areas that were field investigated due to the appearance of wetland signature were dry with dead vegetation. Surface soils in these areas were mostly clays with coarse sandy clay subsoils, so the appearance of wetland signature is likely indicative of temporary ponding after a rain event. Also, vegetation observed in these areas is dominated by Kentucky bluegrass that appears to be regularly manicured. See Photos 11 and 12 in **Appendix B** which are representative of two wetland signature areas investigated on October 20, 2017.

It is acknowledged that the feasibility study area was likely wetland during pre-settlement times. Residential development began in the 1920's and continued to the 1950's, with urban features developed atop fill. An urbanized setting is now the normal state of the feasibility study area, and wetlands were delineated based on the current setting and field conditions.

3.2.1 Wetland 1

Wetland 1 is a 0.05 acre Type 2/3 (PEMB/C), wet meadow/shallow marsh located in the southwest section of the Park in a flat area utilized for sporting activities such as baseball and soccer (**Figure 7**). Wetland 1 is dominated by narrow-leaf cattail (*Typha angustifolia*), common duckweed (*Lemna minor*), Kentucky bluegrass (*Poa pratensis*), and blunt spikerush (*Eleocharis obtusa*). Hydrology within Wetland 1 ranges from surface saturation in the wet meadow community to 3 inches of inundation in the shallow marsh community. Surrounding uplands in this area and throughout the Park are dominated by Kentucky bluegrass.

Primary indicators of hydrology at Wetland Sample Point 1 (1-W) included high water table (A2) and saturation (A3). Secondary indicators of hydrology included geomorphic position (D2) and a positive FAC-Neutral test (D5).

Soils mapped at 1-W and throughout Wetland 1 were identified as Udorthents, wet substratum, 0 to 2 percent slopes (U2A). Sampled soils were black N2.5/0 clay loams with 10 percent grayish brown 10YR 5/2 depletions down to 18 inches. At 18 inches soils transitioned to very dark gray 10YR 3/1 clays with 10 percent dark yellowish brown 10YR 3/4 redox concentrations down to 28 inches. The hydric soil indicator at 1-W was determined to be depleted dark surface (F7).

The transition to upland was defined by the lack of hydrology indicators. Dominant vegetation at Upland Sample Point 1 (1-U) was mown Kentucky bluegrass, which has a wetland status of facultative making it hydrophytic. Soils identified at 1-U were hydric with a redox dark surface indicator (F6).

3.2.2 Wetlands 2a & 2b

Wetland 2a (0.06 acre) and Wetland 2b (0.20 acre) are Type 4 (PEMFd) deep marsh ditches located in the north-central portion of the feasibility study area and are directly connected via a culvert (**Figure 8**). Both wetlands were inundated from 6 to 24 inches and had a dominance of common duckweed. Eastern cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsyvanica*), and European buckthorn (*Rhamnus cathartica*) were present along upland areas adjacent to both wetlands. One representative sample transect was collected for both wetlands because they are hydrologically connected and have the same wetland types.

Primary indicators of hydrology observed at Wetland Sample Point 2B (2B-W) were high water table (A2) and saturation (A3). Secondary indicators of hydrology present included geomorphic position (D2) and a positive FAC-Neutral test (D5).

Soils mapped at 2B-W were identified as Udorthents, wet substratum, 0 to 2 percent slopes (U2A). Soils mapped throughout Wetland 2 were made up of both Udorthents, wet substratum, 0 to 2 percent slopes (U2A), mostly on the southern side; and Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes, rarely flooded (U5A), mostly on the northern side. Sampled soils at 2B-W were black 10YR 2/1 sandy clay loams down to 8 inches. Matrix color starting at 8 inches became very dark gray 10YR 3/1 down to 27 inches. Sandy loam textures with 30 percent 10YR 3/4 redox concentrations occurred between 8 and 15 inches, and loamy sand textures occurred between 15 and 27 inches without redox features. The hydric soil indicator at 2B-W is redox dark surface (F6).

The transition to upland was defined by the lack of hydrology and hydric soil indicators. Dominant vegetation at Upland Sample Point 2B (2B-U) was European buckthorn in both the herbaceous layer and the shrub layer, which has a status of facultative in the Midwest region making it hydrophytic.

3.2.3 Wetland 3

Wetland 3 is a narrow 0.06 acre Type 2/3 (PEMB/Cd), fresh wet meadow/shallow marsh ditch located along the eastern edge of the feasibility study area (**Figure 8**). Wetland 3 is dominated by common duckweed and reed canary grass (*Phalaris arundinacea*). At the time of the site visit, Wetland 3 was inundated with 3 to 8 inches of water and is approximately 5 to 10 feet wide. Surrounding uplands are dominated by a shrub and herbaceous layer of European buckthorn and green ash (*Fraxinus pennsylvanica*) trees.

Primary indicators of hydrology observed at Wetland Sample Point 3 (3-W) were surface water (A1), high water table (A2), and saturation (A3). Secondary indicators of hydrology present included geomorphic position (D2) and a positive FAC-Neutral test (D5).

Soils mapped at 3-W were identified as Udorthents, wet substratum, 0 to 2 percent slopes (U2A). Soils mapped throughout Wetland 3 were made up of mostly Udorthents, wet substratum, 0 to 2 percent slopes (U2A), with a small portion of Wetland 3 on the northwest side mapped as Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes (U1A). Soils were not sampled for Wetland 3 since it is a narrow channel along the edge of the Park that may contain buried utilities.

The transition to upland was defined by the lack of hydrology. Dominant vegetation at Upland Sample Point 3 (3-U) was European buckthorn in both the herbaceous layer and the shrub layer, which has a status of facultative in the Midwest region making it hydrophytic.

3.2.4 Wetland 4

Wetland 4 is a 0.11 acre Type 3 (PEMCd), shallow marsh located along the southeastern edge of the feasibility study area (**Figure 7**). Wetland 4 is dominated by narrow-leaf cattail, reed canary grass, lakebank sedge (*Carex lacustris*), and common duckweed. At the time of the site visit, Wetland 4 was inundated with 2 to 12 inches of water and is approximately 1 to 5 feet wide. Surrounding uplands are made up of gravel pathway, and dominated by Kentucky bluegrass, common dandelion (*Taraxacum officinale*) and great plantain (*Plantago major*).

Primary indicators of hydrology observed at Wetland Sample Point 4 (4-W) were surface water (A1), high water table (A2), and saturation (A3). Secondary indicators of hydrology present included geomorphic position (D2) and a positive FAC-Neutral test (D5).

Soils mapped at 4-W and throughout Wetland 4 were identified as Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes (U1A). Soils were not sampled for Wetland 4 since it is a narrow channel along the edge of the Park that may contain buried utilities.

The transition to upland was defined by the lack of hydrology indicators. Dominant vegetation at Upland Sample Point 4 (4-U) was European buckthorn in both the herbaceous layer and the shrub layer, which has a status of facultative in the Midwest region making it hydrophytic.

4.0 Regulatory Overview

The USACE regulates the placement of dredge or fill materials into wetlands that are located adjacent to or are hydrologically connected to interstate or navigable waters under the authority of Section 404 of the Clean Water Act. If the USACE has jurisdiction over any portion of a project, they may also review impacts to wetlands under the authority of the National Environmental Policy Act.

Filling, excavating, and draining wetlands are also regulated by the Minnesota Wetland Conservation Act (WCA), and the Minnesota Public Waters Inventory Program, which are administered by the City of Minneapolis and the Minnesota Department of Natural Resources (DNR) respectively. The USACE, the City of Minneapolis, and the DNR should be contacted before altering any wetlands on the site. In addition, delineated wetland boundaries may be reviewed, if needed, by a Technical Evaluation Panel (TEP) consisting of representatives from the Minnesota Board of Water and Soil Resources, and Hennepin County. The MnDNR and the USACE may also be present at the TEP meeting if requested.

5.0 References

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Tables

Table 1
Antecedent Moisture Conditions Prior to October 20, 2017 Site Visit
Bryn Mawr Water Quality Improvement Project
Bassett Creek Watershed Management Commission

Precipitation Worksheet Using Gridded Database

Precipitation data for target wetland location:

County: Ramsey
Township Number: 29N
Township Name: unnamed
Range Number: 24W
Nearest Community: Calhoun Beach
Section Number: 28

Aerial photograph or site visit date:
Friday, October 20, 2017

Score using 1981-2010 normal period

(value are in inches)	first prior month: **September 2017**	second prior month: **August 2017**	third prior month: **July 2017**
estimated precipitation total for this location:	1.44R*	6.65R*	3.22R*
there is a 30% chance this location will have less than:	2.3	3.56	2.76
there is a 30% chance this location will have more than:	3.96	5.04	5.22
type of month: **dry** **normal** **wet**	**dry**	**wet**	**normal**
monthly score	**3 * 1 = 3**	**2 * 3 = 6**	**1 * 2 = 2**
multi-month score: 6 to 9 (**dry**) 10 to 14 (**normal**) 15 to 18 (**wet**)	11 (**normal**)		

* A 'R' following a monthly total indicates a provisional value derived from radar-based estimates.

Table 2
Precipitation in Comparison to WETS Data
Bryn Mawr Water Quality Improvement Project
Bassett Creek Watershed Management Commission

Precipitation data for target wetland location:

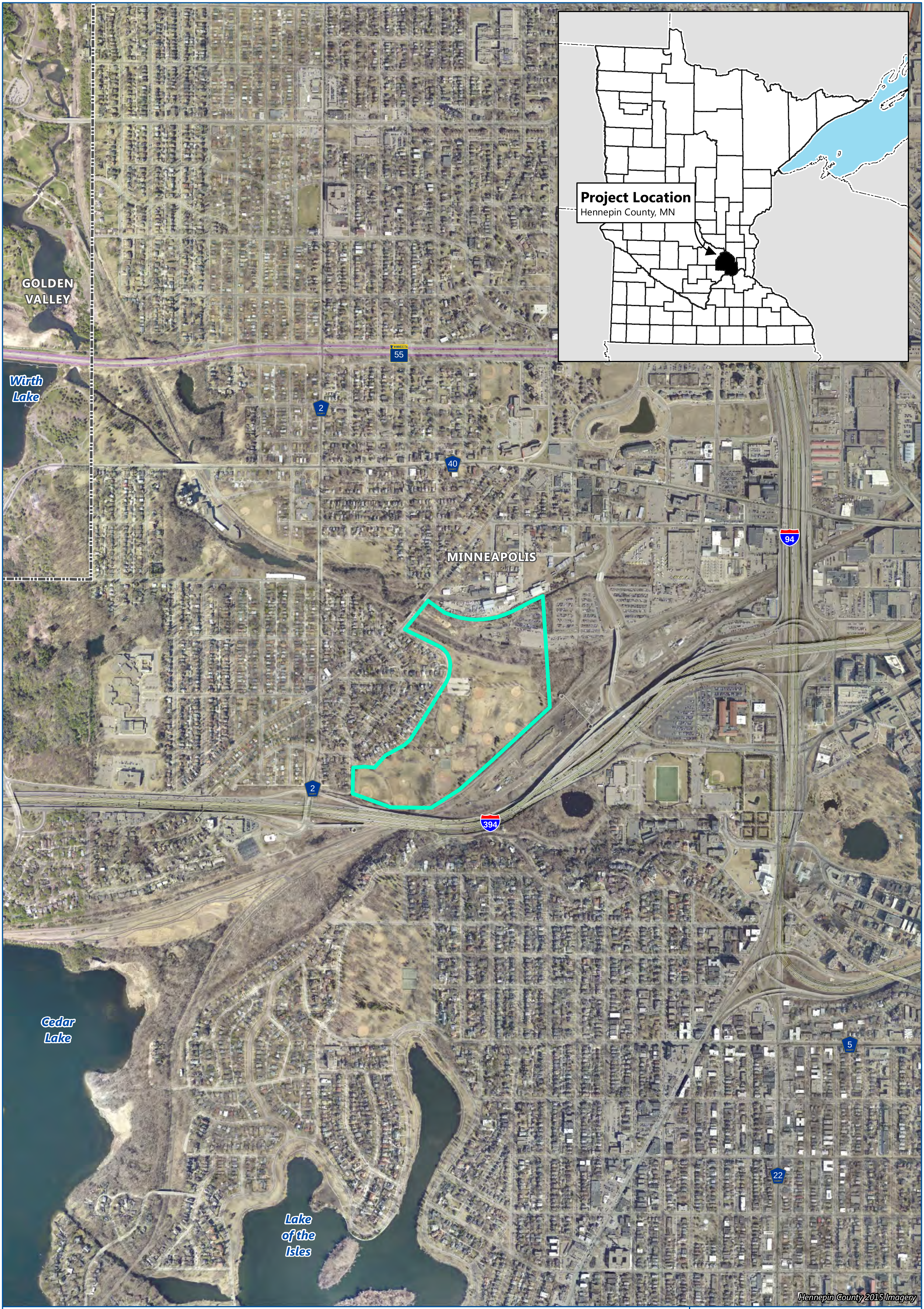
County: Ramsey	**Township Number**: 29N
Township Name: unnamed	**Range Number**: 24W
Nearest Community: Calhoun Beach	**Section Number**: 28

Precipitation Totals are in Inches	
Color Key	**Multi-month Totals**:
total is in lowest 30th percentile of the period-of-record distribution	**WARM** = warm season (May thru September)
total is => 30th and <= 70th percentile	**ANN** = calendar year (January thru December)
total is in highest 30th percentile of the period-of-record distribution	**WAT** = water year (Oct. previous year thru Sep. present year)

Period-of-Record Summary Statistics															
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*WARM*	*ANN*	*WAT*
30%	0.52	0.48	1.10	1.70	2.54	3.09	2.34	2.51	1.95	1.24	0.70	0.56	16.19	26.06	26.05
70%	1.03	1.12	2.01	2.99	4.20	5.33	4.67	4.48	3.73	2.64	1.87	1.36	21.25	32.24	31.94
mean	0.88	0.88	1.65	2.44	3.61	4.44	3.81	3.67	3.04	2.23	1.54	1.04	18.57	29.17	29.24
1981-2010 Summary Statistics															
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*WARM*	*ANN*	*WAT*
30%	0.54	0.42	1.39	2.20	2.65	3.41	2.76	3.56	2.30	1.37	1.09	0.70	18.06	30.23	28.44
70%	1.21	0.97	2.10	3.12	4.14	5.29	5.22	5.04	3.96	3.62	2.22	1.58	22.22	34.84	36.66
mean	0.91	0.79	1.91	2.87	3.62	4.55	4.46	4.23	3.43	2.63	1.88	1.25	20.29	32.52	32.33
Year-to-Year Data															
Year	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*WARM*	*ANN*	*WAT*
2017	0.92	0.79	0.75	3.75	6.31	3.47	3.22R*	6.65R*	1.44R	5.59R*	---	---	21.09	---	35.61
2016	0.33	0.87	1.89	4.00	1.84	4.04	4.68	10.03	5.40	3.14	2.76	2.41	25.99	41.39	42.40
2015	0.33	0.31	0.71	2.28	4.54	3.91	6.72	3.04	3.69	2.77	4.32	2.23	21.90	34.85	28.90
2014	1.07	1.32	0.77	6.61	3.90	10.26	2.95	2.61	2.23	1.22	1.13	1.02	21.95	35.09	37.99
2013	0.86	1.19	1.96	4.52	5.45	7.19	4.11	2.16	1.24	4.15	0.63	1.49	20.15	34.95	32.51
2012	0.60	1.84	1.60	3.14	8.97	3.56	5.01	1.61	0.37	1.32	0.95	1.56	19.52	30.53	28.84
2011	0.98	1.12	2.51	3.21	5.00	4.62	7.05	4.05	0.63	0.97	0.26	0.91	21.35	31.31	36.24
2010	0.66	0.78	0.89	2.21	2.72	6.70	4.79	6.85	6.10	1.92	1.77	3.38	27.16	38.77	40.77
2009	0.56	1.17	1.64	1.74	0.35	3.24	1.23	6.61	0.58	6.07	0.53	2.47	12.01	26.19	21.89
2008	0.16	0.56	2.02	4.11	2.50	3.66	2.06	2.41	2.14	1.77	1.39	1.61	12.77	24.39	26.64
2007	0.74	1.62	3.66	2.07	3.03	1.90	2.35	6.56	5.65	4.95	0.11	1.96	19.49	34.60	31.33
2006	1.03	0.39	1.78	3.77	2.99	3.50	2.61	7.12	2.80	0.56	1.06	2.13	19.02	29.74	34.20
2005	1.36	1.12	1.22	2.83	3.31	5.28	3.22	4.16	6.18	5.10	1.72	1.39	22.15	36.89	33.99
2004	0.53	1.63	2.30	3.00	6.10	3.48	4.31	1.37	4.69	3.67	1.11	0.53	19.95	32.72	30.48
2003	0.38	0.90	1.78	2.79	5.95	7.82	1.91	0.50	1.96	0.91	1.18	0.98	18.14	27.06	28.61
2002	0.50	0.62	2.13	3.78	3.32	8.48	5.55	6.08	3.89	4.25	0.07	0.30	27.32	38.97	39.17
2001	1.34	1.48	1.09	7.48	5.68	5.31	2.28	2.43	4.13	1.00	3.13	0.69	19.83	36.04	38.16
2000	1.00	1.16	1.22	1.31	4.35	3.95	6.92	3.83	3.35	1.22	4.15	1.57	22.40	34.03	28.92
1999	1.51	0.33	2.00	3.69	6.89	5.21	5.51	3.78	3.02	0.65	0.81	0.37	24.41	33.77	36.77
1998	1.53	0.62	3.58	2.22	4.40	4.69	2.82	4.71	1.04	2.68	1.66	0.49	17.66	30.44	28.82

* A 'R' following a monthly total indicates a provisional value derived from radar-based estimates.

Figures



🟩 Feasibility Study Area

N

0 1,000 2,000
Feet

PROJECT LOCATION MAP
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 1

Barr Footer: ArcGIS 10.4.1, 2018-02-28 08:46 File: I:\Client\BassettCreek\Work_Orders\2017\Bryn_Mawr\Maps\Wetland_Delineation\Figure 2 - Topography.mxd User: rcs2

🟩 Feasibility Study Area

Public Water Inventory Watercourses

LiDAR Ground Surface Elevation Contours (Spring/Fall 2011)

10 ft Contour

Railroad

N

0 500 1,000

Feet

TOPOGRAPHY
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 2

🟩 Feasibility Study Area

〜 Public Water Inventory Watercourses

Wetlands (MN DNR NWI East Central Update)

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine

N

0 500 1,000

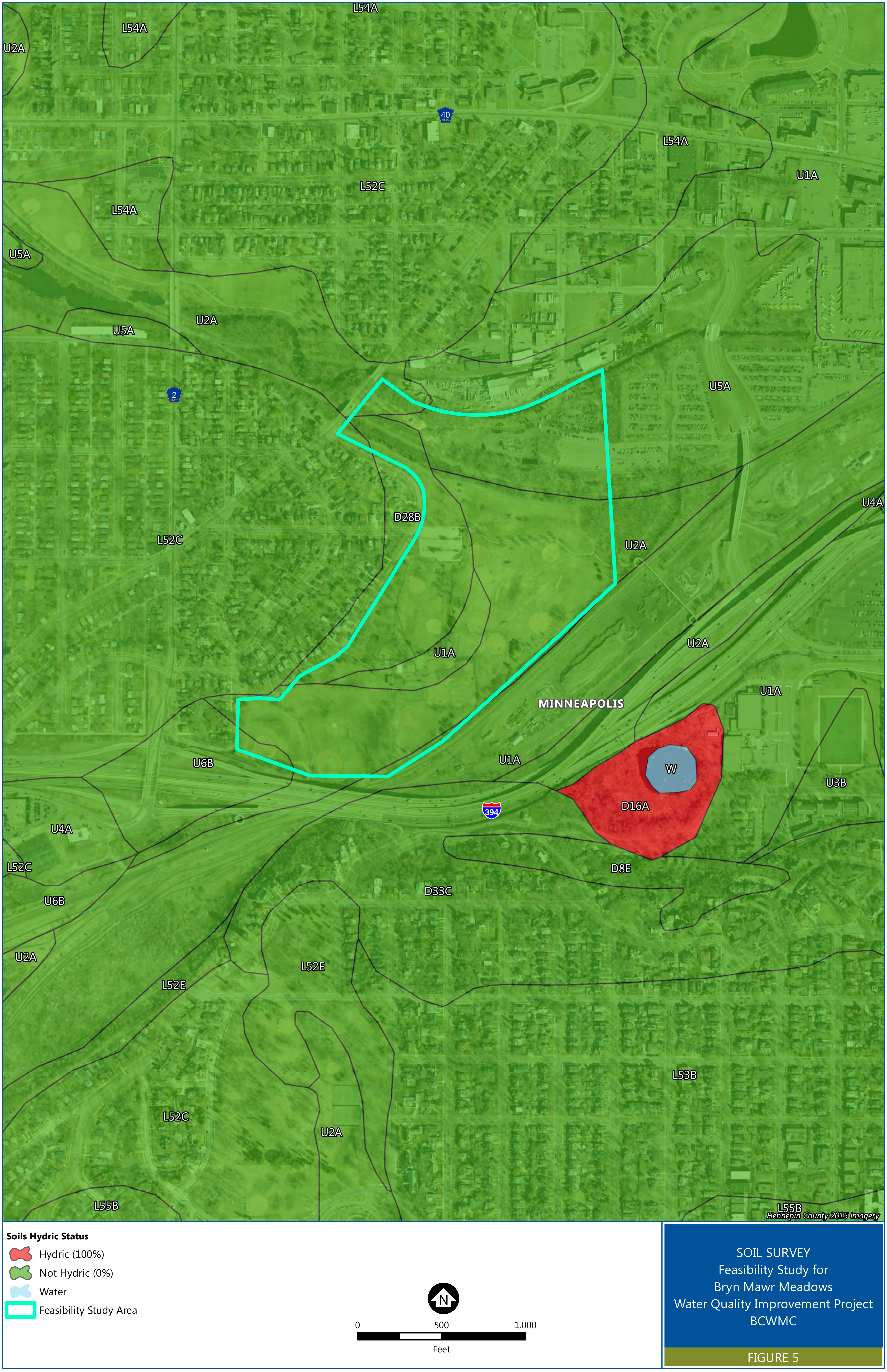
Feet

NATIONAL WETLANDS INVENTORY
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 3

PUBLIC WATERS INVENTORY
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 4



Soils Hydric Status

🟥 Hydric (100%)

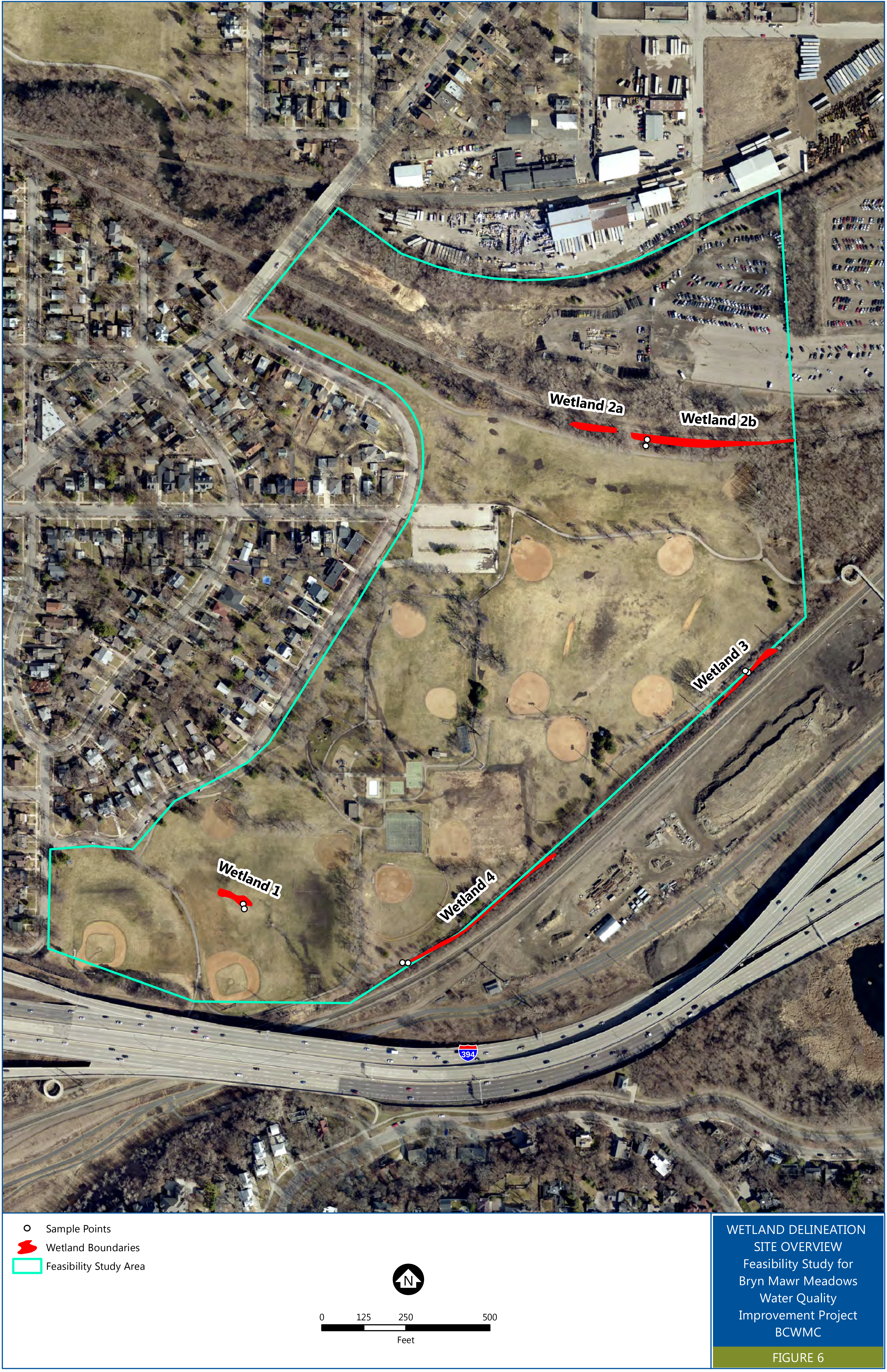
🟩 Not Hydric (0%)

🟦 Water

▭ Feasibility Study Area

SOIL SURVEY
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 5



WETLAND DELINEATION
SITE OVERVIEW
Feasibility Study for
Bryn Mawr Meadows
Water Quality
Improvement Project
BCWMC

FIGURE 6

WETLAND DELINEATION
WETLANDS 1 & 4
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 7

WETLAND DELINEATION
WETLANDS 2a, 2b & 3
Feasibility Study for
Bryn Mawr Meadows
Water Quality Improvement Project
BCWMC

FIGURE 8

Appendix A

Wetland Data Forms

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 1-U
Land Form: Flat
Local Relief: None
Slope %: 0
Soil Map Unit Name: Udorthents, wet sub, 0 to 2% slopes
Subregion (LRR): M
Latitude: 4979754
Longitude: 475979
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: Upland
Circular 39 Classification: Upland
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Eggers & Reed (primary): Upland
Are vegetation No Soil No Hydrology No significantly disturbed?
Are "normal circumstances" present? Yes
Eggers & Reed (secondary): N/A
Eggers & Reed (tertiary): N/A
Are vegetation No Soil No Hydrology No naturally problematic?
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Indicators of wetland hydrology present? No
Is the sampled area within a wetland? No
General Remarks (explain any answers if needed):
If yes, optional Wetland Site ID: Upland

VEGETATION

Tree Stratum (Plot Size: 30 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

Herb Stratum (Plot Size: 5 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.	Poa pratensis	70	Yes	FAC
2.	Plantago major	10	No	FAC
3.	Taraxacum officinale	10	No	FACU
4.	Trifolium pratense	10	No	FACU
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	100		

Woody Vine Stratum (Plot Size: 30 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
	Total Cover:	0		

% Bare Ground in Herb Stratum:
% Sphagnum Moss Cover:

Vegetation Remarks: (include photo numbers here or on a separate sheet)

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	0	0
Herb Stratum	20	50
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

	Total % Cover of:		Multiply by:	
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	80	X 3	240	
FACU Species	20	X 4	80	
UPL Species	0	X 5	0	
Column Totals:	**100**	(A)	**320**	(B)

Prevalence Index = B/A = **3.20**

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
No	Prevalence Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 1-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 10	10YR 2/1	95	10YR 3/4	5	C	M	sandy clay loam	
2.	10 - 16	10YR 3/4	100					loamy sand	
3.	16 - 24	10YR 2/1	86	7.5YR 4/4	2	C	M	clay/sand mix	
4.	-			5GY 5/1 gley	2	C	M		
5.	-			10YR 4/3	10	C	M		
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** ______

Hydric soil present? Yes

Soil Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Surface Water Depth (inches): ______

Water table present? ☐ Water Table Depth (inches): ______

Saturation present? (includes capillary fringe) ☑ Saturation Depth (inches): 18

Indicators of wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

1/17/2018 7:40:23 PM

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 1-W
Land Form: Depression
Local Relief: Concave
Slope %: 1
Soil Map Unit Name: Udorthents, wet sub, 0 to 2% slopes
Subregion (LRR): M
Latitude: 4979758
Longitude: 475978
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: PEMB/C
Circular 39 Classification: Type 2/3
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Eggers & Reed (primary): Fresh (Wet) Meadow
Are vegetation No Soil No Hydrology No significantly disturbed?
Are "normal circumstances" present? Yes
Eggers & Reed (secondary): Shallow Marsh
Eggers & Reed (tertiary): N/A
Are vegetation No Soil No Hydrology No naturally problematic?
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Indicators of wetland hydrology present? Yes
Is the sampled area within a wetland? Yes
General Remarks (explain any answers if needed):
If yes, optional Wetland Site ID: Wetland 1

VEGETATION

Tree Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

Herb Stratum (Plot Size: 5 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.	Typha angustifolia	40	Yes	OBL
2.	Eleocharis obtusa	30	Yes	OBL
3.	Lemna minor	30	Yes	OBL
4.	Poa pratensis	10	No	FAC
5.	Echinochloa crus-galli	5	No	FACW
6.		0		
7.		0		
8.		0		
	Total Cover:	115		

Woody Vine Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
	Total Cover:	0		

% Bare Ground in Herb Stratum: ____
% Sphagnum Moss Cover: ____

Vegetation Remarks: (include photo numbers here or on a separate sheet)

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	0	0
Herb Stratum	23	57.5
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**3**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:		
OBL Species	100	X 1	100	
FACW Species	5	X 2	10	
FAC Species	10	X 3	30	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**115**	(A)	**140**	(B)
Prevalence Index = B/A =			**1.22**	

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevalence Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 1-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 18	N 2.5/0	90	10YR 5/2	10	D	M	clay loam	
2.	18 - 28	10YR 3/1	90	10YR 3/4	10	C	M	clay	
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☑ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** ______

Hydric soil present? Yes

Soil Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☑ FAC-Neutral Test (D5)

Field Observations:

Surface water present?	☐	Surface Water Depth (inches):	
Water table present?	☑	Water Table Depth (inches):	11
Saturation present? (includes capillary fringe)	☑	Saturation Depth (inches):	0

Indicators of wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 2B-U
Land Form: Toeslope
Local Relief: Concave
Slope %: 1
Soil Map Unit Name: See Summary Remarks
Subregion (LRR): M
Latitude: 4980179
Longitude: 476344
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: Upland
Circular 39 Classification: Upland
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Are vegetation No Soil No Hydrology No significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes
Eggers & Reed (primary): Deep Marsh
Eggers & Reed (secondary): N/A
Eggers & Reed (tertiary): N/A
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? No
Indicators of wetland hydrology present? No
Is the sampled area within a wetland? No

General Remarks (explain any answers if needed): -Soil Map Unit Name: Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes, rarely flooded.

If yes, optional Wetland Site ID: Upland

VEGETATION

Tree Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.	Rhamnus cathartica	15	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	15		

Herb Stratum (Plot Size: 5 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.	Rhamnus cathartica	5	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	5		

Woody Vine Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
	Total Cover:	0		

% Bare Ground in Herb Stratum: 95
% Sphagnum Moss Cover:

Vegetation Remarks: (include photo numbers here or on a separate sheet)

50/20 Thresholds:

	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	3	7.5
Herb Stratum	1	2.5
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	0	X 1	0
FACW Species	0	X 2	0
FAC Species	20	X 3	60
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	**20** (A)		**60** (B)

Prevalence Index = B/A = **3.00**

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevalence Index **≤ 3.0 [1]**
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 2B-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 10	10YR 2/1	100					sandy loam	
2.	10 - 18	10YR 3/2	90	10YR 3/4	10	C	M	sandy loam	
3.	18 - 30	10YR 3/2	98	10YR 3/4	2	C	M	loamy sand	
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ 2 cm Muck (A10)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ 5 cm Mucky Peat or Peat (S3)

☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ Coast Prairie Redox (A16)
☐ Dark Surface (S7)
☐ Iron-Manganese Masses (F12)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** ______

Hydric soil present? No

Soil Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ True Aquatic Plants (B14)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Gauge or Well Data (D9)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Surface Water Depth (inches): ______
Water table present? ☐ Water Table Depth (inches): ______
Saturation present? (includes capillary fringe) ☑ Saturation Depth (inches): 20

Indicators of wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 2B-W
Land Form: Hillslope
Local Relief: Concave
Slope %: 2
Soil Map Unit Name: See Summary Remarks
Subregion (LRR): M
Latitude: 4980173
Longitude: 476343
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: PEMFd
Circular 39 Classification: Type 4
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Are vegetation No Soil No Hydrology No significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes
Eggers & Reed (primary): Deep Marsh
Eggers & Reed (secondary): N/A
Eggers & Reed (tertiary): N/A
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Indicators of wetland hydrology present? Yes
Is the sampled area within a wetland? Yes
If yes, optional Wetland Site ID: Wetland 2B

General Remarks (explain any answers if needed):

-Soil Map Unit Name: Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes, rarely flooded.

-Wetlands 2A and 2B are separated by a culvert. A sample point was not collected for Wetland 2A.

VEGETATION

Tree Stratum (Plot Size: 30 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

Herb Stratum (Plot Size: 5 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.	Lemna minor	15	Yes	OBL
2.	Rhamnus cathartica	2	No	FAC
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	17		

Woody Vine Stratum (Plot Size: 30 ft)		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
	Total Cover:	0		

% Bare Ground in Herb Stratum: 98
% Sphagnum Moss Cover:

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	0	0
Herb Stratum	3.4	8.5
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:		
OBL Species	15	X 1	15	
FACW Species	0	X 2	0	
FAC Species	2	X 3	6	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**17**	(A)	**21**	(B)

Prevalence Index = B/A = **1.24**

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevalence Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Vegetation Remarks: (include photo numbers here or on a separate sheet)

Sample point 2B-W was positioned near the edge of the inundated portionWetland 2B. Duckweed was present on the surface of the water as well as areas that were not inundated surrounding the borehole.

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 2B-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 8	10YR 2/1	100					sandy clay loam	
2.	8 - 15	10YR 3/1	70	10YR 3/4	30	C	M	sandy loam	
3.	15 - 27	10YR 3/1	100					loamy sand	
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** ______

Hydric soil present? Yes

Soil Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☑ FAC-Neutral Test (D5)

Field Observations:

Surface water present?	☐	Surface Water Depth (inches):	
Water table present?	☑	Water Table Depth (inches):	10
Saturation present? (includes capillary fringe)	☑	Saturation Depth (inches):	5

Indicators of wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

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WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17

Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 3-U

Land Form: Hillslope
Local Relief: Concave
Slope %: 3
Soil Map Unit Name: Udorthents, wet sub, 0 to 2% slopes

Subregion (LRR): M
Latitude: 4979969
Longitude: 476433
Datum: UTM Nad 83 Zone 15N

Cowardin Classification: Upland
Circular 39 Classification: Upland
Mapped NWI Classification: Upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation No Soil No Hydrology No significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary): N/A
Eggers & Reed (tertiary): N/A
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? NA
Indicators of wetland hydrology present? No
Is the sampled area within a wetland? No

General Remarks (explain any answers if needed):

If yes, optional Wetland Site ID:

VEGETATION

Tree Stratum (Plot Size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.	0		
2.	0		
3.	0		
4.	0		
Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Rhamnus cathartica	15	Yes	FAC
2.	0		
3.	0		
4.	0		
5.	0		
Total Cover:	15		

Herb Stratum (Plot Size: 5 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Rhamnus cathartica	10	Yes	FAC
2. Laportea canadensis	2	No	FACW
3.	0		
4.	0		
5.	0		
6.	0		
7.	0		
8.	0		
Total Cover:	12		

Woody Vine Stratum (Plot Size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.	0		
2.	0		
Total Cover:	0		

% Bare Ground in Herb Stratum:

% Sphagnum Moss Cover:

Vegetation Remarks: (include photo numbers here or on a separate sheet)

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	3	7.5
Herb Stratum	2.4	6
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**2**	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	0	X 1	0
FACW Species	2	X 2	4
FAC Species	25	X 3	75
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	**27** (A)		**79** (B)

Prevalence Index = B/A = **2.93**

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevalence Index **≤ 3.0 [1]**
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

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WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 3-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
1.	-								
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** ______

Hydric soil present? NA

Soil Remarks: Soils were not sampled for Wetland 3 since it is a narrow channel along the edge of the Bryn Mawer Meadows Park property that may have buried utilities.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☑ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Surface Water Depth (inches): ______

Water table present? ☐ Water Table Depth (inches): ______

Saturation present? (includes capillary fringe) ☐ Saturation Depth (inches): ______

Indicators of wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks: No primary indicators of hydrology were observed.

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WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 3-W
Land Form: Toeslope
Local Relief: Concave
Slope %: 0
Soil Map Unit Name: Udorthents, wet sub, 0 to 2% slopes
Subregion (LRR): M
Latitude: 4979968
Longitude: 476436
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: PEMB/Cd
Circular 39 Classification: Type 2/3
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Eggers & Reed (primary): Fresh (Wet) Meadow
Are vegetation No Soil No Hydrology No significantly disturbed?
Are "normal circumstances" present? Yes
Eggers & Reed (secondary): Shallow Marsh
Eggers & Reed (tertiary): N/A
Are vegetation No Soil No Hydrology No naturally problematic?
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Indicators of wetland hydrology present? Yes
Is the sampled area within a wetland? Yes

General Remarks (explain any answers if needed):

If yes, optional Wetland Site ID: Wetland 3

VEGETATION

Tree Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

Herb Stratum (Plot Size: 5 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.	Lemna minor	10	Yes	OBL
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	10		

Woody Vine Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
	Total Cover:	0		

% Bare Ground in Herb Stratum:
% Sphagnum Moss Cover:

Vegetation Remarks: (include photo numbers here or on a separate sheet)

50/20 Thresholds:

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	0	0
Herb Stratum	2	5
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC: **1** (A)
Total Number of Dominant Species Across All Strata: **1** (B)
Percent of Dominant Species That Are OBL, FACW or FAC: **100.00%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	10	X 1	10
FACW Species	0	X 2	0
FAC Species	0	X 3	0
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	**10**	(A)	**10** (B)

Prevalence Index = B/A = **1.00**

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevalence Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 3-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	-								
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Dark Surface (S7)
- ☐ Iron-Manganese Masses (F12)
- ☐ Very Shallow Dark Surface (TF12)
- ☑ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** ______

Hydric soil present? Yes

Soil Remarks: Soils were not sampled for Wetland 3 since it is a narrow channel along the edge of the Bryn Mawer Meadows Park property that may have buried utilities. However Aquic conditions are assumed based on the dominance of obligate vegetation and primary indicators of hydrology.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Gauge or Well Data (D9)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☑ FAC-Neutral Test (D5)

Field Observations:

Surface water present?	☑	Surface Water Depth (inches):	6
Water table present?	☑	Water Table Depth (inches):	0
Saturation present? (includes capillary fringe)	☑	Saturation Depth (inches):	0

Indicators of wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

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WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 4-U
Land Form: Flat
Local Relief: None
Slope %: 0
Soil Map Unit Name: See Summary Remarks
Subregion (LRR): M
Latitude: 4979705
Longitude: 476122
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: Upland
Circular 39 Classification: Upland
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Eggers & Reed (primary): Upland
Eggers & Reed (secondary): N/A
Eggers & Reed (tertiary): N/A
Eggers & Reed (quaternary): N/A
Are vegetation No Soil No Hydrology No significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes
Hydric soil present?	NA
Indicators of wetland hydrology present?	No
Is the sampled area within a wetland?	No

General Remarks (explain any answers if needed):

If yes, optional Wetland Site ID:

VEGETATION

Tree Stratum (Plot Size: 30 ft)

	Absolute % Cover	Dominant Species?	Indicator Status
1.	0		
2.	0		
3.	0		
4.	0		
Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)

	Absolute % Cover	Dominant Species?	Indicator Status
1.	0		
2.	0		
3.	0		
4.	0		
5.	0		
Total Cover:	0		

Herb Stratum (Plot Size: 5 ft)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Poa pratensis	20	Yes	FAC
2. Taraxacum officinale	5	No	FACU
3. Plantago major	5	No	FAC
4.	0		
5.	0		
6.	0		
7.	0		
8.	0		
Total Cover:	30		

Woody Vine Stratum (Plot Size: 30 ft)

	Absolute % Cover	Dominant Species?	Indicator Status
1.	0		
2.	0		
Total Cover:	0		

% Bare Ground in Herb Stratum:
% Sphagnum Moss Cover:

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	0	0
Herb Stratum	6	15
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

	Total % Cover of:	Multiply by:	
OBL Species	0	X 1	0
FACW Species	0	X 2	0
FAC Species	25	X 3	75
FACU Species	5	X 4	20
UPL Species	0	X 5	0
Column Totals:	**30** (A)		**95** (B)

Prevalence Index = B/A = **3.17**

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
No	Prevalence Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Vegetation Remarks: (include photo numbers here or on a separate sheet)

Remaining area is gravel pathway.

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 4-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	-								
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ 2 cm Muck (A10)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ 5 cm Mucky Peat or Peat (S3)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ Coast Prairie Redox (A16)
☐ Dark Surface (S7)
☐ Iron-Manganese Masses (F12)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** **Depth (inches):**

Hydric soil present? NA

Soil Remarks: Soils were not sampled for Wetland 4 since it is a narrow channel along the edge of the Bryn Mawer Meadows Park property that may have buried utilities.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)
☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ True Aquatic Plants (B14)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Gauge or Well Data (D9)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ Surface Water Depth (inches):
Water table present? ☐ Water Table Depth (inches):
Saturation present? (includes capillary fringe) ☐ Saturation Depth (inches):

Indicators of wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks: No primary or secondary indicators of hydrology were observed.

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Bryn Mawr Water Quality Improvement Project
Applicant/Owner: BCWMC
City/County: Minneapolis/Hennepin
State: MN
Sampling Date: 10/20/17
Investigator(s): BKB
Section: 29
Township: 24
Range: 28
Sampling Point: 4-W
Land Form: Toeslope
Local Relief: Concave
Slope %: 1
Soil Map Unit Name: See Summary Remarks
Subregion (LRR): M
Latitude: 4979705
Longitude: 476127
Datum: UTM Nad 83 Zone 15N
Cowardin Classification: PEMCd
Circular 39 Classification: Type 3
Mapped NWI Classification: Upland
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Eggers & Reed (primary): Shallow Marsh
Are vegetation No Soil No Hydrology No significantly disturbed?
Are "normal circumstances" present? Yes
Eggers & Reed (secondary): N/A
Eggers & Reed (tertiary): N/A
Are vegetation No Soil No Hydrology No naturally problematic?
Eggers & Reed (quaternary): N/A

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes	General Remarks (explain any answers if needed):	Soil Map Unit: Urban land-Udorthents, wet substratum, complex, 0 to 2 percent slopes
Hydric soil present?	Yes		
Indicators of wetland hydrology present?	Yes		
Is the sampled area within a wetland?	Yes	If yes, optional Wetland Site ID:	Wetland 4

VEGETATION

Tree Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

Sapling/Shrub Stratum (Plot Size: 15 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

Herb Stratum (Plot Size: 5 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.	Typha angustifolia	15	Yes	OBL
2.	Phalaris arundinacea	5	Yes	FACW
3.	Carex lacustris	5	Yes	OBL
4.	Lemna minor	5	Yes	OBL
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	30		

Woody Vine Stratum (Plot Size: 30 ft)

		Absolute % Cover	Dominant Species?	Indicator Status
1.		0		
2.		0		
	Total Cover:	0		

% Bare Ground in Herb Stratum: ______
% Sphagnum Moss Cover: ______

Vegetation Remarks: (include photo numbers here or on a separate sheet)

50/20 Thresholds:	20%	50%
Tree Stratum	0	0
Sapling/Shrub Stratum	0	0
Herb Stratum	6	15
Woody Vine Stratum	0	0

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**4**	(A)
Total Number of Dominant Species Across All Strata:	**4**	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	25	X 1	25
FACW Species	5	X 2	10
FAC Species	0	X 3	0
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	**30**	(A)	**35** (B)

Prevalence Index = B/A = **1.17**

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevalence Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

WETLAND DETERMINATION DATA FORM - Midwest Region

SOIL

Sampling Point: 4-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	-								
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ 2 cm Muck (A10)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ 5 cm Mucky Peat or Peat (S3)

☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Loamy Mucky Mineral (F1)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ Coast Prairie Redox (A16)
☐ Dark Surface (S7)
☐ Iron-Manganese Masses (F12)
☐ Very Shallow Dark Surface (TF12)
☑ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** **Depth (inches):**

Hydric soil present? Yes

Soil Remarks: Soils were not sampled for Wetland 4 since it is a narrow channel along the edge of the Bryn Mawer Meadows Park property that may have buried utilities. However Aquic conditions are assumed based on the dominance of obligate vegetation and primary indicators of hydrology.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☑ Surface Water (A1)
☑ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ True Aquatic Plants (B14)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Gauge or Well Data (D9)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☑ Geomorphic Position (D2)
☑ FAC-Neutral Test (D5)

Field Observations:
Surface water present? ☑ Surface Water Depth (inches): 8
Water table present? ☑ Water Table Depth (inches): 0
Saturation present? (includes capillary fringe) ☑ Saturation Depth (inches): 0

Indicators of wetland hydrology present? Yes
Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

Appendix B

Site Photographs

Appendix B
Bryn Mawr Meadows Water Quality Improvement Project
Wetland Delineation Site Photos - October 20, 2017

Photo 1: Wetland 1 facing northwest. Hydrology contributing to this wetland appears to be originating from an exposed pipe causing water to pool in this low area which is creating shallow marsh community.

Photo 2: Wetland 1 facing east. Most of the wet meadow portion of Wetland 1 is saturated to the surface and dominated by mown Kentucky bluegrass.

Photo 3: Non-vegetated upland ditch area adjacent to railroad bed. This area eventually leads into Wetland 2a located approximately 650 feet ESE from this point. This is a typical view of upland areas adjacent to the railroad bed.

Photo 4: Wetland 2a facing west. Most of the 6-12 inches of surface water in Wetland 2a is covered by leaves, but dominant vegetation present at the time of the site visit was common duckweed. Wetlands 2a & 2b are ditch wetlands separated by a culvert.

Photo 5: Wetland 2b facing east-southeast. Dominant vegetation present at the time of the site visit was common duckweed. Wetland 2b was inundated between 6 and 24 inches. Wetlands 2a & 2b are ditch wetlands separated by a culvert.

Photo 6: Wetland 3 facing southwest. Wetland 3 is a narrow ditch wetland (between 5-10 feet wide) dominated by common duckweed, and reed canary grass. Wetlands 3 and 4 are low spots within the same ditch.

Appendix B
Bryn Mawr Meadows Water Quality Improvement Project
Wetland Delineation Site Photos - October 20, 2017

Photo 7: Typical view of upland ditch located between Wetland 3 and Wetland 4. Area is mostly not vegetated but does harbor European buckthorn in the herbaceous and shrub layers in some areas.

Photo 8: Wetland 4 facing southeast at the narrowest point (approximately 12 inches wide). Common duckweed is dominant in this location and is inundated approximately 2 inches. Wetlands 3 and 4 are low spots within the same ditch.

Photo 9: Wetland 4 facing northeast at the widest point (approximately 4 feet wide). Duckweed, lakebank sedge, reed canary grass, and cattail are all dominant at this location and is inundated approximately 12 inches.

Photo 10: Wetland 4 facing southeast. Culvert reveals one potential source of hydrology for Wetland 4.

Photo 11: Area that occasionally becomes inundated after a rain event located southwest side of Bryn Mawr Meadow Park.

Photo 12: Area that occasionally becomes inundated after a rain event located northeast side of Bryn Mawr Meadow Park.

Appendix E

Opinion of Cost

PREPARED BY: BARR ENGINEERING COMPANY

SHEET:	1	OF		1
BY:	JPP		DATE:	10/10/2018
CHECKED BY:	MAK		DATE:	10/10/2018
APPROVED BY:	KAL		DATE:	10/10/2018
ISSUED:	For BCWMC Review		DATE:	10/10/2018
ISSUED:			DATE:	
ISSUED:			DATE:	
ISSUED:			DATE:	

ENGINEER'S OPINION OF PROBABLE PROJECT COST

PROJECT: Bryn Mawr Meadows Park Water Quality Project
LOCATION: Minneapolis, MN
PROJECT #: 23/27-0051.41
OPINION OF COST - SUMMARY

Engineer's Opinion of Probable Project Cost
Concept 1 - Northwest Neighborhood Diversion

Item. No.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST	NOTES
A	MOBILIZATION/DEMOBILIZATION (5%)	LS	1	$13,500.00	$13,500.00	1,2,3,4,5,6,7
B	EROSION AND SEDIMENT CONTROL	LS	1	$1,000.00	$1,000.00	1,2,3,4,5,6,7
C	TRAFFIC CONTROL	LS	1	$2,000.00	$2,000.00	1,2,3,4,5,6,7
D	EXCAVATION, HAUL AND DISPOSE	TON	4,000	$25.00	$100,000.00	1,2,3,4,5,6,7
E	15" PE STORM SEWER	LF	300	$40.00	$12,000.00	1,2,3,4,5,6,7
F	CATCH BASIN	EA	7	$2,000.00	$14,000.00	1,2,3,4,5,6,7
G	60" DIAMETER OUTLET STRUCTURE WITH WEIR, OVERFLOW GRATE ON PILES	LS	1	$20,000.00	$20,000.00	1,2,3,4,5,6,7
H	30" PE OUTLET PIPE	LF	150	$120.00	$18,000.00	1,2,3,4,5,6,7
I	CONNECT TO EXISTING STRUCTURE	LS	1	$1,000.00	$1,000.00	1,2,3,4,5,6,7
J	BITUMINOUS PAVEMENT PATCH, FULL DEPTH	SF	3,000	$4.00	$12,000.00	1,2,3,4,5,6,7
K	CONCRETE CURB AND GUTTER	LF	300	$20.00	$6,000.00	1,2,3,4,5,6,7
L	SITE RESTORATION	AC	2.0	$4,500.00	$9,000.00	1,2,3,4,5,6,7
	CONSTRUCTION SUBTOTAL				$209,000.00	1,2,3,4,5,6,7,8
	CONSTRUCTION CONTINGENCY (30%)				$63,000.00	1,5,8
	ESTIMATED CONSTRUCTION COST				$272,000.00	1,2,3,4,5,6,7,8
	PLANNING, ENGINEERING & DESIGN (30%)				$82,000.00	1,2,3,4,5,8
	ESTIMATED TOTAL PROJECT COST				$354,000.00	1,2,3,4,5,7,8
	ESTIMATED ACCURACY RANGE	**-20%**			**$284,000.00**	5,7,8
		30%			**$461,000.00**	5,7,8

Notes

[1] Limited Design Work Completed (10 - 15%).

[2] Quantities Based on Design Work Completed.

[3] Unit Prices Based on Information Available at This Time.

[4] Limited Field Investigation Completed.

[5] This feasibility-level (Class 4, 10-15% design completion per ASTM E 2516-06) cost estimate is based on feasibility-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the Final Total Project Cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and Maintenance costs are not included.

[6] No costs included for soil correction or overexcavation.

[7] Estimate costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following

[8] Estimate costs are reported to nearest thousand dollars.

PREPARED BY: BARR ENGINEERING COMPANY

SHEET:	1	OF	1	
BY:	JPP		DATE:	10/10/2018
CHECKED BY:	MAK		DATE:	10/10/2018
APPROVED BY:	KAL		DATE:	10/10/2018
ISSUED:	For BCWMC Review		DATE:	10/10/2018
ISSUED:			DATE:	
ISSUED:			DATE:	
ISSUED:			DATE:	

ENGINEER'S OPINION OF PROBABLE PROJECT COST
PROJECT: Bryn Mawr Meadows Park Water Quality Project
LOCATION: Minneapolis, MN
PROJECT #: 23/27-0051.41
OPINION OF COST - SUMMARY

Engineer's Opinion of Probable Project Cost
Concept 2 - Penn Pond Low Flow Diversion

Item. No.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST	NOTES
A	MOBILIZATION/DEMOBILIZATION (5%)	LS	1	$20,600.00	$20,600.00	1,2,3,4,5,6,7
B	EROSION AND SEDIMENT CONTROL	LS	1	$1,000.00	$1,000.00	1,2,3,4,5,6,7
C	TRAFFIC CONTROL	LS	1	$2,000.00	$2,000.00	1,2,3,4,5,6,7
D	EXCAVATION, HAUL AND DISPOSE	TON	9,500	$25.00	$237,500.00	1,2,3,4,5,6,7
E	12" PE STORM SEWER	LF	130	$40.00	$5,200.00	1,2,3,4,5,6,7
F	60" DIAMETER OUTLET STRUCTURE WITH WEIR, OVERFLOW GRATE ON PILES	LS	1	$20,000.00	$20,000.00	1,2,3,4,5,6,7
G	30" PE OUTLET PIPE	LF	150	$120.00	$18,000.00	1,2,3,4,5,6,7
H	CONNECT TO EXISTING STRUCTURE	LS	1	$1,000.00	$1,000.00	1,2,3,4,5,6,7
I	BITUMINOUS PAVEMENT PATCH, FULL DEPTH	SF	400	$4.00	$1,600.00	1,2,3,4,5,6,7
J	CONCRETE CURB AND GUTTER	LF	20	$40.00	$800.00	1,2,3,4,5,6,7
K	SITE RESTORATION	AC	2.0	$4,500.00	$9,000.00	1,2,3,4,5,6,7
	CONSTRUCTION SUBTOTAL				$317,000.00	1,2,3,4,5,6,7,8
	CONSTRUCTION CONTINGENCY (30%)				$95,000.00	1,5,8
	ESTIMATED CONSTRUCTION COST				$412,000.00	1,2,3,4,5,6,7,8
	PLANNING, ENGINEERING & DESIGN (30%)				$124,000.00	1,2,3,4,5,8
	ESTIMATED TOTAL PROJECT COST				$536,000.00	1,2,3,4,5,7,8
	ESTIMATED ACCURACY RANGE	**-20%**			**$429,000.00**	5,7,8
		30%			**$697,000.00**	5,7,8

Notes

[1] Limited Design Work Completed (10 - 15%).

[2] Quantities Based on Design Work Completed.

[3] Unit Prices Based on Information Available at This Time.

[4] Limited Field Investigation Completed.

[5] This feasibility-level (Class 4, 10-15% design completion per ASTM E 2516-06) cost estimate is based on feasibility-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the Final Total Project Cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and Maintenance costs are not included.

[6] No costs included for soil correction or overexcavation

[7] Estimate costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following constuction.

[8] Estimate costs are reported to nearest thousand dollars

PREPARED BY: BARR ENGINEERING COMPANY

SHEET:	1	OF	1
BY:	JPP	DATE:	10/10/2018
CHECKED BY:	MAK	DATE:	10/10/2018
APPROVED BY:	KAL	DATE:	10/10/2018
ISSUED:	For BCWMC Review	DATE:	10/10/2018
ISSUED:		DATE:	
ISSUED:		DATE:	
ISSUED:		DATE:	

ENGINEER'S OPINION OF PROBABLE PROJECT COST

PROJECT: Bryn Mawr Meadows Park Water Quality Project
LOCATION: Minneapolis, MN
PROJECT #: 23/27-0051.41

OPINION OF COST - SUMMARY

Engineer's Opinion of Probable Project Cost
Concept 3 - Northwest Neighborhood Diversion and Penn Pond Low Flow Diversion

Item. No.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST	NOTES
A	MOBILIZATION/DEMOBILIZATION (5%)	LS	1	$30,500.00	$30,500.00	1,2,3,4,5,6,7
B	EROSION AND SEDIMENT CONTROL	LS	1	$1,000.00	$1,000.00	1,2,3,4,5,6,7
C	TRAFFIC CONTROL	LS	1	$2,000.00	$2,000.00	1,2,3,4,5,6,7
D	EXCAVATION, HAUL AND DISPOSE	TON	13,500	$25.00	$337,500.00	1,2,3,4,5,6,7
E	15" PE STORM SEWER	LF	300	$40.00	$12,000.00	1,2,3,4,5,6,7
F	12" PE STORM SEWER	LF	130	$40.00	$5,200.00	1,2,3,4,5,6,7
G	CATCH BASIN	EA	7	$2,000.00	$14,000.00	1,2,3,4,5,6,7
H	60" DIAMETER OUTLET STRUCTURE WITH WEIR, OVERFLOW GRATE ON PILES	LS	1	$20,000.00	$20,000.00	1,2,3,4,5,6,7
I	30" PE OUTLET PIPE	LF	150	$120.00	$18,000.00	1,2,3,4,5,6,7
J	CONNECT TO EXISTING STRUCTURE	LS	1	$1,000.00	$1,000.00	1,2,3,4,5,6,7
K	BITUMINOUS PAVEMENT PATCH, FULL DEPTH	SF	3,400	$4.00	$13,600.00	1,2,3,4,5,6,7
L	CONCRETE CURB AND GUTTER	LF	320	$20.00	$6,400.00	1,2,3,4,5,6,7
M	SITE RESTORATION	AC	2.0	$4,500.00	$9,000.00	1,2,3,4,5,6,7
	CONSTRUCTION SUBTOTAL				$470,000.00	1,2,3,4,5,6,7,8
	CONSTRUCTION CONTINGENCY (30%)				$141,000.00	1,5,8
	ESTIMATED CONSTRUCTION COST				$611,000.00	1,2,3,4,5,6,7,8
	PLANNING, ENGINEERING & DESIGN (30%)				$183,000.00	1,2,3,4,5,8
	ESTIMATED TOTAL PROJECT COST				$794,000.00	1,2,3,4,5,7,8
	ESTIMATED ACCURACY RANGE	**-20%**			**$636,000.00**	5,7,8
		30%			**$1,033,000.00**	5,7,8

Notes

[1] Limited Design Work Completed (10 - 15%).

[2] Quantities Based on Design Work Completed.

[3] Unit Prices Based on Information Available at This Time.

[4] Limited Field Investigation Completed.

[5] This feasibility-level (Class 4, 10-15% design completion per ASTM E 2516-06) cost estimate is based on feasibility-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the Final Total Project Cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and Maintenance costs are not included.

[6] No costs included for soil correction or overexcavation

[7] Estimate costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional task

[8] Estimate costs are reported to nearest thousand dollars