Appendix F

Dewatering Radius of Impact Analysis

Stantec

Memo

To:	Amanda Mondor Metropolitan Council 3656 Kennebec Drive Eagan, MN 55122	From:	Justin Soberaski 733 Marquette Avenue Suite 1000 Minneapolis, MN 55402
File:	Stantec Project No. 173420091 MCES Project No. 819017	Date:	September 29, 2023

Reference: Estimation of Radius of Influence at Proposed Dewatering Locations Along Nicols Road to Support the 7031-9003 Siphon Outlet Improvements Project

BACKGROUND AND OBJECTIVE

The Metropolitan Council Environmental Services (MCES) plans to complete dewatering activities to support the 7031-9003 Siphon Outlet Improvements Project (Project) located along Nicols Road within the city of Eagan near the border of Dakota and Hennepin County and the Minnesota River.

The Project includes the replacement of the South Junction Structure, replacement of Manhole No. 1 (MH1), Interceptor 7033 joint repair near MH6, and replacement of Interceptor 7030 that extends along Nicols Road between the L13 lift station and the South Junction structure. The Project Location is shown on Figure 1.

Dewatering is proposed to support construction activities around MH1, South Junction Structure and M501A (Figure 1). Construction is currently planned to occur for two winter seasons (2024 - 2025 and 2025 - 2026) when surficial soils are frozen, plants are dormant, and when the groundwater table is potentially more predictable.

MCES is preparing a discretionary Environment Assessment Worksheet (EAW) for the Project. In accordance with Minnesota Rules 4410.0500, Subpart 5.A, MCES is the Responsible Governmental Unit (RGU) for the EAW. MCES and Stantec conducted an early coordination meeting with the Minnesota Department of Natural Resources (DNR) on November 2, 2022. During this meeting, Joe Richter, the DNR District Appropriations Hydrologist requested that cross sections and geospatial analysis is provided to support the temporary water appropriation permit along with the EAW. Additionally, Jennie Skancke, DNR Wetlands Program Coordinator, discussed the need for a Calcareous Fen Management Plan (CFMP). Based on subsequent correspondence and discussions with the DNR, it was suggested that documentation is provided to demonstrate that impacts to the fen would be avoided. Furthermore, based on direction from the DNR, it was decided to incorporate the Project into the CFMP concurrently being prepared for the Seneca Wastewater Treatment Plant. This memo has been prepared to provide documentation as recommended by the DNR to support the EAW and inform the CFMP to be prepared separate from the Project.

The purpose of this memorandum is to summarize the methodology used to estimate the Radius of Influence (ROI) or the distance of influence produced during the planned dewatering activities.

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SITE CHARACTERIZATION DATA

The Project location is approximately 3,000 feet south of the Minnesota River within the Minnesota River Valley. Surface elevations within the Project Location range between 720 feet to 750 feet North American Vertical Datum of 1983 (NAVD 1983; Figure 1). Based on nearby topographic information, the surface water elevation of the Minnesota River near the Hwy 77 Bridge is estimated to be 690 feet NAVD 1983 (Figure 1).

Figure 1 shows the location of Nicols Fen as provided by Jennie Skancke (DNR) during email correspondence on November 7, 2022. The Nicols Fen is located adjacent west of the Project Location approximately 350 feet (Figure 1).

Figure 2 shows the surficial geology as mapped by the Minnesota Geological Survey (MGS; 2019) underlying the Project Location. Terrace alluvium deposits are identified at the Project Location, which are defined as gravelly sand that coarsens to cobbly gravel. These deposits are preserved above the modern floodplain and were deposited during higher stages of flow along rivers that served as outlets for glacial meltwater (MGS, 2019). Floodplain alluvium deposits are identified to the north of the Project Location and consist mostly of gravelly sand to sandy silt (MGS, 2019).

The Report of Geotechnical Exploration (MCES L-13 Siphon Outlet Structures) prepared by American Engineering Testing (AET; 2021) summarizes the geotechnical investigation conducted in 2021. The investigation was completed in the southern portion of the Project Location in the vicinity of MH1 and South Junction Structure. Soil borings B-1 and B-2 and piezometer P-1 were advanced during the 2021 investigation to identify the underlying soils. The location of the soil borings and piezometer are shown on Figure 3. Fill deposits overlying swamp deposits and coarse alluvial sands and gravels are identified in the boring logs provided in the 2021 AET Report. The fill deposits are comprised of silty sand with little gravel and ranged in thickness between 9.5 and 15.5 feet (AET, 2021). The swamp deposits consist of hemic and sapric peats and were encountered below the fill deposits (AET, 2021). The peat deposits extend to depths of more than 24 feet below ground surface (bgs) and are underlain by coarse alluvial deposits (AET, 2021). The coarse alluvium consists of poorly graded sands and poorly graded sands with silt (AET, 2021).

Piezometer P-1 is screened (perforated well interval) in the peat deposits between 13 and 23 feet bgs. Groundwater was not observed in P-1 immediately after well installation on October 28, 2021, which likely indicates the soils surrounding the screen interval do not transmit groundwater readily. Groundwater elevations of 747.3 and 747.5 feet NAVD 1983 (1.6 and 1.3 bgs) were measured at P-1 on November 8, 2021 and December 16, 2021, respectively.

Figure 3 shows the location of wells and borings identified by the Minnesota Well Index (MWI) in the vicinity of the Project Location. MWI provides basic information about location, depth, geology, construction and static water level, for many wells and borings drilled in Minnesota (Minnesota Department of Health [MDH], 2023).

Figure 3 shows the location of cross section A-A' and cross section B-B'. Cross section A-A' was selected to roughly intersect the proposed M501A dewatering location and generally parallels the railroad corridor. Cross section B-B' was selected to roughly intersect the proposed M501A, South Junction Structure, and MH1dewatering locations and generally parallels Nicols Road. Cross section

A-A' and B-B' bisect each other proximal to the intersection of the railroad corridor and Nicols Road (Figure 3). Cross section A-A' is shown on Figure 4 and cross section B-B' is shown Figure 5.

Attachment 1 provides Minnesota Well Index (MWI) boring and well logs used in the development of cross section A-A' and cross section B-B'. Boring and well logs for B-1, B-2, and P-1 were used in the development of cross section A-A' and are provided in the Report of Geotechnical Exploration (AET, 2021). Figure 4 and Figure 5 identify some boring and well logs, which were projected a short distance onto each respective cross section.

Cross section A-A' and cross section B-B' show the geology underlying the Project Location generally consists of 5 to 15 feet of peat overlying coarse-grained sand. Heterogeneities include fill deposits within the peat deposits and gravel and clay lenses within the coarse-grained sand.

Historical groundwater levels reported on the boring or well log are shown on Figure 4 and Figure 5. The groundwater table at the Project Location is likely unconfined, near the surface, and mimics topography at depth. An average depth to groundwater of 1.5 feet bgs is anticipated to occur across the Project Location.

PLANNED DEWATERING ACTIVITIES

Dewatering activities to support construction at MH1 and the South Junction Structure will employ steel sheeting, which will provide a barrier to horizontal groundwater flow on all four sides of the excavation. General seepage through the perimeter steel sheeting is anticipated to only occur through any defects or imperfections such as leaking joints. Although the steel sheeting is proposed to be installed to an approximate depth of 30 feet at each location, excavation and dewatering activities are not planned beyond a depth of 20 feet. Figure 6 shows the approximate perimeter of the proposed excavation (20 feet x 20 feet at MH1; 20 feet x 30 feet at South Junction Structure).

Dewatering activities to support construction near M501A will likely employ multiple trench boxes instead of steel sheeting to minimize the size of the excavation (it is currently unknown whether dewatering will be needed during construction near M501A). The trench box will provide a barrier to horizontal groundwater flow on each side of the excavation cut. Excavation and dewatering activities are not planned beyond a depth of 8 feet. Figure 6 shows the approximate perimeter of the proposed excavation using a single trench box (12 feet x 4 feet in the vicinity of M501A).

METHODOLOGY AND ASSUMPTIONS

The most reliable means of estimating the radius of influence (ROI) or the distance of influence induced by groundwater drawdown is by Jacob analysis of a pumping test. This method will reveal the degree of connection with surface water bodies and recharge from other aquifers (Powers, 2013). Smaller values (i.e., distance) for ROI are typically identified for unconfined aquifers (Powers, 2013).

Reference: Estimation of Radius of Influence at Proposed Dewatering Locations Along Nicols Road to Support the 7031-9003 Siphon Outlet Improvements Project

Lacking results from a completed pumping test, it is possible to estimate ROI based on an empirical relationship developed by Sichardt. This equation provides ROI as a function of drawdown (H-h) and hydraulic conductivity (K):

$$ROI = 3000\,(H - h)\,\sqrt{K}$$

Where:

H = the total head of the water table aquifer in meters (m)
h = the total head of the dewatered aquifer in m
ROI = radius of influence in m, calculated using the Sichardt equation
K = hydraulic conductivity, in m/second (s)

The relationship between the total head of the water table aquifer (H) and the total head of the dewatered aquifer (h) is equal to anticipated drawdown within the excavation due to groundwater pumping during dewatering activities.

Based on the estimated depth to groundwater of 1.5 feet bgs and the maximum estimated depth to groundwater during excavation dewatering of 20 feet bgs, the anticipated drawdown within the proposed excavations at MH1 and South Junction Structure is assumed to be 18.5 feet (H-h).

Based on the average estimated depth to groundwater of 1.5 feet bgs and the maximum estimated depth to groundwater during excavation dewatering of 8 feet bgs, the anticipated drawdown within the proposed excavation near M501A for a single trench box is assumed to be 6.5 feet (H-h).

Figure 5 shows peat deposits from the ground surface to the proposed excavation depth at M501A. Figure 5 shows fill deposits from the ground surface to about 10 feet bgs and peat deposits to the proposed excavation depth at South Junction Structure and MH1.

The peat deposits are not expected to yield predicable volumes of water when compared with inorganic soils like clay, sand and gravel due to their unique characteristics (i.e., high compressibility, high moisture content, and low bearing capacities). Cross section A-A' and cross section B-B' show the fill deposits appear to be localized to a small portion of the Project Location. Based on the presence of a limited quantity of fill deposits, a substantial groundwater yield is not anticipated from this material.

Wong et al. (2009) reported the vertical hydraulic conductivity (K) of peat deposits range between 10^{-5} to 10^{-8} meter/second (m/s), (2.8 to 0.0028 feet/day [ft/day]).

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RESULTS AND CONCLUSIONS

Solving for ROI using the Sichardt's equation returns an estimated ROI extent at which drawdown could be observed due to proposed dewatering activities at MH1, South Junction Structure, and M501A.

Assuming a hydraulic conductivity anisotropy ratio of 1:1 vertical to horizontal hydraulic conductivity and dewatering at MH1, South Junction Structure, and M501A will not occur simultaneously. The ROI was estimated to be 176 feet at MH1, 176 feet at South Junction Structure, and 62 feet at M501A using the most conservate vertical hydraulic conductivity value (10^{-5} m/s; 2.8 ft/day) reported by Wong et al. (2009).

Figure 6 shows the estimated ROI at each proposed dewatering/excavation location is not anticipated to extend to Nicols Fen.

Attachment 2 provides the results from a sensitivity analysis by varying the magnitude of hydraulic conductivity value at each of the proposed dewatering locations. The sensitivity analysis shows the ROI is smaller with lower hydraulic conductivity values and larger with higher hydraulic conductivity values.

The ROI is anticipated to be substantially less than estimated at each of the proposed locations, based on the following reasons:

- The lack of observable groundwater at piezometer P-1 immediately after well installation on October 28, 2021 likely indicates the hydraulic conductivity is much lower than the conservative hydraulic conductivity value used to estimate the ROI at each location.
- The estimation method does not account for the use of steel sheeting and trench boxes, which will provide a barrier to groundwater flow and should greatly reduce the flow of groundwater into the excavation.
- Dewatering may not be required at M501A. Additionally, if excavation activities were to occur, the total depth is limited to 8 feet.
- The estimate method assumes that dewatering activities within the excavation are performed long enough for pseudo steady-state conditions to be reached, which is unlikely to occur.

LIMITATIONS

The following limitations affect the estimation of the ROI:

- There is a relatively large literature range and few references for aquifer properties of peat materials.
- There is no site-specific aquifer property data.
- The estimation method assumes a homogenous anisotropic aquifer with a constant head.

These limitations are not believed to substantively affect the ability to meet the primary objective to approximate the radius of influence at each proposed excavation area.

Reference: Estimation of Radius of Influence at Proposed Dewatering Locations Along Nicols Road to Support the 7031-9003 Siphon Outlet Improvements Project

REFERENCES

AET, 2021. Report of Geotechnical Exploration MCES L-13 Siphon Outlet Structures, 3725 Nichols Roads. Prepared for Metropolitan Council Environmental Services by American Engineering Testing, December 20, 2021.

EPGMD, 2022. Environmental Protection and Growth Management Department, Broward County, Florida. Calculation Methods for Radius of Influence and Dewatering Flow Rate From Aquifer Test Data. Last accessed November 4, 2022. https://www.broward.org/environment/contaminatedsites/documents/sopexhibitiii1209.pdf

Wong L.S, Hasim R, and Ali F.H, 2009. A Review on Hydraulic Conductivity and Compressibility of Peat, Journal of Applied Sciences, Volume 9, Issue 18, Page No.: 3207-3218. https://scialert.net/abstract/?doi=jas.2009.3207.3218

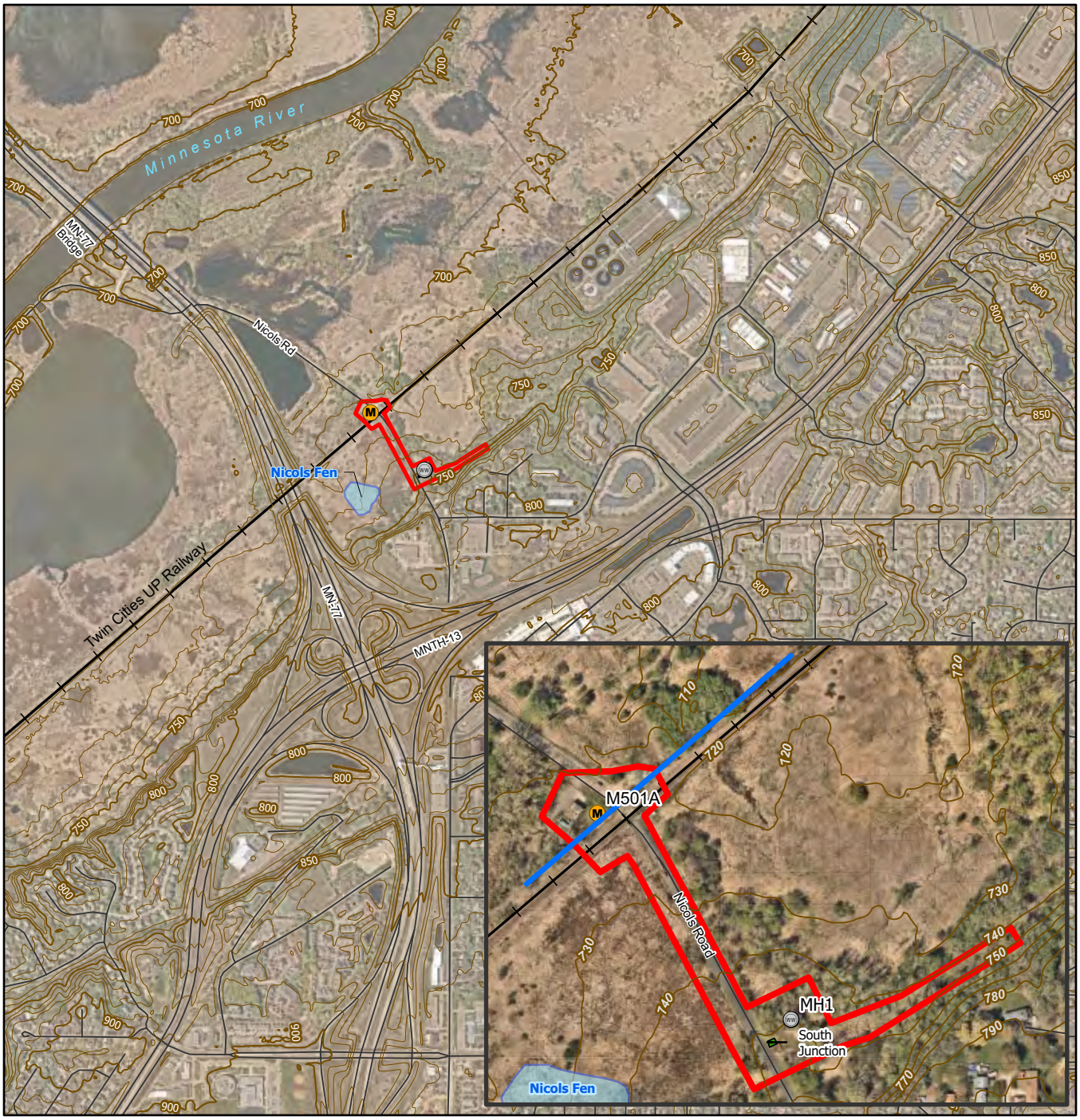
MDH, 2023. Wells: Minnesota Health Department Well Index. Last accessed August 10, 2023. https://mnwellindex.web.health.state.mn.us/

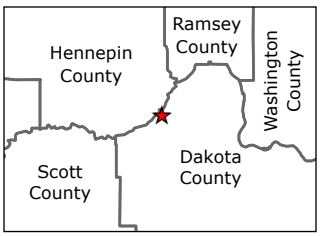
MGS, 2019. Lusardi, B.A., Gowan, A.S., McDonald, J.M., Marshall, K.J., Meyer, G.N., Wagner, K.G. (2019). S-23 Geologic Map of Minnesota – Quaternary Geology. Minnesota Geological Survey. Retrieved from the University of Minnesota Digital Conservancy, https://hdl.handle.net/11299/208552

Powers, J.P., Corwin A.B, Schmall. P.C, Walter E.K, 2013. Construction Dewatering and Ground Control, New Methods and Applications, 3rd Edition, New York.

Wong et. al., 2009. A Review on Hydraulic Conductivity and Compressibility of Peat. Journal of Applied Sciences 9 (18):3207-3218. Wong L.S, Hashim R., Ali F.H. https://meadows.ucdavis.edu/sites/g/files/dgvnsk10941/files/2021-05/3207-3218.pdf

FIGURES





Notes

1. Coordinate System: NAD 1983 HARN Adj MN Dakota Feet
2. Data Sources: Topography (http://arcgis.dnr.state.mn.us/maps/mntopo/), MCES, MNDNR, MNDOT, Dakota Co.
3. Background: 2021 Dakota Co.
4. Location of Nicols Fen as shown by Jennie Skancke (DNR) in November 7, 2022 email

Legend

- MH1
- M501A
- South Junction Structure
- Project Location
- Railroad
- Streets
- Elevation (10ft Contour)

0 600 1,200 Feet
(At original document size of 8.5x11)
1:18,000

N

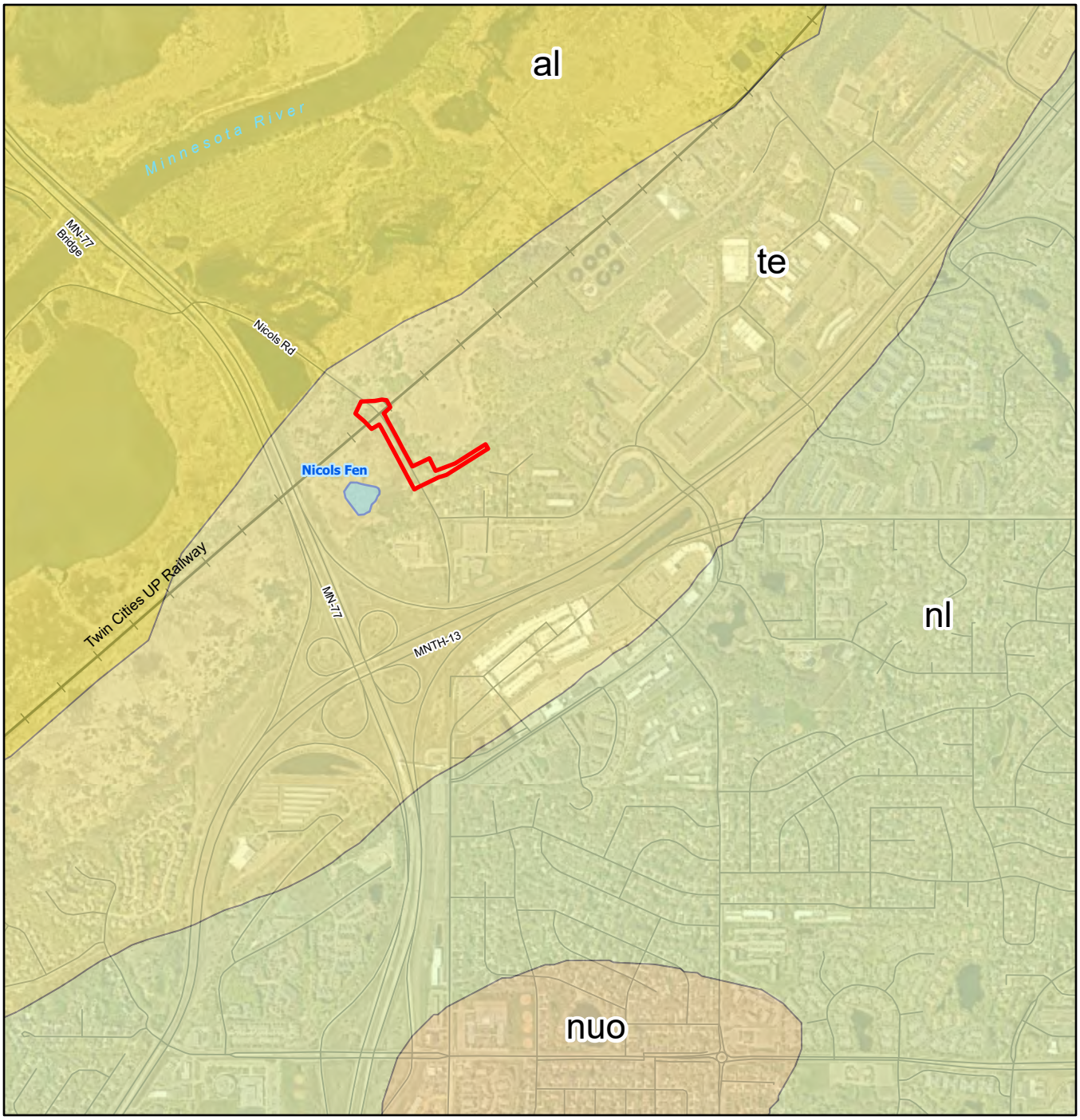
Stantec

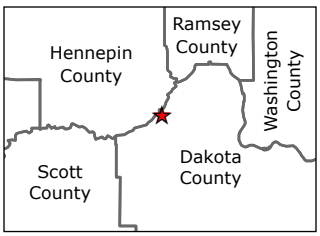
Project Location
T27N, R23W, S18
Eagan, Dakota Co., MN

Client/Project 173420091
Met Council Environmental Services
Estimation of Radius of Influence to Support Siphon Outlet Improvements Project

Figure No.
1

Title
Project Location





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2. Data Sources: Topography (http://arcgis.dnr.state.mn.us/maps/mntopo/), MCES, MNDNR, MNDOT, Dakota Co.
3. Background: 2021 Dakota Co.
4. Location of Nicols Fen as shown by Jennie Skancke (DNR) in November 7, 2022 email

Legend

Surficial Geology

- al - Floodplain Alluvium
- nl - Villard Member
- nuo - Outwash
- te - Terrace Alluvium
- Streets
- Railroad
- Project Location

0 600 1,200 Feet
(At original document size of 8.5x11)
1:18,000

N

Stantec

Project Location
T27N, R23W, S18
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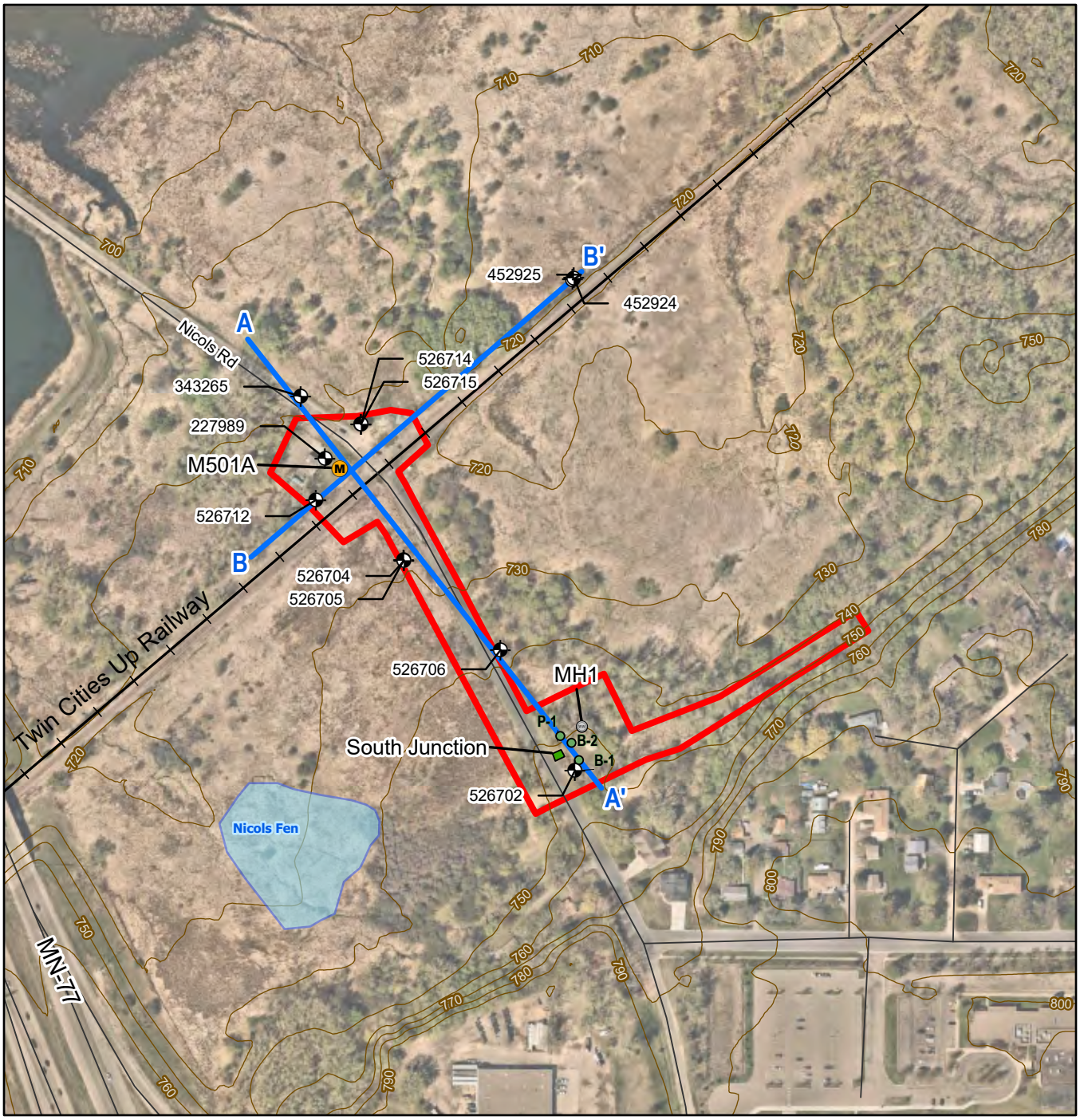
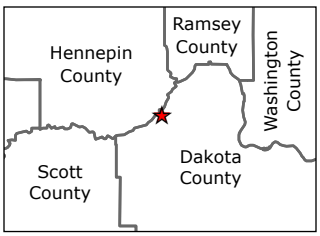
Figure No.
2

Title
Surficial Geology





Legend

Boring Locations

- Well
- Geotech Boring
- M501A
- MH1

- South Junction Structure
- Cross Section
- Streets
- Railroad
- Elevation (10ft Contour)
- Project Location

0 100 200 Feet
(At original document size of 8.5x11)
1:4,000

N

Notes

1. Coordinate System: NAD 1983 HARN Adj MN Dakota Feet
2. Data Sources: Geotech: AET, 2021. Report of Geotechnical Exploration MCES L-13 Siphon Outlet Structures, 3725 Nichols Roads. Prepared for Metropolitan Council Environmental Services by American Engineering Testing, December 20, 2021. MDH, 2023. Wells: Minnesota Health Department Well Index. Last accessed August 10, 2023 https://mnwellindex.web.health.state.mn.us/, Topography: (http://arcgis.dnr.state.mn.us/maps/mntopo/), MCES, MNDNR, MNDOT, Dakota Co.
3. Background: 2021 Dakota Co.

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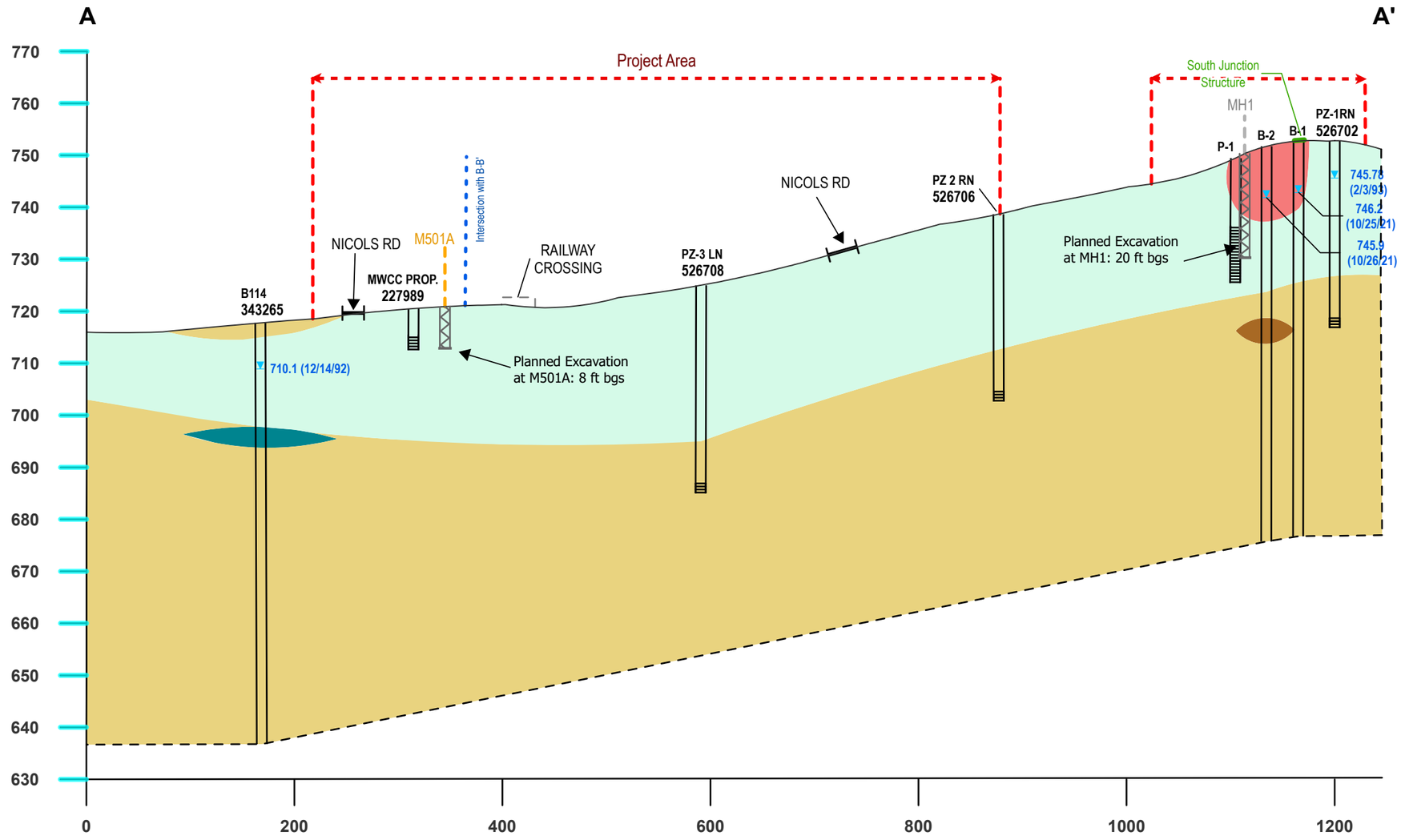
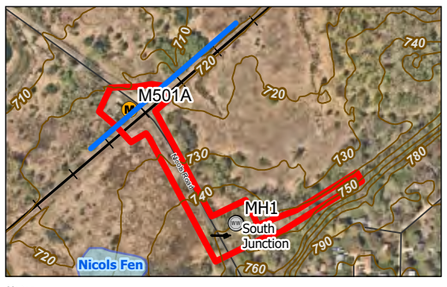
Figure No.
3

Title
Cross Section Location





Legend

Lithology
- Clay
- Fill (sand, gravel)
- Gravel
- Peat
- Sand

Well Construction
- Boring
- Well Casing
- Well Screen
- Static Groundwater Elevation
- Planned Excavation

0 25 50 metres

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

5x Vertical Exaggeration

N

Notes
1. Coordinate System: MN Dakota Lambert Conformal Conic
2. Data Sources: Stantec, MDH/MGS, AET, Wells: Minnesota Health Department Well Index. Last accessed August 10, 2023 https://mnwellindex.web.health.state.mn.us/
3. Background: MnGeo WMS service (aerial photography):

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Project Location
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Met Council Environmental Services
Estimation of Radius of Influence to Support
Siphon Outlet Improvements Project

Figure No.
4

Title
A-A' Cross Section

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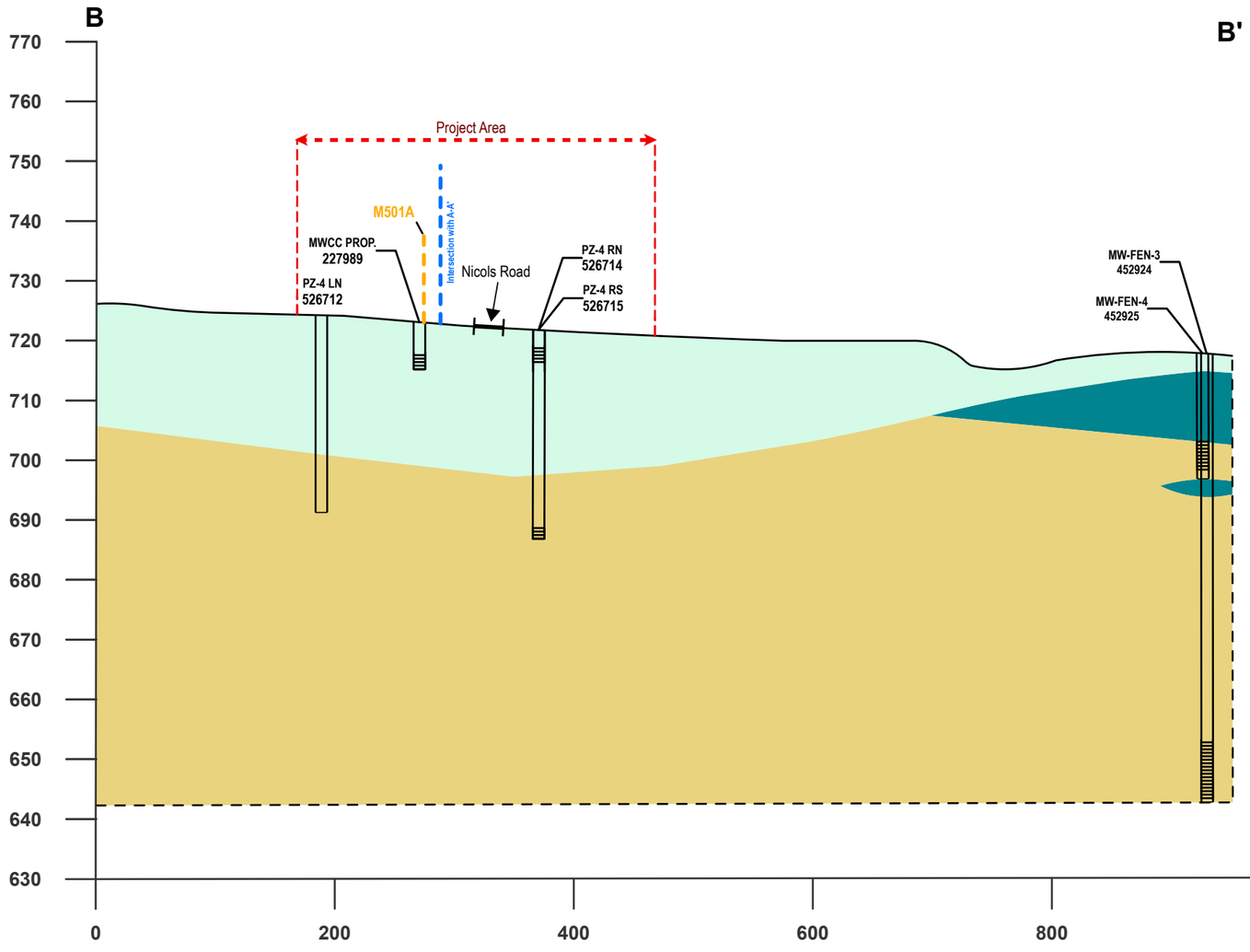

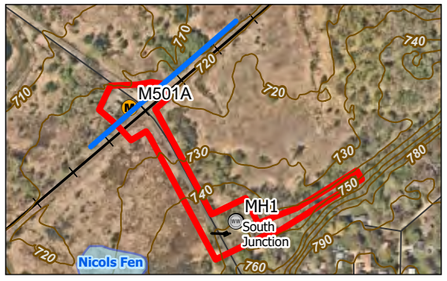

Notes

1. Coordinate System: MN Dakota Lambert Conformal Conic
2. Data Sources: Stantec, MDH/MGS, AET, Wells: Minnesota Health Department Well Index. Last accessed August 10, 2023 https://mnwellindex.web.health.state.mn.us/
3. Background: MnGeo WMS service (aerial photography):
4. * Indicates that the monitoring location is a short distance from the transect but is projected onto the cross section

Legend

Lithology

- clay
- peat
- sand

Well Construction

- Well Casing
- Well Screen

0 25 50 metres

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

5x Vertical Exaggeration

N

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Estimation of Radius of Influence to Support Siphon Outlet Improvements Project

Figure No.
5

Title
B-B' Cross Section

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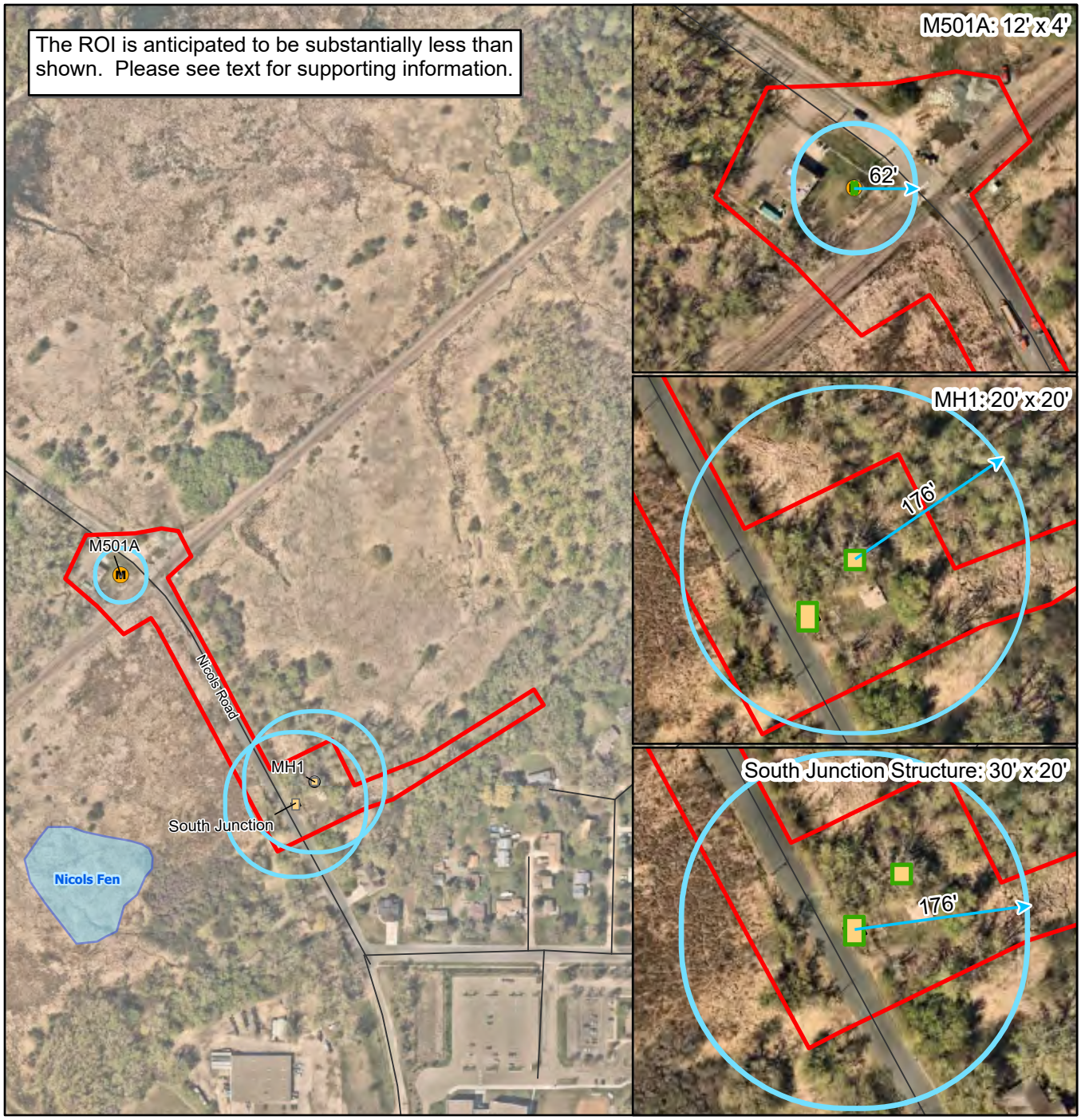

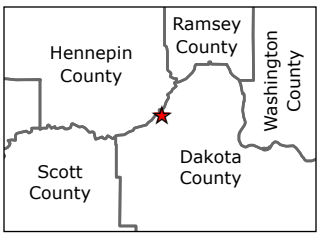

Legend

- Passive Soil Resistance Barrier
- Radius of Influence (ROI)
- Proposed Dewatering/ Excavation
- Project Location
- M501A
- MH1
- South Junction Structure
- Streets
- Railroad

0 100 200 Feet
(At original document size of 8.5x11)
1:5,000

N

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Dakota Feet
2. Data Sources: Geotech: AET, 2021. Report of Geotechnical Exploration MCES L-13 Siphon Outlet Structures, 3725 Nichols Roads. Prepared for Metropolitan Council Environmental Services by American Engineering Testing, December 20, 2021. MDH, 2023. Wells: Minnesota Health Department Well Index. Last accessed August 10, 2023 https://mnwellindex.web.health.state.mn.us/, MCES, MNDNR, MNDOT, Dakota Co.
3. Background: 2021 Dakota Co.

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Project Location
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Met Council Environmental Services
Estimation of Radius of Influence to Support Siphon Outlet Improvements Project

Figure No.
6

Title
Estimated Radius of Influence

ATTACHMENT 1

Minnesota Well Index Boring and Well Logs

Minnesota Unique Well Number

227989

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 12/04/1992
Update Date 08/31/2018
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MWCC PROP.	27	23	W	18	CDBACD

Elevation 722 ft. **Elev. Method** LiDAR 1m DEM (MNDNR)

Address

Contact 702 POST OFFICE BLDG. ST PAUL MN 55101

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
FIBROUS PEAT	0	8	BLACK	SOFT

Remarks

40' W. OF NICOLS RD. & 100' N. OF RR.
CONTAMINATION: MWCC STATION.
WELL SEALED 10-1-1990 BY 27194.
ORIGINAL USE MW - MONITOR WELL.

Well Depth 8 ft. **Depth Completed** 8 ft. **Date Well Completed** 05/20/1988

Drill Method Power Auger **Drill Fluid**

Use monitor well **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below** 3 ft.

Casing Diameter	Weight	Hole Diameter
2 in. To 5 ft.	lbs./ft.	7 in. To 8 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	10	3 ft.	5 ft. 8 ft.

Static Water Level

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement		ft. 3	ft.

Nearest Known Source of Contamination

20 feet South Direction Other Type

Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water
Last Strat peat-black Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or
System UTM - NAD83, Zone 15, Meters X 482528 Y 4963207
Unique Number Verification Site Plan Input Date 08/31/2018

Angled Drill Hole

Well Contractor

U.S. Geol Survey M0113
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Well Index Report | **227989** | Printed on 08/16/2023 HE-01205-15

Minnesota Unique Well Number

343265

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 06/06/2023
Update Date 06/06/2023
Received Date

Well Name	Township	Range	Dir	Section	Subsection
B114	27	23	W	18	CDBABC

Elevation 719.1 **Elev. Method** Surveyed

Address

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
CLAYEY SAND, SILTY	0	3	BRN/GRY	
PEAT & MUCK	3	11	BLK/BRN	
MUCK	11	20	BRN/GRY	
LEAN CLAY, LENSES	20	24	GRAY	
SILTY SAND W/A	24	28	GRAY	
FINE SAND,	28	81	GRY/BRN	

Remarks

Well Depth 81 ft. **Depth Completed** 81 ft. **Date Well Completed** 12/14/1992

Drill Method Hollow Stem Auger **Drill Fluid**

Use environ. bore hole **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type **Joint**
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Open Hole From ft. To ft.

Screen? ☐ **Type** **Make**

Static Water Level
9 ft. land surface Measure null

Pumping Level (below land surface)

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☐ No ☐ Not Specified

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name
Model Number HP Volt
Length of drop pipe ft Capacity g.p. Typ

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Aquifer
Last Strat sand Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or
System UTM - NAD83, Zone 15, Meters X 482517 Y 4963246
Unique Number Verification Info/GPS from data Input Date 06/06/2023

Angled Drill Hole

Well Contractor
Twin City Testing M0112
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

526702

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 09/05/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PZ-1RN	27	23	W	18	CDDBDD

Elevation 753.08 **Elev. Method** Surveyed

Address

Well 3800 NICOLS RD MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	26	BLACK	SOFT
SAND LOOSE	26	36	BROWN	

Remarks

SEALED 03-31-1997 BY M0143

Well Depth	Depth Completed	Date Well Completed
36 ft.	36 ft.	02/03/1993

Drill Method Driven **Drill Fluid**

Use piezometer **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**

Drive Shoe? Yes ☒ No ☐ **Above/Below** 1.92 ft.

Casing Diameter	Weight
1.2 in. To 34 ft.	lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** TEEL

Diameter	Slot/Gauze	Length	Set	
1.2 in.	60	2 ft.	34 ft.	36 ft.

Static Water Level

7.3 ft. land surface Measure 02/05/1993

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☒ Casing Protection ☐ 12 in. above grade

☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☒ No ☐ Not Specified

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☐ Yes ☐ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or

System UTM - NAD83, Zone 15, Meters X 482693 Y 4963000

Unique Number Verification Information from Input Date 07/22/2019

Angled Drill Hole

Well Contractor

Twin City Testing M0122

Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

526706

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 09/05/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PZ 2 RN	27	23	W	18	CDDBBA

Elevation 738.82 **Elev. Method** Surveyed

Address

Well 3800 NICOLS RD MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	26	BLACK	SOFT
SAND LOOSE	26	36	BROWN	

Remarks

SEALED 03-31-1997 BY M0143

Well Depth	Depth Completed	Date Well Completed
37 ft.	37 ft.	02/01/1993

Drill Method Driven **Drill Fluid**

Use piezometer **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☒ No ☐ **Above/Below** 7.25 ft.

Casing Diameter	Weight
1.2 in. To 34.8 ft.	lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** TEEL

Diameter	Slot/Gauze	Length	Set	
1.2 in.	60	2 ft.	34.8 ft.	36.8 ft.

Static Water Level

-3.1 ft. land surface Measure 02/05/1993

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☒ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☒ No ☐ Not Specified

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or

System UTM - NAD83, Zone 15, Meters X 482644 Y 4963080

Unique Number Verification Information from Input Date 07/22/2019

Angled Drill Hole

Well Contractor

Twin City Testing	M0122	BRABENDER, L.
Licensee Business	Lic. or Reg. No.	Name of Driller

Minnesota Unique Well Number

526708

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 09/05/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PZ-3 LN	27	23	W	18	CDBDAD

Elevation 727.71 **Elev. Method** Surveyed

Address

Well 3800 NICOLS RD MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	30	BLACK	SOFT
SAND LOOSE	30	40	BROWN	

Remarks

STATIC WATER LEVEL: FROZEN
SEALED 03-31-1997 BY M0143

Well Depth 40 ft. **Depth Completed** 40 ft. **Date Well Completed** 02/02/1993

Drill Method Driven **Drill Fluid**

Use piezometer **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**

Drive Shoe? Yes ☒ No ☐ **Above/Below** 3.91 ft.

Casing Diameter **Weight**

1.2 in. To 38 ft. lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** TEEL

Diameter	Slot/Gauze	Length		Set			
1.2 in.	60	2	ft.	38	ft.	40	ft.

Static Water Level

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☒ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☒ No ☐ Not Specified

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or

System UTM - NAD83, Zone 15, Meters X 482580 Y 4963140

Unique Number Verification Information from Input Date 07/22/2019

Angled Drill Hole

Well Contractor

Twin City Testing	M0122	BRABENDER, L.
Licensee Business	Lic. or Reg. No.	Name of Driller

Minnesota Unique Well Number

227989

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 12/04/1992
Update Date 08/31/2018
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MWCC PROP.	27	23	W	18	CDBACD

Elevation 722 ft. **Elev. Method** LiDAR 1m DEM (MNDNR)

Address

Contact 702 POST OFFICE BLDG. ST PAUL MN 55101

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
FIBROUS PEAT	0	8	BLACK	SOFT

Remarks

40' W. OF NICOLS RD. & 100' N. OF RR.
CONTAMINATION: MWCC STATION.
WELL SEALED 10-1-1990 BY 27194.
ORIGINAL USE MW - MONITOR WELL.

Well Depth 8 ft. **Depth Completed** 8 ft. **Date Well Completed** 05/20/1988

Drill Method Power Auger **Drill Fluid**

Use monitor well **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below** 3 ft.

Casing Diameter	Weight	Hole Diameter
2 in. To 5 ft.	lbs./ft.	7 in. To 8 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	10	3 ft.	5 ft. 8 ft.

Static Water Level

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement		ft. 3	ft.

Nearest Known Source of Contamination

20 feet South Direction Other Type

Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water
Last Strat peat-black Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or
System UTM - NAD83, Zone 15, Meters X 482528 Y 4963207
Unique Number Verification Site Plan Input Date 08/31/2018

Angled Drill Hole

Well Contractor

U.S. Geol Survey M0113
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Well Index Report | **227989** | Printed on 08/16/2023 HE-01205-15

Minnesota Unique Well Number

452924

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 03/12/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MW-FEN-3	27	23	W	18	CADCDA

Elevation 720.2 **Elev. Method** Surveyed

Address

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	3	BLACK	
ORGANIC CLAY DK.	3	15	VARIED	SOFT
FINE SAND LOOSE TO	15	21	BRN/GRY	
CLAY STIFF	21	24	RED/BRN	
FINE SAND DENSE	24	48	BROWN	
SILTY SAND VERY	48	53	RED/BRN	
FINE SAND VERY	53	75	BROWN	

Remarks
LOCATION: 550'E OF NICOLS RD ON RR RIGHT OF WAY

Well Depth	Depth Completed	Date Well Completed
75 ft.	75 ft.	05/25/1989

Drill Method Multiple methods used **Drill Fluid** Bentonite

Use monitor well **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below** 2.2 ft.

Casing Diameter	Weight	Hole Diameter
2 in. To 64.5 ft.	lbs./ft.	6 in. To 74.5 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** plastic **Make** TIMCO

Diameter	Slot/Gauze	Length	Set	
2 in.	10	10 ft.	64.5 ft.	74.5 ft.

Static Water Level

Pumping Level (below land surface)

Wellhead Completion
Pitless adapter manufacturer Model
☒ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement		ft.	50.2 ft.

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed
Manufacturer's name
Model Number HP Volt
Length of drop pipe ft Capacity g.p. Typ

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Aquifer indeterminate
Last Strat sand-brown Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 482694 Y 4963326
Unique Number Verification Tag on well Input Date 03/08/2018

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Gislason, John	M0070	NELSON, T.

Minnesota Unique Well Number

452925

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 10/22/2021
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MW-FEN-4	27	23	W	18	CADCDA

Elevation 721.2 **Elev. Method** Surveyed

Address

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
LOG FROM ADJACENT	0	3	BLACK	
ORGANIC CLAY DK	3	15	VARIED	SOFT
FINE SAND LOOSE TO	15	21	BRN/GRY	

Remarks

Well Depth	Depth Completed	Date Well Completed
21 ft.	20 ft.	05/26/1989

Drill Method Power Auger **Drill Fluid**

Use monitor well **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below** 2.4 ft.

Casing Diameter	Weight	Hole Diameter
2 in. To 14.6 ft.	lbs./ft.	8 in. To 21 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** plastic **Make** TIMCO

Diameter	Slot/Gauze	Length	Set	
2 in.	10	5 ft.	14.6 ft.	19.6 ft.

Static Water Level

Pumping Level (below land surface)

Wellhead Completion
Pitless adapter manufacturer Model
☒ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement		ft.	10.5 ft.

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed
Manufacturer's name
Model Number HP Volt
Length of drop pipe ft Capacity g.p. Typ

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Aquifer
Last Strat sand Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 482693 Y 4963326
Unique Number Verification Tag on well Input Date 03/08/2018

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Gislason, John	M0070	NELSON, T.

Minnesota Unique Well Number

526712

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 09/05/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PZ-4 LN	27	23	W	18	CDBDBB

Elevation 723.99 **Elev. Method** Surveyed

Address

Well 3800 NICOLS RD MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	23	BLACK	SOFT
SAND LOOSE	23	33	BROWN	

Remarks

SEALED 03-31-1997 BY M0143

Well Depth	Depth Completed	Date Well Completed
33 ft.	33 ft.	02/04/1993

Drill Method Driven **Drill Fluid**

Use piezometer **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☒ No ☐ **Above/Below** 2.08 ft.

Casing Diameter	Weight
1.2 in. To 31 ft.	lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** TEEL

Diameter	Slot/Gauze	Length	Set	
1.2 in.	60	2 ft.	31 ft.	33 ft.

Static Water Level

32.4 ft. land surface Measure 02/05/1993

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☒ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☒ No ☐ Not Specified

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or

System UTM - NAD83, Zone 15, Meters X 482522 Y 4963180

Unique Number Verification Information from Input Date 07/22/2019

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Twin City Testing	M0122	BRABENDER, L.

Minnesota Unique Well Number

526714

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 09/05/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PZ-4 RN	27	23	W	18	CDBADB

Elevation 721.29 **Elev. Method** Surveyed

Address

Well 3800 NICOLS RD MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	7	BLACK	SOFT

Remarks

SEALED 03-31-1997 BY M0143

Well Depth 7 ft. **Depth Completed** 7 ft. **Date Well Completed** 02/04/1993

Drill Method Driven **Drill Fluid**

Use piezometer **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**

Drive Shoe? Yes ☒ No ☐ **Above/Below** 1.62 ft.

Casing Diameter **Weight**

1.2 in. To 3.7 ft. lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** TEEL

Diameter	Slot/Gauze	Length	Set	
1.2 in.	60	3 ft.	3.7 ft.	6.7 ft.

Static Water Level

3.1 ft. land surface Measure 02/05/1993

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☒ Casing Protection ☐ 12 in. above grade

☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☒ No ☐ Not Specified

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☐ Yes ☒ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat peat-black Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or

System UTM - NAD83, Zone 15, Meters X 482552 Y 4963230

Unique Number Verification Information from Input Date 07/22/2019

Angled Drill Hole

Well Contractor

Twin City Testing	M0122	BRABENDER, L.
Licensee Business	Lic. or Reg. No.	Name of Driller

Minnesota Unique Well Number

526715

County Dakota
Quad St Paul SW
Quad ID 103C

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 09/22/2008
Update Date 09/05/2020
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PZ-4 RS	27	23	W	18	CDBADB

Elevation 721.29 **Elev. Method** Surveyed

Address

Well 3800 NICOLS RD MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT	0	25	BLACK	SOFT
SAND LOOSE	25	35	BROWN	

Remarks

SEALED 03-31-1997 BY M0143

Well Depth	Depth Completed	Date Well Completed
35 ft.	35 ft.	02/03/1993

Drill Method Driven **Drill Fluid**

Use piezometer **Status** Sealed

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☒ No ☐ **Above/Below** 2.46 ft.

Casing Diameter	Weight
1.2 in. To 33 ft.	lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** TEEL

Diameter	Slot/Gauze	Length	Set	
1.2 in.	60	2 ft.	33 ft.	35 ft.

Static Water Level

32.8 ft. land surface Measure 02/05/1993

Pumping Level (below land surface)

Wellhead Completion

Pitless adapter manufacturer Model

☒ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☒ No ☐ Not Specified

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☐ Yes ☐ No

Pump ☒ Not Installed Date Installed

Manufacturer's name

Model Number HP Volt

Length of drop pipe ft Capacity g.p. Typ

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or

System UTM - NAD83, Zone 15, Meters X 482552 Y 4963230

Unique Number Verification Information from Input Date 07/22/2019

Angled Drill Hole

Well Contractor

Twin City Testing	M0122	BRABENDER, L.
Licensee Business	Lic. or Reg. No.	Name of Driller

ATTACHMENT 2

Sensitivity Analysis

ROI		H-h		K	
(ft)	(m)	(m)	(ft)	(m/sec)	(ft/day)
MH1/South Junction Structure					
555	169	5.6	18.5	1E-04	28
176	**54**	**5.6**	**18.5**	**1E-05**	**2.8**
56	17	5.6	18.5	1E-06	0.28
M501A					
195	59	2.0	6.5	1E-04	28
62	**19**	**2.0**	**6.5**	**1E-05**	**2.8**
20	6	2.0	6.5	1E-06	0.28

Notes:

ROI - radius of influence (calculated using Sichardt Equation)

H-h - Proposed drawdown within excavation

K - hydraulic conductivity