

Minnehaha Creek Watershed District -Permit
Application Supporting Documentation

Orono Interceptor 7113 Improvements

MCES Project No. 802837

MCES0 179552 | February 11, 2026



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February 11, 2026

RE: Orono Interceptor 7113 Improvements
Minnehaha Creek Watershed District
Permit Application No. 25-583
MCES Project 802837
SEH Project MCES0 179552

Veronica Sannes
Permitting Lead
Minnehaha Creek Watershed District
15320 Minnetonka Blvd.
Minnetonka, MN 55345

Dear Ms. Sannes:

Please find enclosed supporting documentation for Permit Application #25-583, for the Orono Interceptor 7113 Improvements project located in Township 117N, Range 23W, and Sections 02 and 10 in Orono, Hennepin County, Minnesota and within the boundaries of the Minnehaha Creek Watershed District. Permit application and supporting documentation were submitted on December 8, 2025. MCWD formal response was received on December 29th, 2025 requesting revisions and additional information.

This revised document includes updated information and revisions to address MCWD's comments specific to Erosion Control, Floodplain Alteration, Waterbody Crossings and Structures, and Wetland Protection Rules.

Please feel free to contact us if you have any questions or comments.

Sincerely,

Angly Ulschmid, PE
Water Resources Engineer

aulschmid@sehinc.com

Luis Sandia, PE
Wastewater Engineer

lsandia@sehinc.com

Engineers | Architects | Planners | Scientists

Short Elliott Hendrickson Inc., 3535 Vadnais Center Drive, St. Paul, MN 55110-3507

651.490.2000 | 800.325.2055 | 888.908.8166 fax | sehinc.com

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1	Sylvia Doerr Stantec-Minnehaha Creek Watershed District
1	Daniel Fick Project Manager Metropolitan Council Environmental Services



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- Appendix D Plan Set

Orono Interceptor 7113 Improvements

Prepared for Metropolitan Council Environmental Services

1 Project Description

The Metropolitan Council Environmental Services (MCES) is seeking to install a redundant forcemain from Lift Station L59 in Orono to the 7113A junction structure at the intersection of Orono Orchard Road and Shoreline Drive (CSAH 15). The project activities include excavation, removal of existing bituminous pavement, installation of new sanitary forcemain via open cut and horizontal directional drilling (HDD), installation of cleanout and air release structures, stormwater culvert improvements, clearing and grubbing of selected areas, pavement restoration and site restoration work. The project area is located within the boundaries of the Minnehaha Creek Watershed District.

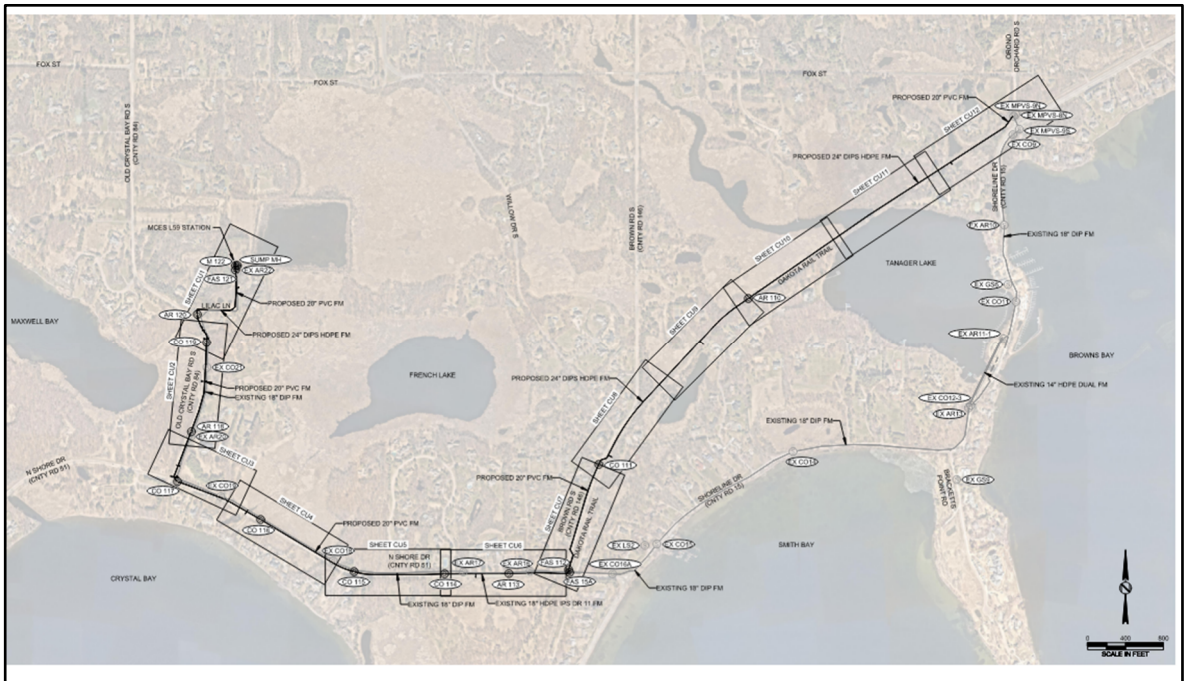


Figure 1 – Project Corridor Location

This project is critical to ensure the reliable conveyance of wastewater from the Lake Minnetonka area to the Blue Lake Wastewater Treatment Plant (WWTP) in Shakopee; the existing Forcemain FM 7113 constructed in 1979, is reaching the end of its designed lifespan. The goal of the project is to provide a system that will reliably convey wastewater for the next 30 to 50 years.

2 Project Corridor

The Project Corridor is located within Township 117N, Range 23W, and Sections 02 and 10 in Orono, Hennepin County, Minnesota. From the western terminus the Project Corridor begins at MCES Lift Station 59, then follows Lilac Lane to Old Crystal Bay Road South (County Road 84), to the intersection of North Shore Drive (County Road 51) it continues east and turns north at the intersection of Brown Road South (County Road 146), from here the Corridor runs generally parallel to the Dakota Rail Trail until the approximate intersection of Shoreline Drive and Orono Orchard Road South. The location of the Project Corridor is shown in Figure 1 and plan sheet GI6.

The Project Corridor is public right-of-way along Lilac Lane, Old Crystal Bay Road, North Shore Drive, Brown Road South and Orono Orchard Road. The eastern portion of the Project Corridor along the Dakota Rail Trail is owned by the Hennepin County Railroad Authority. The Project Corridor is primarily surrounded by residential properties, wetlands, ponds and lakes and the French Creek Preserve at the western terminus.

3 Impervious Surfaces

3.1 Scope of Work

The project scope of work includes trench excavation, horizontal directional drilling (HDD), backfill, pavement restoration and site restoration. The overall project will represent a net decrease in impervious surfaces, see Table 1.

Table 1 – Impervious Surface Summary

Impervious Surface Summary		
Existing Impervious Area	5.90	Acres
Proposed Impervious Area	5.70	Acres
Utility Trench (exempt) Area	3.00	Acres
Pavement restoration outside trench existing road section >30"	1.86	Acres
Pavement restoration outside trench existing road section < 30"	0.84	Acres

3.2 Geotechnical background information

Published geology indicates native surficial soils within the Project Corridor primarily consists of silt loam, sandy loam, and loamy sand and gravel. Fine-grained sand and silt within the Lake Minnetonka basin along isthmuses and peninsulas are the result of sorting of finer grained sediments in stagnant meltwater between large ice blocks. Additionally located throughout the Project Corridor is organic detritus described as partially decomposed, fine- to coarse-grained plant matter in post-glacial land surface depressions currently or formerly beneath the water table (Minnesota Geological Survey [MGS], 2018).

According to published hydrogeologic data, groundwater is expected to flow to the south toward Lake Minnetonka. Depth to groundwater is approximately 10 to 30 feet bgs (MGS, 2021). However,

due to the proximity to the lake, the depth and flow of groundwater could fluctuate seasonally with water level changes of Lake Minnetonka.

Project specific geotechnical investigations were conducted, a phased exploration approach was utilized, the first phase of site exploration included 12 soil borings extending to depths ranging from 26 ½ to 41 ½ feet and was completed in 2020. A geophysical investigation consisting of Multi-Channel Analysis of Surface Waves (MASW) surveys were completed in 2021 to provide more comprehensive mapping of organic soils along the project corridor and identify areas to focus a second phase of site exploration. Using the results of the initial site exploration and MASW surveys, additional 9 supplemental soil boring locations were selected extending to depths ranging from 26 to 46 feet. Additional geotechnical investigations were performed in 2025 and 2025 during which 19 additional soil borings were completed. Soil borings location and details are shown in plan sheets CU2 to CU13, geotechnical report available upon request.

Due to the unique physical setting of the corridor and original construction of the roads along wetlands and lakes, pavement profiles vary greatly; the geotechnical exploration data was used to categorize pavement thickness and correlate existing conditions with the pavement restoration to ensure compliance with Hennepin County road design requirements. Table 2 and Table 3 summarize soils borings by road, station range and road width to determine total pavement restoration areas shown in Table 1.

Table 2. Pavement Existing Conditions Summary

Pavement Existing Conditions										
Road Location	Old Crystal	Old Crystal	Old Crystal	North Shore	North Shore	North Shore	North Shore	North Shore	North Shore	Brown Road
Soil Boring ID	B-201	SB-202	SB-203	B-204	B-205	B-206	B-207	B-208	B-209	SB-210
Station (Plan Sheets CP3-CP9)	605+00	612+00	619+00	701+25	709+00	719+00	723+25	733+50	741+25	806+50
Measured existing bituminous thickness (inches)	5.5 Bit	6.0 Bit	6.0 Bit	5.0 Bit	14.5 Bit	21.0 Bit	6.0 Bit	5.0 Bit	6.0 Bit	5.0 Bit
Estimated existing base thickness (inches)	18.5 Gravel/R ecycle	18.0 Gravel/ Recycle	18.0 Gravel/R ecycle	19.0 Gravel/R ecycle	9.5 Gravel/ Sand	63.0 Silty Sand, Sandy Clay	18.0 Sand/ Gravel/ Recycle	19.0 Sand	9.0 Recycle	8.0 Gravelly Sand / Recycle
Estimated existing subbase thickness (inches)	30.0 Fill	30.0 Fill	30.0 Fill	30.0 Sand	Lean 30.0 Clay, Gravel		30.0 Sand	Sandy 30.0 Silt/Lean Clay	9.0 Sand	Silty 11.0 Sand / Recycle
									30.0 Sand	30.0 Sand / Recycle

Table 3. Pavement Restoration Summary

Pavement Restoration										
Soil Boring ID	B-201	SB-202	SB-203	B-204	B-205	B-206	B-207	B-208	B-209	SB-210
Minimum Total Estimated Road Section ¹	24 "	24 "	24 "	54 "	24 "	84 "	54 "	24 "	54 "	54 "
Maximum Total Estimated Road Section ¹	54 "	54 "	54 "	54 "	54 "	84 "	54 "	54 "	54 "	54 "
Preferred Typical County Section	30 "	30 "	30 "	30 "	30 "	30 "	30 "	30 "	30 "	30 "
From Station ²	602+00	608+50	616+50	700+25	705+50	714+00	721+25	728+50	737+50	800+25
To Station ²	608+50	616+50	620+00	705+50	714+00	721+25	728+50	737+50	745+20	813+05
Length (ft)	650	800	350	525	850	725	725	900	770	1280
Trench Width at Pavement (ft)	20	20	20	20	20	20	20	20	20	20
Pavement Width (plus shoulder) (ft)	30	30	30	31	30	31	32	31	31	32
Remaining Impervious Width (ft) ³	10	10	10	11	10	11	12	11	11	12
Additional Cut to Reach 30" Depth [in] ⁴	6	6	6	0	6	0	0	6	0	0
Estimated Restoration Area Outside of Trench [ft ²] ⁵	6500	8000	3500	0	8500	0	0	9900	0	0
Estimated Restoration Area Outside of Trench [acre] ⁵	0.15	0.18	0.08	0.00	0.20	0.00	0.00	0.23	0.00	0

Key Notes

- Each Soil Boring from includes a general description/depth/thickness by layer. This data was used to estimate Minimum and Maximum road section, a range was used as some of the fill appears to be part of the road section.
- A representative station range was defined for each Soil Boring location.
- Remaining impervious width (bit/gravel) based on a 20' estimated impact to the pavement due to trenching.
- Additional depth required to reach the 30" typical section based on the Minimum estimated road depth.
- Estimated restoration area based on the over-cut areas.

3.3 Road and Trail Restoration

The proposed design includes restoration of all disturbed areas and replacement of selected shoulder areas with native perennial vegetation. Typical sections are shown to provide an overview of the road sections, see plan set for complete overall road plan.

Lilac Lane existing conditions and pavement removal, see plan sheet CD2. Road plan and profiles see plan sheet CP2. Typical section, paving details, grade and subgrade details see plan sheet CP13.

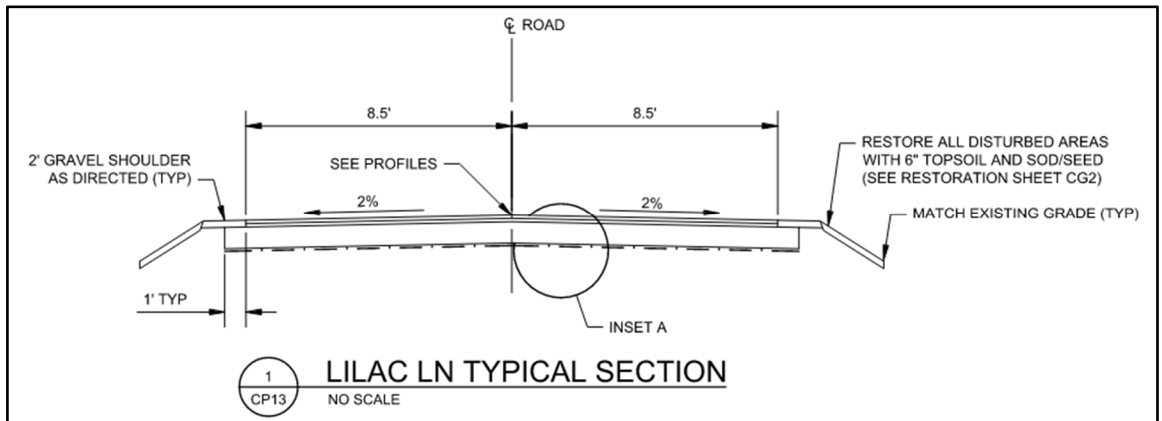


Figure 2 – Lilac Lane Typical Section

Old Crystal Road existing conditions and pavement removal plan, see sheets CD2 to CD4. Road plan & profiles see plan sheets CP3 and CP4. Typical section, paving details, grade and subgrade details see plan sheet CP13.

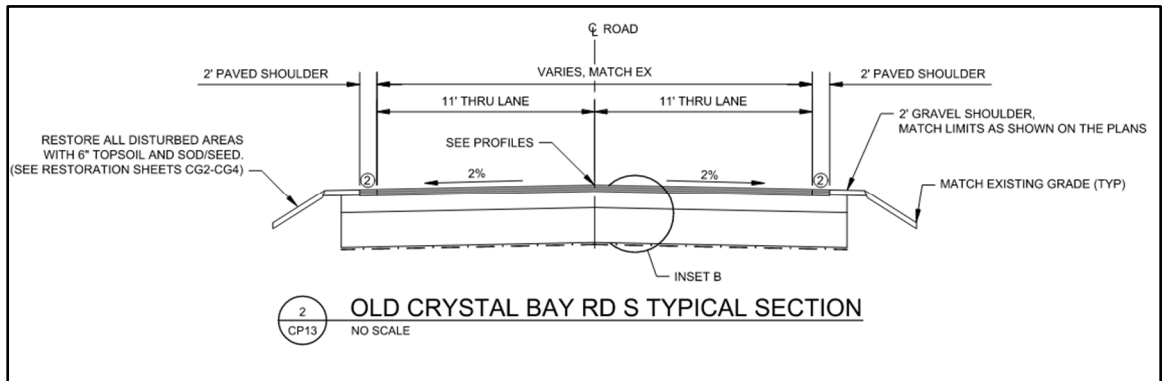


Figure 3 – Old Crystal Bay Road South Typical Section

North Shore Drive existing conditions and pavement removal, see plan sheets CD4 to CD7. Road plan & profiles see plan sheets CP5 to CP8. Typical section, paving details, grade and subgrade details see plan sheet CP13.

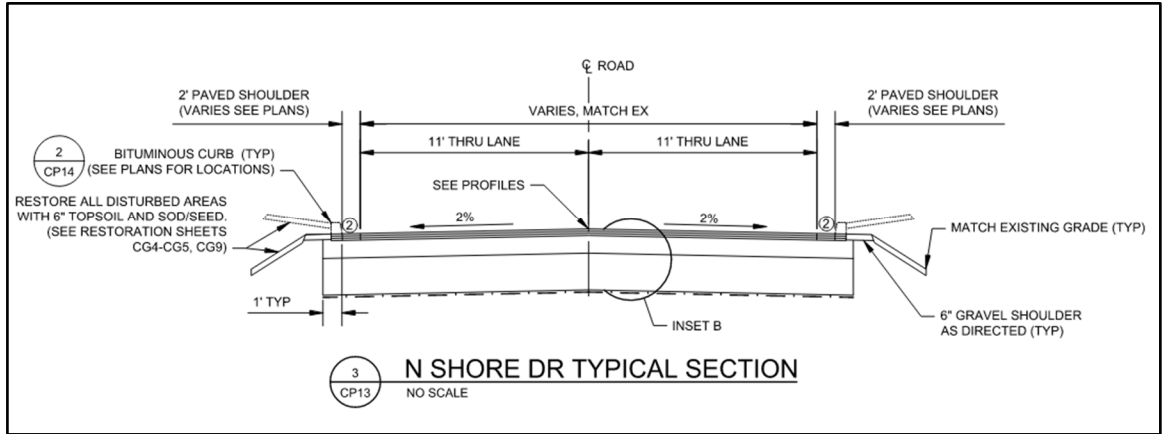


Figure 4 – North Shore Drive Typical Section

Brown Road existing conditions and pavement removal plan, see plan sheets CD7 and CD8. Road plan & profiles see plan sheet CP9 and CP10. Typical section, paving details, grade and subgrade details see plan sheet CP13

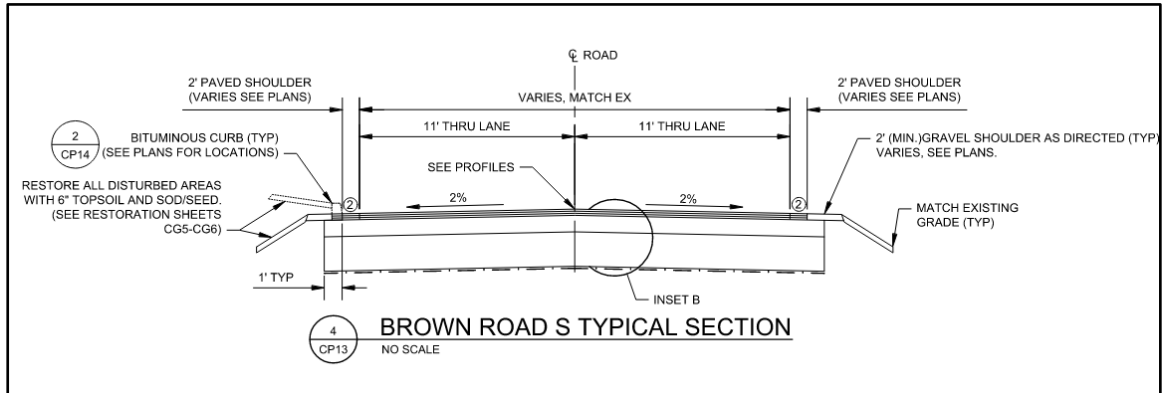


Figure 5 – Brown Road South Typical Section

Dakota Rail Trail existing conditions and pavement removal see plan sheets CD7 to CD10. Proposed trail restoration plan & profiles, plan sheets CP11 and CP12. Trail typical section, paving details, grade and subgrade details see plan sheet CP14.

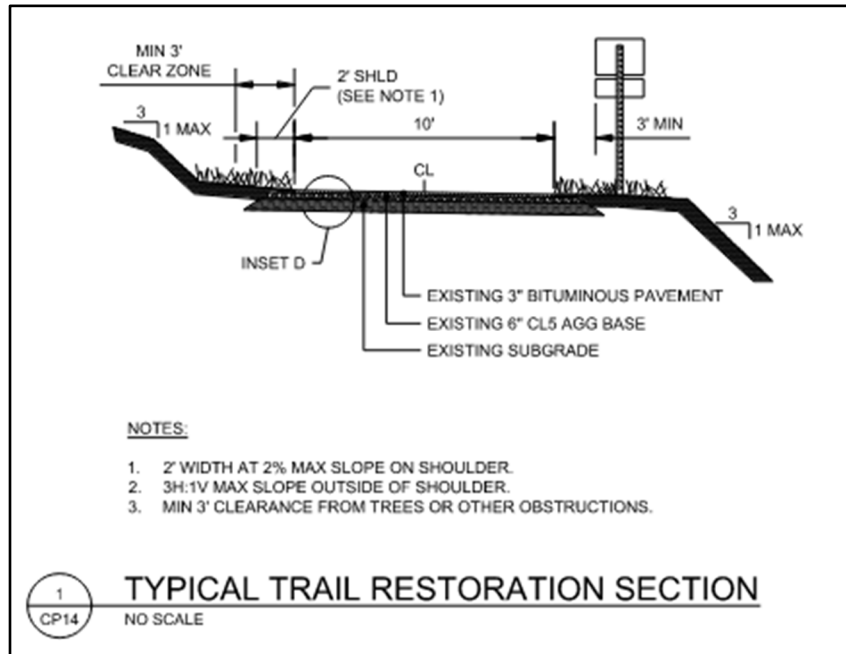


Figure 6 – Dakota Trail Typical Section

utilities easement and clearly define the maximum extent of construction operations to ensure the contractor maintains all operations within the established footprint.

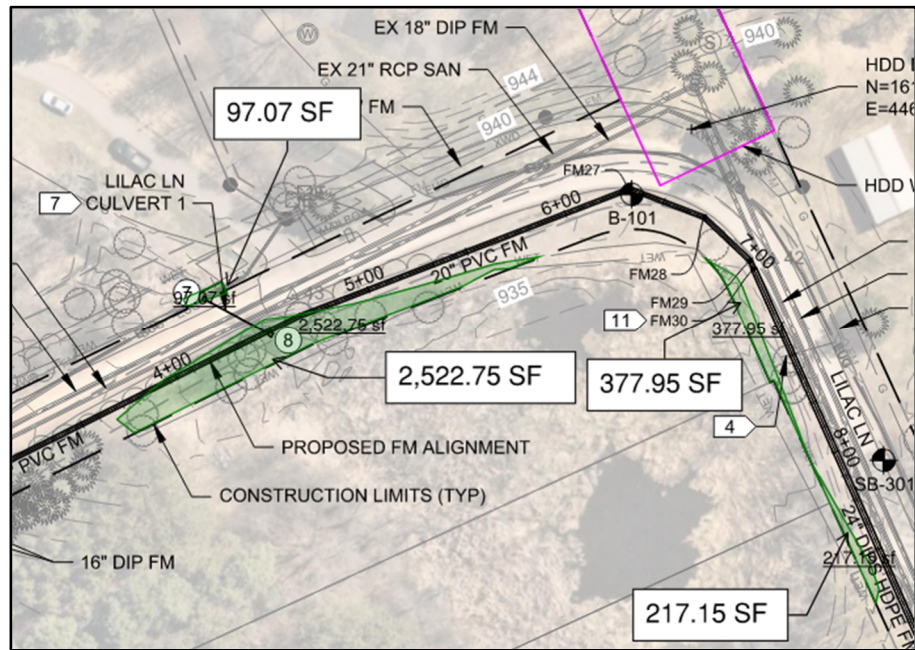


Figure 8 – Estimated Area of Potential Disturbance Station 4+00 to Sta 8+00

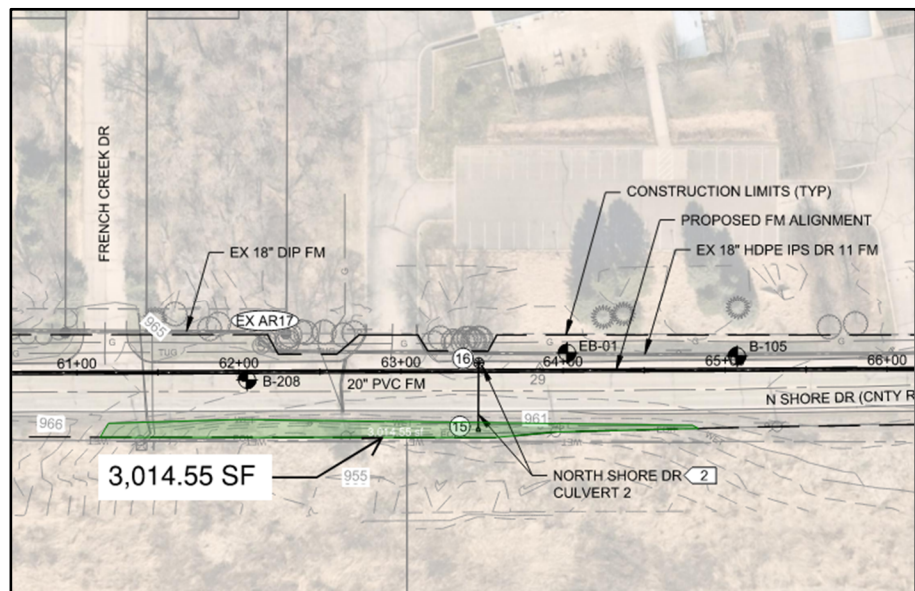


Figure 9 – Estimated Area of Potential Disturbance Sta 61+00 to Sta 65+00

The volumes estimated represent the cut and fill that potentially would be necessary to install the forcemain or for culvert rehabilitation operations. For example, the estimated area of potential disturbance between Station 61+00 and Station 65+00 is 3,014.55 SF, see Figure 9. The estimated

volume of cut and fill is 6 CY for culvert removal and replacement, no permanent fill will be placed as part of the proposed operations, therefore the net cut/fill volume is zero and the area will be restored after operations are complete.

Given that the forcemain installation coincides with wetlands along the entire corridor, it is not feasible to avoid construction operations along wetlands. However, mitigation measures have been designed to reduce the potential of disturbance and excavation will be limited to the minimum required to complete operations safely.

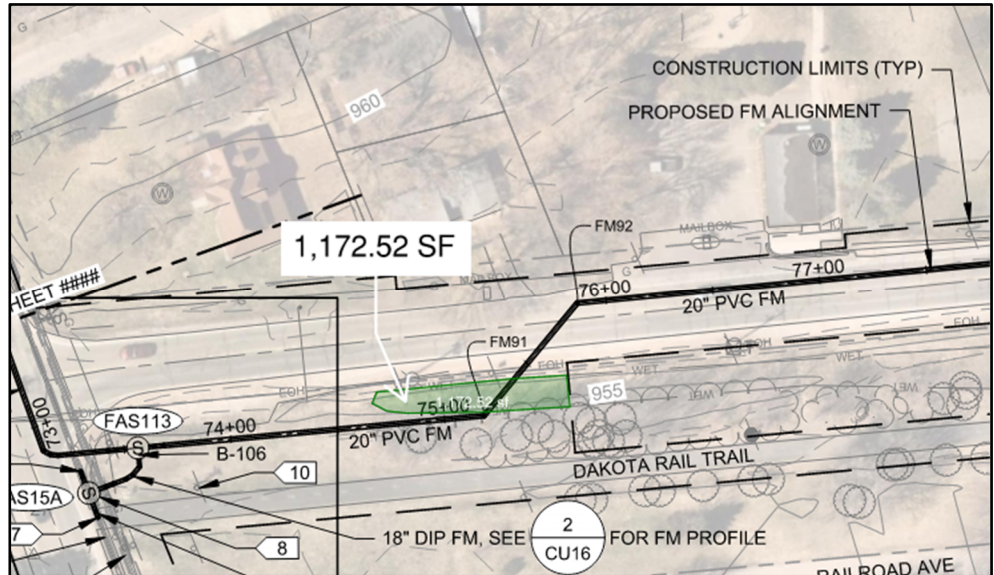


Figure 10 – Estimated Area of Potential Disturbance Sta 75+00

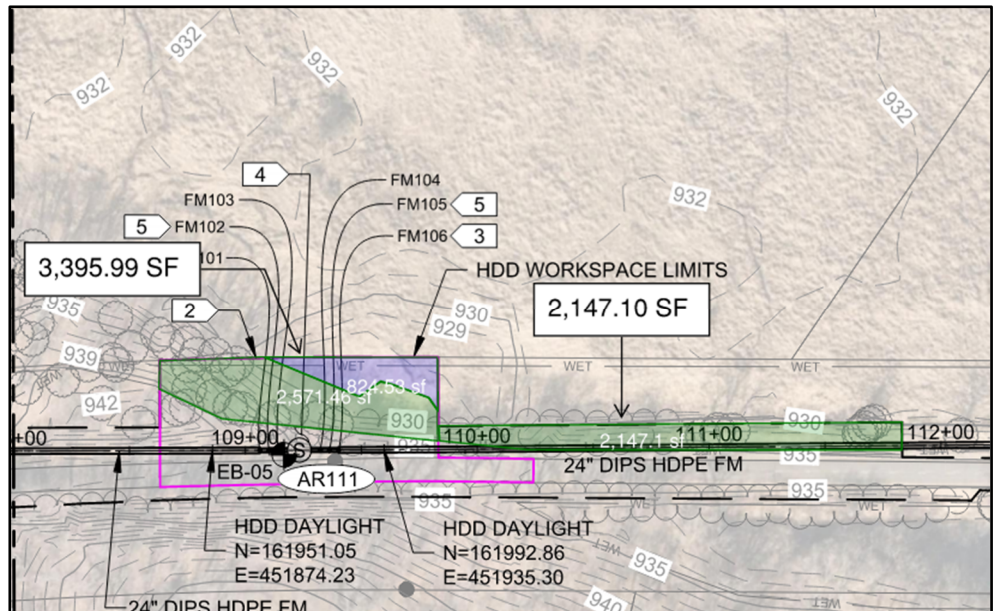


Figure 11 – Estimated Area of Potential Disturbance Sta 109+00 to Sta 112+00

The estimated area of potential disturbance between Station 109+00 and Station 110+00 is 3,396 SF, see Figure 11. A permanent air release structure is proposed at this location with a proposed permanent fill volume of 8.69 CY which is necessary for slope stability; a detailed analysis of the temporary operations and permanent structure is presented in Section 5- Floodplain alteration rule. No excavation is anticipated between Station 110+00 and Station 112+00.

At the end of the corridor multiple areas of potential disturbance have been identified, however excavation operations will be limited to a section approximately between Station 142+00 to Station 143+00 for forcemain installation, see Figure 12; the net cut/fill volume is zero and the area will be restored to existing conditions after operations are complete.

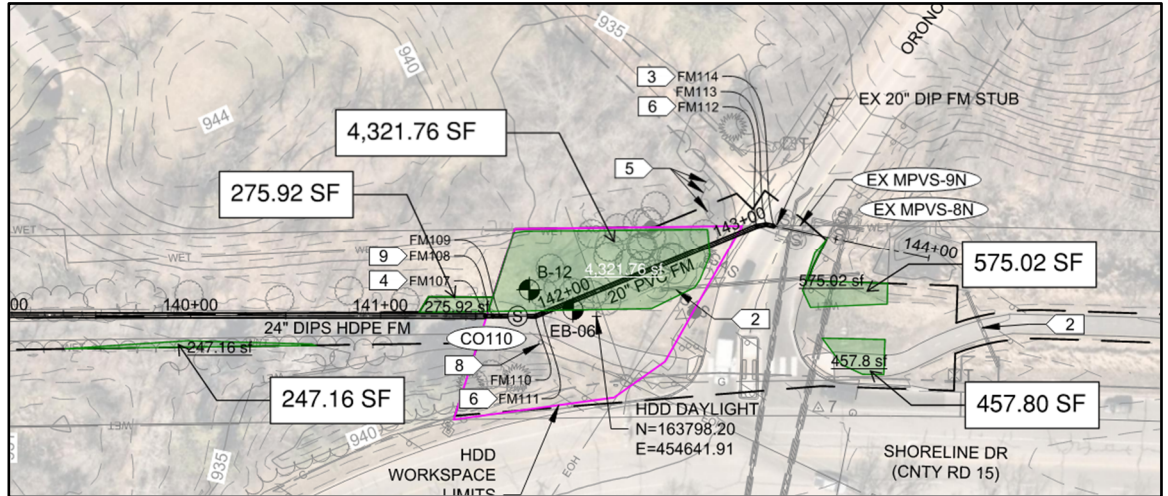


Figure 12 – Estimated Area of Potential Disturbance Sta 140+00 to Sta 144+00

Table 4. Wetlands - Potential Disturbance Summary

Wetlands Potential Disturbance					
Estimated Area and Volume Summary					
Station Range	Estimated Area of potential disturbance*	Estimated Cut Volume	Estimated Fill Volume	Net Cut/Fill	Description of the Work
	(SF)	(CY)	(CY)	(CY)	
4+00 to 6+00	2523	384	384	0	Forcemain installation and pavement restoration.
	97	0	0	0	Lilac Lane Culvert improvements.
7+00 to 9+00	378	0	0	0	Estimated area of potential disturbance (Figure 7 green area) is the intersection area between wetland boundaries and construction limits, no excavation anticipated.
	217	0	0	0	
13+00 to 14+00	467	0	0	0	Old Crystal Bay Rd. Culvert 1 improvements.
18+00 to 19+00	42	0	0	0	Old Crystal Bay Rd. Culvert 2 improvements.
28+00 to 29+00	174	0	0	0	Old Crystal Bay Rd. Culvert 3 improvements.
	231	0	0	0	Old Crystal Bay Rd. Culvert 4 improvements.
30+00 to 35+00	4837	0	0	0	North Shore Dr. Private Culvert improvements.
37+00 to 40+00	405	3	3	0	North Shore Dr. Culvert 1 improvements.
	445	0	0	0	
	445	0	0	0	CO117 clean-out structure installation
61+00 to 65+00	3015	6	6	0	North Shore Dr. Culvert 2 improvements.
75+00	1173	112	112	0	Forcemain installation and pavement restoration.
87+00	144	4	4	0	Dakota Trail Culvert 1 improvements.
87+00	104	4	4	0	
88+00 to 96+50	2428	0	0	0	Estimated area of potential disturbance is the intersection area between wetland boundaries and construction limits, no excavation anticipated.
97+00	194	0	0	0	
100+00 to 102+50	187	0	0	0	Dakota Trail Culvert 2 improvements.
	337	8	8	0	
	308	8	8	0	
107+00	833	0	0	0	Forcemain installation and pavement restoration.
109+00 to 110+00	3396	8.69	8.69	0	Permanent fill to stabilize the slope as needed for permanent structure. See Section 5-Floodplain alteration rule for detailed analysis.
110+00 to 112+00	2147	0	0	0	Estimated area of potential disturbance (Figure 10-green area) is the intersection area between wetland boundaries and construction limits, no excavation anticipated.
126+00	60	0	0	0	Estimated area of potential disturbance is the intersection area between wetland boundaries and construction limits, no excavation anticipated.
135+00	186	0	0	0	Dakota Trail Culvert 2 improvements.
	42	0	0	0	
140+00 to 141+00	247	0	0	0	Estimated areas of potential disturbance (Figure 11-green areas) are the intersection area between wetland boundaries and construction limits, no excavation anticipated.
	276	0	0	0	
142+00 to 143+00	4322	720	720	0	Forcemain installation and pavement restoration.
144+00	575	0	0	0	Estimated areas of potential disturbance (Figure 11-green areas) are the intersection area between wetland boundaries and construction limits, no excavation anticipated.
	458	0	0	0	

5 Floodplain Alteration Rule

In compliance with the MCWD Floodplain Alteration Rule and applicable policy to “*Preserve flood storage capacity between the ordinary and 100-year high water elevations of waterbodies to limit flood frequency and severity, limit flood risk for structures built in or adjacent to floodplain and protect streambanks for stability, water quality and ecological values.*”

WCWD requested clarification of Table 4. Table 4 summarizes the estimated area of potential disturbance within the wetland boundaries defined by the project-specific wetland delineation. These calculations are specific to wetland areas and construction limits, see Section 4 for complete details.

Only one location has been identified where the proposed operations will occur below the 100-year flood elevation as defined by MCWD. A permanent Air Release Structure (AR111) is proposed along Dakota Rail Trail, see Figure 13, plan sheet CU11 and CG10. Temporary and permanent grading operations are necessary between Station 109+00 and Station 110+00 for the installation of the permanent air release structure.



Figure 13 – AR111 Air Release Valve Location

The floodplain elevations of the impacted wetland provided by MCWD are as follows:

- 100-year HWL: 930.580 ft NGVD 29
- 5-year HWL (OWHL): 929.963 ft NGVD 29

Additionally, the MCWD states: “*The 5-year HWL was used as a proxy for the OHWL instead of the 2-year because the wetland appears to be modeled as a basin, not a watercourse.*”

The project vertical control is based on NAVD 88. *The MCWD Floodplain Alteration Rule requires that all elevations be reduced to NGVD 29 (1929 datum). Based on the NOAA tool and project location the recommended conversion is as follows:*

1929 NAVD + 0.18 = NAVD 1988

Floodplain Elevation	NGVD 29	NAVD 88
100-Year HWL	930.580 ft	930.760 ft
5-Year HWL (OHWL)	929.963 ft	930.143 ft

5.1 Temporary Fill

The permanent location of structure AR111 will also serve as Horizontal Directional Drilling (HDD) work platform, see area overview in Figure 14 and plan sheet CK3. The temporary platform is necessary for the installation of the forcemain via trenchless HDD. See HDD plan, profiles and details in plan sheets CK4 to CK6.

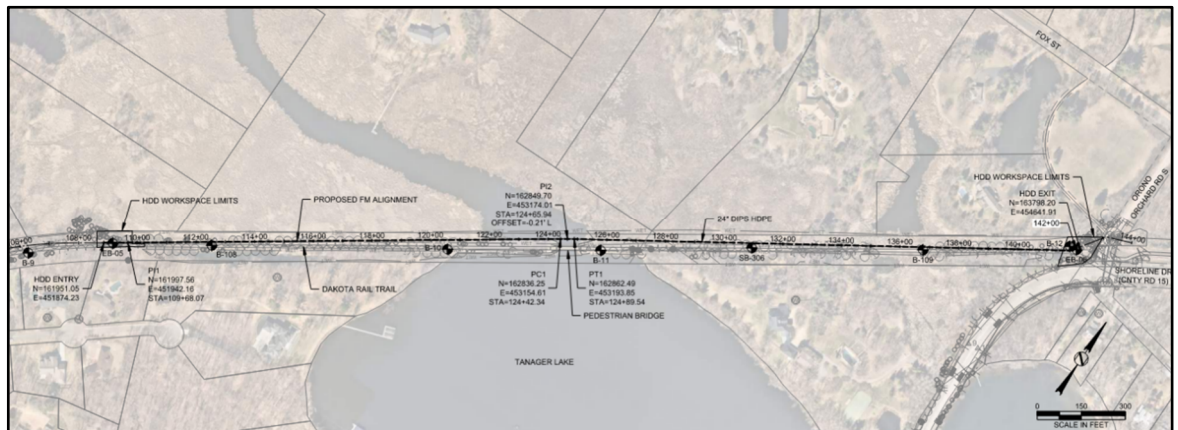


Figure 14 – Tanager Lake Area Overview

This location was selected to minimize environmental impacts, avoid extensive excavation in the area and minimize impacts to surface waters including Long Lake Creek, Tanager Lake and adjacent wetlands. Installation of the forcemain with any other methods is not feasible from Station 108+00 to Station 140+00, therefore it is impractical to avoid the proposed temporary floodplain fill given that entry and exit ports are necessary for HDD operations.

The temporary platform will be removed after completion of the HDD operations, and the area will be restored to existing conditions, incorporating permanent grading operations for AR111, see section 5.2- Permanent Fill.



Figure 15 – AR111 Area Wetlands Overview - NWI

The HDD method minimizes disruption to the surface waters in the area to the greatest extent possible, given that the existing forcemain is located along North Shoreline Drive, there are no other alternatives for the proposed operations, see Figure 15.

Construction limits strictly follow the Hennepin County Regional Railroad Authority (HCRRRA) Right of Way (ROW), see Figure 16. License for utility to cross public waters (License Number UWAT013989), was issued by the Minnesota Department of Natural Resources on February 1, 2025, the purpose if this license is the construction, maintenance and operation of the proposed pipeline under Long Lake Creek within the existing easement, see documentation in Appendix B.

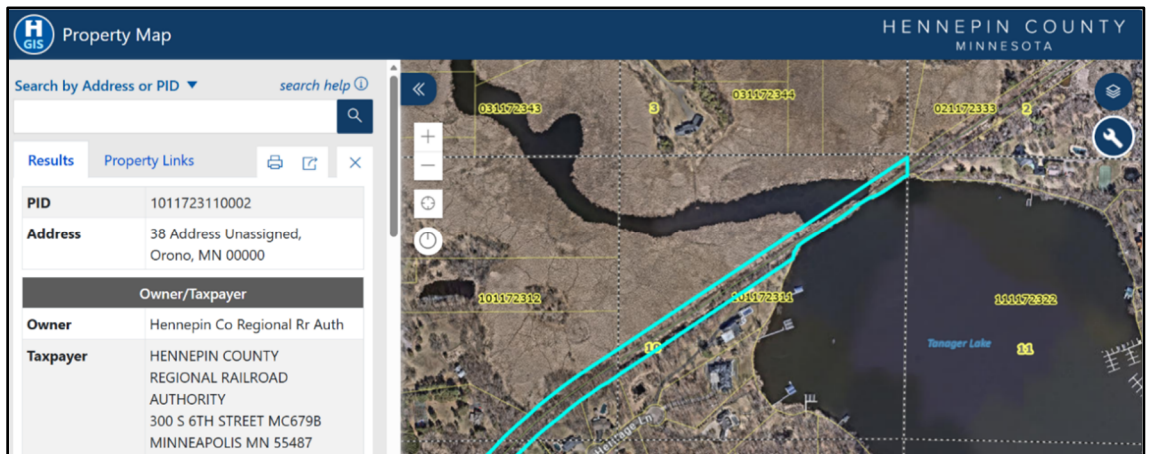


Figure 16 – HCRRRA Right-of-Way Overview

The anticipated duration of the construction operations is four (4) months; to further minimize potential impacts to the area operations will be taking place during the winter months, anticipated beginning in December ending in March, and final restoration during the spring season. Main construction activities and estimated time frame as follows:

- Temporary construction platform (1 month)
- HDD pipeline installation (2 months)
- Removal construction platform (2 weeks)
- Air release structure-permanent structure (2 weeks)
- Restoration (2 weeks- Spring season)

Construction sequence as follows:

1. Construction operations are strictly limited to the winter season.
2. Due to the limited trail width, the sequence of work requires closure of the trail.
3. From Station 87+00 to Station 142+00 the forcemain will be installed using horizontal directional drilling (HDD) trenchless method. HDD workspace limits are shown in plans sheets CK2 to CK 4.
4. A temporary working platform will be constructed to widen the trail surface at approximately at Station 109+00 to safely accommodate horizontal directional drilling (HDD) equipment.
5. Sheet-pile system will be installed along the perimeter of construction limits which follows the HCRRRA ROW. The sheet pile system was designed to support the temporary working platform and minimize the overall construction footprint. Extending the construction limits beyond the HCRRRA ROW is unfeasible and would represent a significant impact to wetlands, floodplain areas and private properties.
6. The proposed temporary platform will serve as the HDD work area; this platform is necessary for forcemain installation operations.
7. Following completion of the HDD installation, the air release structure will be constructed, and the forcemain will be connected to the structure.
8. Upon completion of construction, the temporary working platform, sheet pile system, and temporary fill will be removed, and all disturbed areas will be restored to existing conditions.
9. The proposed permanent graded area is required for ongoing access, safety, and maintenance of the air release structure.

As requested by MCWD, Figures 17 and 18 show the proposed location of the temporary platform relative to the 5-year HWL (OHWL) and 100-year HWL contours and proposed temporary structure.

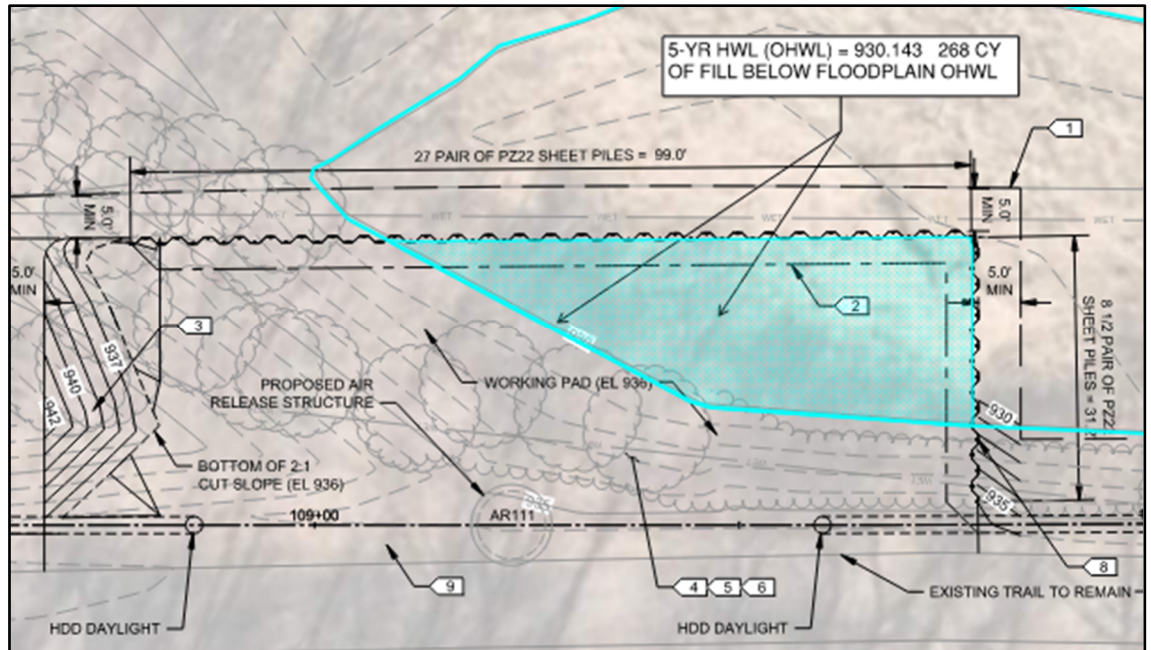


Figure 17 – Temporary Fill Below OHWL

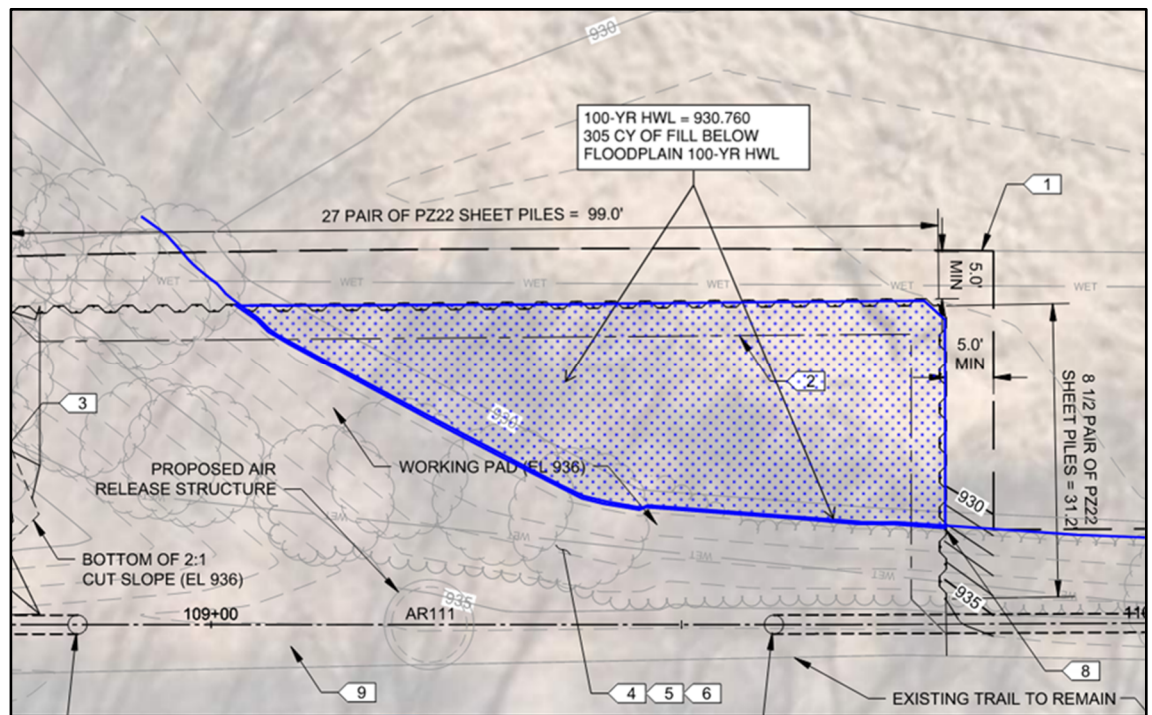


Figure 18 – Temporary Fill Below 100-YR HWL

For temporary net-fill, the following calculations have been completed to demonstrate that the increase in the 100-year high water level is no more than 0.00 ft from the existing to the proposed temporary condition (HDD working platform), as required by the floodplain alteration rule. The MCWD indicated that *“an instantaneous calculation may be provided in which you calculate the amount of floodplain storage between the OHWL and 100-year HWL, adding the proposed volume of fill to determine if it will lead to a rise in the wetland.”*

Lake Minnetonka Total Footprint	14,500 Acres	631,620,000 SF
Floodwater depth	2.1000 FT	

Floodwater volume	1,326,402,000.00 CF	2.1 ft * 14,500 Acres
-------------------	---------------------	-----------------------

Fill below the floodplain 5-year High Water Level (OHWL)

Area	1,050 SF
------	----------

Volume	268 CY
--------	--------

Total floodwater volume plus HDD working pad displacement volume =	1,326,409,236.00 CF
--	---------------------

New floodwater depth of Lake Minnetonka =	2.100011 FT
---	-------------

Total floodwater volume plus HDD working pad displacement volume - total footprint of Lake Minnetonka	
---	--

Fill below the floodplain 100-year High Water Level

Area	1,265 SF
------	----------

Volume	305 CY
--------	--------

Total floodwater volume plus HDD working pad displacement volume	1,326,410,235.00 CF
--	---------------------

New floodwater depth of Lake Minnetonka =	2.100013 FT
---	-------------

Total floodwater volume plus HDD working pad displacement volume - total footprint of Lake Minnetonka	
---	--

Notes:

All storage areas are simplified to vertical walls (Volume calculation = Area * Depth)

Long lake creek, its floodplain and adjacent wetlands are hydraulically connected to the main body of Lake Minnetonka). See Figure 19.

HDD Working pad is a leveled platform contained within the perimeter of the sheet pile system.

5.2 Permanent Fill

The permanent Air Release Structure (AR111) proposed along Dakota Rail Trail is located between Station 109+00 and Station 110+00. This location was selected based on topography, geotechnical analysis, forcemain operations considerations and to minimize impacts to the area to the greatest extent possible.

The Three Rivers Park District requires a minimum 3-foot clear zone between the trail pavement and the structure casting for maintenance and public safety. In addition, MCES Operations and Maintenance (O&M) requires safe access to AR111 for ongoing system maintenance.

To meet multiple requirements and provide safe access for O&M personnel, the proposed permanent platform extends approximately 10 feet from the trail pavement.



Figure 19 – NFHL Area Overview

Permanent grading is necessary to create a stable slope for the permanent structure. Initially a 3:1 slope was evaluated, to minimize impacts to the wetlands a 2:1 slope was selected to reduce the permanent fill within the adjacent wetland and avoid permanent fill within the floodplain, see slope footprint comparison in Figure 20 and proposed grading plan in plan sheet CG10.

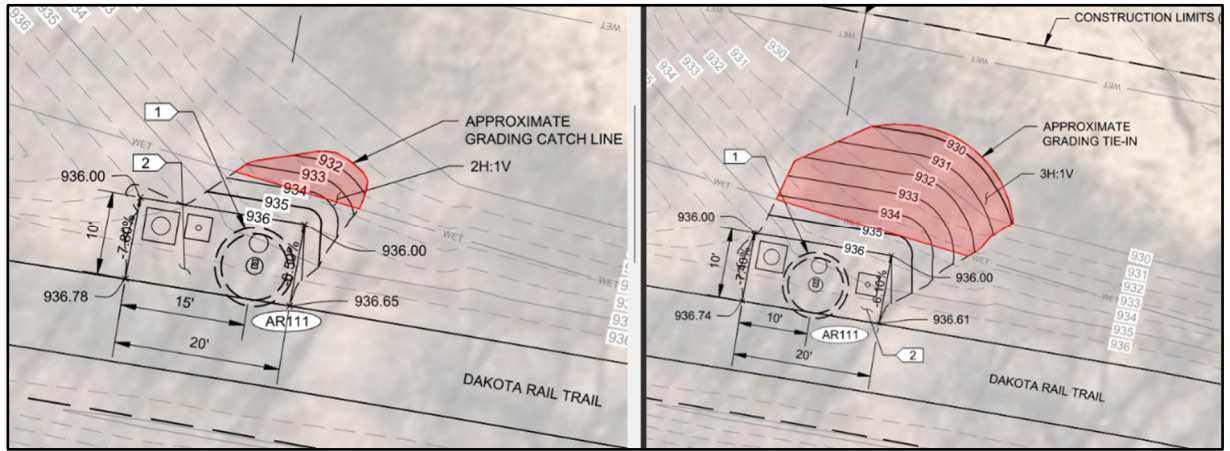


Figure 20 – Permanent Fill Mitigation – Slope Comparison

To further minimize wetland impacts construction operations will take place in the winter months after the temporary HDD operations are complete; the areas will be restored to existing conditions after construction of the permanent structure is complete.

The permanent structure AR111 will be placed above the 100-year high water elevation and above the 5-year high water elevation (OHWL), therefore there will be no loss in flood storage as a result of the installation of the proposed structure. See Figure 21.

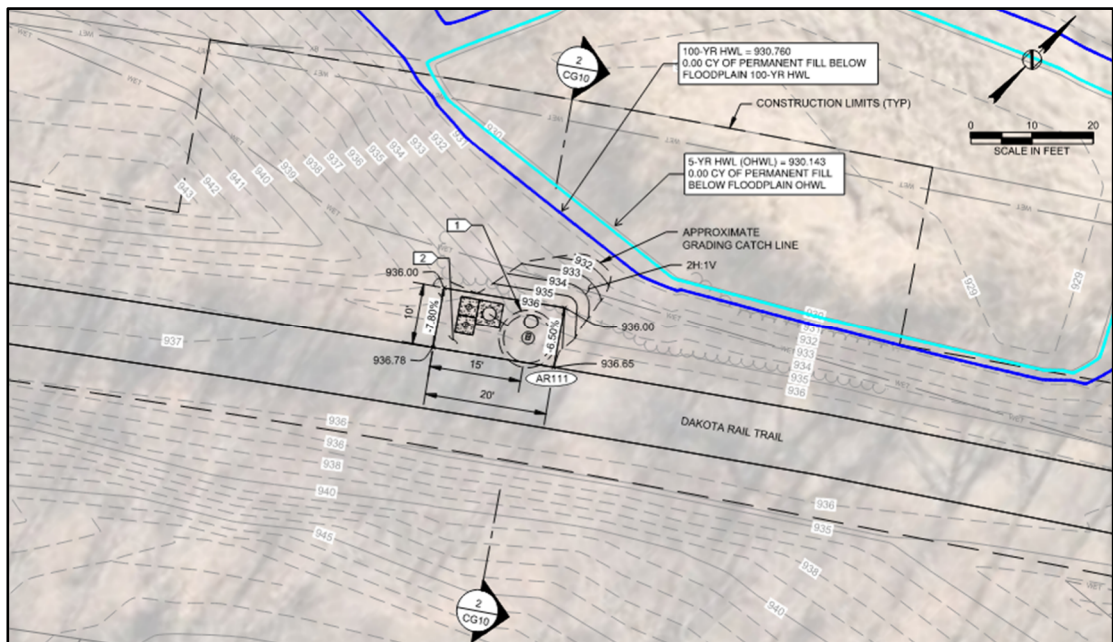


Figure 21 – Permanent Structure & Floodplain HWL & OWHL

6 Erosion and Sediment Control

A project specific Stormwater Pollution Prevention Plan (SWPPP) has been designed to address the requirements of the NPDES- Construction Stormwater General Permit and the MCWD Erosion and Sediment Control Rule, see plan sheets CG11 to CG13.

Temporary best management practices (BPMs) including perimeter control, sediment control, stabilization methods will be maintained throughout the duration of the project as described in the SWPPP. Phasing of construction operations will be implemented to limit area and duration of exposed soils, all disturbed areas will be restored and revegetated.

Permanent BMPs include the establishment of approximately 280,000 square feet (6.50 Acres) of native vegetation along the project corridor. Seeding was selected in accordance with the MnDOT seeding manual and designed based on site conditions to ensure proper vegetation establishment. Seeded areas will be maintained until a minimum of 70% vegetation establishment has been achieved, specific locations of seeding, rolled erosion control blanket, hydraulic stabilized fiber matrix and fertilizer are shown in plan sheets CG9 and CG14.

Table 5 – Vegetation Areas

Proposed Native Vegetation		
Item Description	Area	
	SF	Acre
Seed Southern Shortgrass Roadside	93,967	2.16
Seed Turfgrass	160,432	3.68
Seed Wet Ditch	15,387	0.35
Seed Southern Tallgrass Roadside	13,234	0.30
Seeding Total	283,140	6.50
Sodding Type Salt Tolerant	46,099	1.06

The project replaces approximately 8,700 square feet (0.2 Acres) of impervious surfaces with native perennial vegetation and replaces approximately 46,000 square feet of landscape sod areas. Permanent perennial cover and landscaped sod will prevent soil erosion and will serve as permanent stabilization measure along the entire project corridor; vegetation directly adjacent to impervious pavement areas creates a buffer between impervious areas and surface waters which will benefit water quality.

Erosion control plan sheets CG2, CG3, CG5 and CG8 were updated to address erosion control items identified by MCWD.

7 Waterbody Crossings and Structures

7.1 License for Utility to Cross Public Waters

The Minnesota Department of Natural Resources issued License Number UWAT013989 to the Metropolitan Council Environmental Services for the project activities including construction, maintenance and operation of the Orono Interceptor 7113 improvements project as described in section 1. See Appendix B for complete documentation.

7.2 Stormwater Culvert Change Analysis

The stormwater infrastructure scope of work includes improvements to twelve (12) stormwater culverts located within the project area. The proposed culvert improvements include the replacement of two (2) corrugated metal pipe (CMP) culverts with new CMP, nine (9) CMP will be replaced with new reinforced concrete pipe (RCP) culverts and the 48-inch CMP culvert located at North Shore Drive will be rehabilitated using CIPP lining in order to preserve the existing deep foundation system.

The purpose of the proposed work is to improve the existing conditions and extend the service life of the structures, while maintaining the existing hydraulic capacity of the system to avoid any increases in flood stage. Culvert changes were evaluated individually utilizing the Minnehaha Creek Watershed District (MCWD) Culvert Change Analysis Worksheet to ensure compliance with the WCWD methodology. Additionally North Shore Drive Culvert 1 was analyzed with XPSWMM and Lilac Lane culvert and Dakota Trail Culvert 3 were analyzed with HydroCAD.

Summary of existing conditions and proposed conditions shown on Table 6. Individual culvert change analysis are detailed in pages 24 to 42. See plan sheets CD1 to CD10 for culverts existing conditions and existing culverts profiles in plan sheets CD14 and CD15. See plan sheets CU1 to CU13 for proposed conditions and proposed culvert profiles in plan sheets CU18 and CU19.

Table 6 - Culvert Change Analysis Summary

Culvert ID	Plan Sheet	Existing Conditions								Proposed Conditions									
		Size [in]	Material	Manning's Roughness	Slope (%)	Length (lf)	Upstream Invert	Downstream Invert	Pipe Capacity [cfs]	Size [in]	Material	Manning's Roughness	Slope (%)	Length (lf)	Upstream Invert	Downstream Invert	Pipe Capacity [cfs]	Capacity Δ (cfs) [P-E]	Capacity Δ %
Lilac Lane Culvert 1	CU2 Sta 4+40	24	CMP	0.025	-1.87%	24	935.17	934.72	13.62	24	CMP	0.025	-1.65%	37	935.17	934.56	13.55	-0.07	-0.51%
Old Crystal Bay Rd. S. Culvert 1	CU 3 Sta 13+75	15	CMP	0.025	2.31	46	932.16	931.10	5.11	15	CMP	0.025	2.21	43	932.16	931.22	4.98	-0.13	-2.55%
Old Crystal Bay Rd. S. Culvert 2	CU3 Sta 18+30	15	CMP	0.025	0.59	53	932.94	932.63	2.58	15	RCP	0.012	0.13	50	932.94	932.87	2.63	0.05	1.92%
Old Crystal Bay Rd. S. Culvert 3	CU4 Sta 27+75	15	CMP	0.025	1.89	42	938.80	938.00	4.65	15	RCP	0.012	0.47	43	938.80	938.60	4.79	0.14	2.95%
Old Crystal Bay Rd. S. Culvert 4	CU4 Sta 29+00	18	CMP	0.025	3.19	66	939.16	937.06	9.77	18	RCP	0.012	0.77	66	939.16	938.65	10.03	0.26	2.67%
North Shore Drive Private Culvert	CU4 Sta 31+00	8	PVC	0.010	2.29	69	936.90	935.32	2.38	12	RCP	0.012	0.40	69	935.59	935.32	2.42	0.04	1.57%
North Shore Drive Culvert 1 (1)	CU5 Sta 37+60	48	CMP	0.025	0.30	47	925.73	925.59	96.08	46	CMP-Lined	0.020	0.30	47	925.73	925.59	88.24	-7.84	-8.16%
North Shore Drive Culvert 2	CU7 Sta 63+45	12	CMP	0.025	2.74	42	958.72	957.57	3.07	15	RCP	0.012	0.19	39	958.72	958.65	3.08	0.01	0.11%
Browns Road South Culvert 1	CU8 Sta 78+50	15	CMP	0.025	1.22	53	953.67	953.02	3.73	15	RCP	0.012	0.30	50	953.67	953.52	3.79	0.06	1.66%
Dakota Trail Culvert 1	CU9 Sta 86+80	24	CMP	0.025	1.32	44	940.11	939.53	13.54	21	RCP	0.012	0.65	46	940.11	939.81	13.90	0.36	2.64%
Dakota Trail Culvert 2	CU10 Sta 102+30	30	CMP	0.025	0.79	49	930.56	930.17	19.08	24	RCP	0.012	0.63	49	930.56	930.25	19.55	0.47	2.44%
Dakota Trail Culvert 3	CU13 Sta 135+00	18	CMP	0.025	0.31	23	930.36	930.29	7.92	15	RCP	0.012	0.20	25	930.360	930.31	7.39	-0.53	-6.69%

7.2.1 Lilac Lane Culvert

The existing CMP culvert is located at Station 4+40, see plan sheet CU2. Survey and field observations confirmed that the shallow culvert is deformed at both ends, with an estimated original diameter of 24-inches, the existing pipe is in very poor condition, cover at the end sections was estimated to be between 4-6 inches. At the time of the October 2025 assessment the culvert was approximately 40% full of sediment.

The proposed project includes the improvement of Lilac Lane from MCES L59 to the intersection of Old Crystal Bay Road South, see plan sheet CP2, such improvements include new pavement and widening of the road, which in turn will require an extension of the culvert pipe from 24 feet to 37 feet.

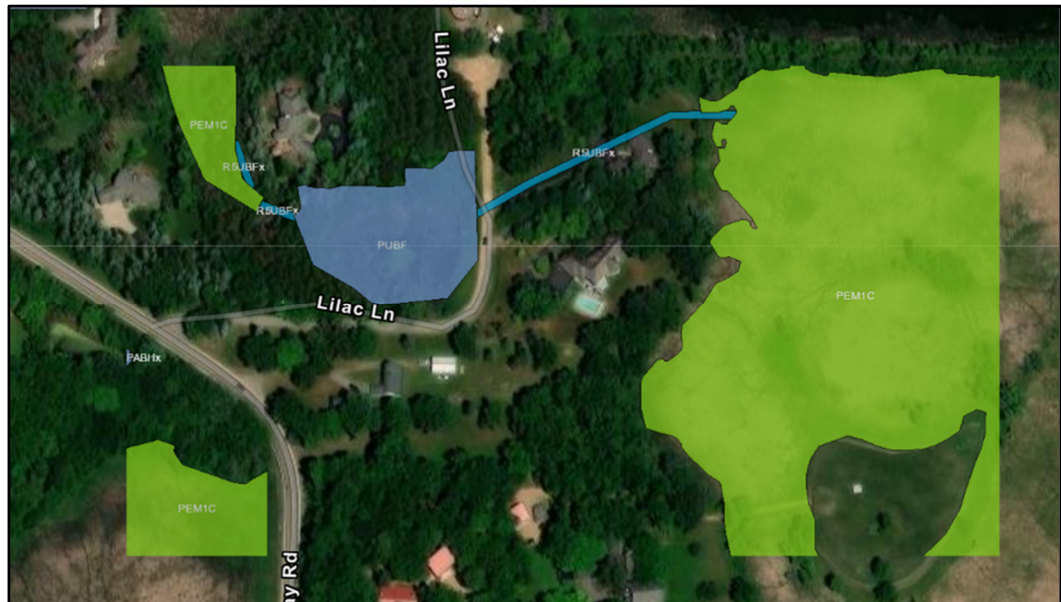


Figure 22 – Lilac Lane 2025 Wetlands Overview

The 2025 NWI shows wetlands on both west and east sides of Lilac Lane, see figure 21; however, the 2023 NWI and at the time of the 2023 wetland delineation, wetlands were identified at the west side of Lilac Lane only, see Appendix A. The culvert seems to serve as an equalizing conduit and appears to have a negative slope. Survey data indicates the upstream end of the culvert at the east side of the road with an elevation of 935.17, and downstream end at the west side of the road with an elevation of 934.72, which would represent flow conditions from east to west; however the hydrologic analysis indicates flow conditions from west to east which is consistent with the physical setting of the site and the wetlands study. Please note that a second survey was conducted to verify the culvert elevations and surrounding area elevations, this second survey confirmed the existing elevations as shown in the plans are accurate.

After analyzing the data, two theories were developed; it may be possible that the culvert was installed incorrectly with a negative slope as reflected in the survey data, or it may be possible that differential settlement and low cover created the existing conditions. Because the proposed design aims to provide improvements without resulting in significant changes to the hydraulic capacity of the culvert in order to avoid impacts to flood stage, the recommendation is to recreate existing conditions to the greatest extent possible. Taking into consideration the multiple constraints, the

proposed design maintains the invert elevation of 935.17; the length of the pipe is adjusted as needed for road design requirements to 37 feet, this results in minimum changes in hydraulic capacity. To further analyze the system a HydroCAD model was developed; 100-Year high water results as shown in Table 7. See complete report in Appendix C.

Table 7 – Lilac Lane 100Yr-HWL Summary

Lilac Lane Culvert	100 Yr-High Water Level
Existing Conditions	937.60'
Proposed Conditions	937.60'

After initial review and additional discussions, MCWD states: *“modeling will be required to show no increase in upstream or downstream flood stages for a 100-year event. This is due to the presence of a watercourse and the scope of work being conducted (culvert replacement, not in-kind), as well as MCWD’s Waterbody Crossings and Structures Rule, Section 3b, which states that “a project in a watercourse may not increase upstream or downstream flood stage.”*

The model was updated to address MCWD comments, adding an additional node to demonstrate no increase to upstream or downstream flood stage. Summary of HydroCAD model results are summarized in Table 8, see complete model results in Appendix C.

Table 8 – HydroCAD Results Summary

Lilac Lane Culvert		Existing	Proposed
U/S WSEL		937.60	937.60
U/S Storage Volume		12.956	12.956
D/S WSEL		932.73	932.73
Culver (Primary)	Outflow (cfs)	13.62	13.55
	High Water (ft)	937.60	937.60

Alternative Analysis:

1. No Action- Maintaining the existing culvert is not an acceptable solution given poor condition of the existing culvert and the immediate need for improvements.
2. Replacing the existing CMP culvert with a new RCP is not a feasible solution given that the installation of RCP culvert would significantly increase the hydraulic capacity of the culvert and consequently would have an impact on the flood stage of the watercourse.
3. The proposed design represents the minimum impact solution, considering the interceptor improvements project would be the best time to replace the existing culvert to improve conditions and extend the service life of the system. Conducting all rehabilitation work during one construction project will minimize impacts to the area. A Construction SWPPP will be implemented during construction operations to protect water quality.

Step 1: Describe the proposed changes of the culvert crossing.

Old Crystal Road South - Culvert 1

CU3 Sta 13+75 - In kind culvert replacement. Corrugated Metal Pipe to be replaced with new Corrugated Metal Pipe.

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc.) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: *N/A*

Wetland: *PEM1C*

Downstream Waterbody: *N/A*

Wetland: *PEM1C*

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	CMP	User Selection
Upstream Invert ¹ (ft)	932.160	932.160	User Input
Downstream Invert (ft)	931.100	931.220	User Input
Length (ft)	46	43	User Input
Size: Inside Diameter ² (in.)	15	15	User Input
Manning's n	0.025	0.025	Calculated
Full Flow Capacity (cfs)	5.11	4.98	Calculated
Change in Full Flow Capacity (%)		-2.60%	Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed. *N/A*

4B. Describe how the changes will not adversely affect water quality. *In kind culvert replacement will not impact water quality. Culvert replacement as part of the Interceptor 7113 improvements. The force main improvements require excavation, this construction project is the most efficient time to replace the existing culvert. SWPPP will be implemented during constructions operations to ensure no impacts to water quality.*

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. *1- Replace CMP culvert with RCP is not feasible due to the shallow depth of the existing structure, existing utility conflicts limit adjustments to downstream invert elevation. Replacement with RCP would result in a significant hydraulic capacity increase. Relocating existing utilities is not feasible and would represent a great impact to the area. Even though the preference is to replace CMP with RCP, considering the multiple utility constrains and pipe cover, Hennepin County approved the replacement of existing CMP with new CMP. 2- Replacement of the existing CMP culvert with new CMP will update the system and extent the service life of the pipe. The preference is to maintain the 15" diameter of the culvert for efficient maintenance operations. Culvert replacement with new CMP at the same time of the force main improvements project represents the minimum impact solution.*

Culvert Change Analysis

Step 1: Describe the proposed changes of the culvert crossing.

Old Crystal Bay Road South - Culvert 2

CU3- Station 18+30 - Corrugated Metal Pipe Culvert to be replaced with new Reinforced Concrete Pipe Culvert

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc.) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: N/A

Wetland: N/A

Downstream Waterbody: N/A

Wetland: PEM 1C

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	RCP	User Selection
Upstream Invert ¹ (ft)	932.940	932.940	User Input
Downstream Invert (ft)	932.630	932.870	User Input
Length (ft)	53	50	User Input
Size: Inside Diameter ² (in.)	15	15	User Input
Manning's n	0.025	0.012	Calculated
Full Flow Capacity (cfs)	2.58	2.63	Calculated
Change in Full Flow Capacity (%)		1.92%	Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed.

Change in full flow capacity= 1.92%, the proposed changes will not result in any changes in flood stage.

4B. Describe how the changes will not adversely affect water quality. Culvert replacement will not impact water quality, the proposed improvements are part of Force Main improvement project which requires excavation and associated work, this is the most efficient time to replace the existing culvert to improve conditions and extend service life of the structure. Construction operations SWPPP will be implemented to protect water quality.

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. 1- Replacing CMP culvert with RCP of same length is not feasible due to the necessary road improvements, maintaining existing length and downstream invert would increase hydraulic capacity of the culvert. 2- Replacing CMP culvert with 15" diameter RCP, adjusting length of pipe and downstream invert to meet road requirements will preserve the hydraulic capacity and represents the minimal impact solution.

Step 1: Describe the proposed changes of the culvert crossing.

Old Crystal Bay Road South - Culvert 3

CU4 Station 27+75. Corrugated Metal Pipe to be replaced with Reinforced Concrete Pipe.

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc.) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: N/A

Wetland: N/A

Downstream Waterbody: N/A

Wetland: PEM1A

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	RCP	User Selection
Upstream Invert ¹ (ft)	938.800	938.800	User Input
Downstream Invert (ft)	938.000	938.600	User Input
Length (ft)	42	43	User Input
Size: Inside Diameter ² (in.)	15	15	User Input
Manning's n	0.025	0.012	Calculated
Full Flow Capacity (cfs)	4.65	4.79	Calculated

Change in Full Flow Capacity (%) **2.95%** Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed.

Change in full flow capacity= 2.95%, the proposed changes will not result in changes in flood stage.

4B. Describe how the changes will not adversely affect water quality. Culvert replacement will not impact water quality, the proposed improvements are part of Force Main improvement project which requires excavation and associated work, this is the most efficient time to replace the existing culvert to improve conditions and extend service life of the structure. Construction operations SWPPP will be implemented to protect water quality.

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. 1- Maintaining all existing parameters is not possible due to the necessary road improvements, maintaining existing length and downstream invert elevation would increase hydraulic capacity of the culvert. 2- Replacing existing CMP culvert with 15" diameter RCP, adjusting length of pipe and downstream invert to meet road requirements will preserve the hydraulic capacity and represents the minimal impact solution.

Step 1: Describe the proposed changes of the culvert crossing.

Old Crystal Bay Road South - Culvert 4

Cu 4 - Station 29+00. Corrugated Metal Pipe to be replaced with Reinforced Concrete Pipe.

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: *N/A*

Wetland: *N/A*

Downstream Waterbody: *N/A*

Wetland: *PEM1A*

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	RCP	User Selection
Upstream Invert ¹ (ft)	939.16	939.16	User Input
Downstream Invert (ft)	937.06	938.65	User Input
Length (ft)	66	66	User Input
Size: Inside Diameter ² (in.)	18	18	User Input
Manning's n	0.025	0.012	Calculated
Full Flow Capacity (cfs)	9.77	10.03	Calculated
Change in Full Flow Capacity (%)	2.67%		Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed.

Change in full flow capacity= 2.67%, the proposed changes will not result in flood stage changes.

4B. Describe how the changes will not adversely affect water quality. *Culvert replacement will not impact water quality, the proposed improvements are part of Force Main improvement project which requires excavation and associated work, this is the most efficient time to replace the existing culvert to improve conditions and extend service life of the structure. Construction operations SWPPP will be implemented to protect water quality.*

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. *1- Replacing the CMP with RCP while maintaining all existing parameters is not feasible because it would result in a significant increase of hydraulic capacity of the culvert. 2- Replacing existing CMP culvert with RCP, adjusting downstream invert and preserving diameter, pipe length and upstream invert will preserve the hydraulic capacity and represents the minimal impact solution.*

Step 1: Describe the proposed changes of the culvert crossing.

Private Culvert North Shore Drive

CU4 -Station 31+00 - Replacement of PVC pipe with Reinforced Concrete Pipe.

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc.) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: N/A

Wetland : N/A

Downstream Waterbody: N/A

Wetland: PEM1C

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	PVC	RCP	User Selection
Upstream Invert ¹ (ft)	936.90	935.59	User Input
Downstream Invert (ft)	935.32	935.32	User Input
Length (ft)	69	69	User Input
Size: Inside Diameter ² (in.)	8	12	User Input
Manning's n	0.01	0.012	Calculated
Full Flow Capacity (cfs)	2.38	2.42	Calculated
Change in Full Flow Capacity (%)		1.57%	Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed. N/A

4B. Describe how the changes will not adversely affect water quality. Culvert installation as part of Orono Interceptor 7113 improvements project. The force main improvements require excavation and associated work, this is the most efficient time to install the culvert to improve conditions. Construction operations SWPPP will be implemented to protect water quality.

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. Assumptions have been made based on observations and historical documentation provided by the residents of the private property located at 2685 North Shore Drive, existing conditions could not be verified because the pipe was not found at the time of survey and during site visit. The information provided by the residents indicates that an 8" PVC pipe was installed across N. Shore Dr to provide drainage from the front yard of the 2685 property, however the pipe does not seem to be operational, runoff is collected at an existing cleanout (see plan sheet CD4) and flows thru a pipe under the driveway collecting at the front yard of 2683 N. Shore Dr. causing damage to the yard and vegetation. The installation of the 12" reinforced concrete pipe aims to provide a solution to the drainage issues experienced by the residents over the years. The proposed culvert downstream invert will meet existing slopes to avoid impact to the existing wetlands located along the road. Proposed slope of 0.40% will ensure positive drainage and grading will take place at the upstream end of the culvert to ensure runoff is properly directed to the new culvert pipe.

7.2.7 North Shore Drive Culvert 1

The existing 48-inch culvert is located at Station 37+60 see plan sheet CU5 and existing conditions profile and photographs in plan sheet CD14. Historical documentation indicates that the culvert is supported by a deep foundation system, see Figure 24 and plan sheet RC2. Due to the complexity of the system a culvert replacement is not feasible; however, a culvert rehabilitation is needed to improve existing conditions of the culvert and surrounding embankments.

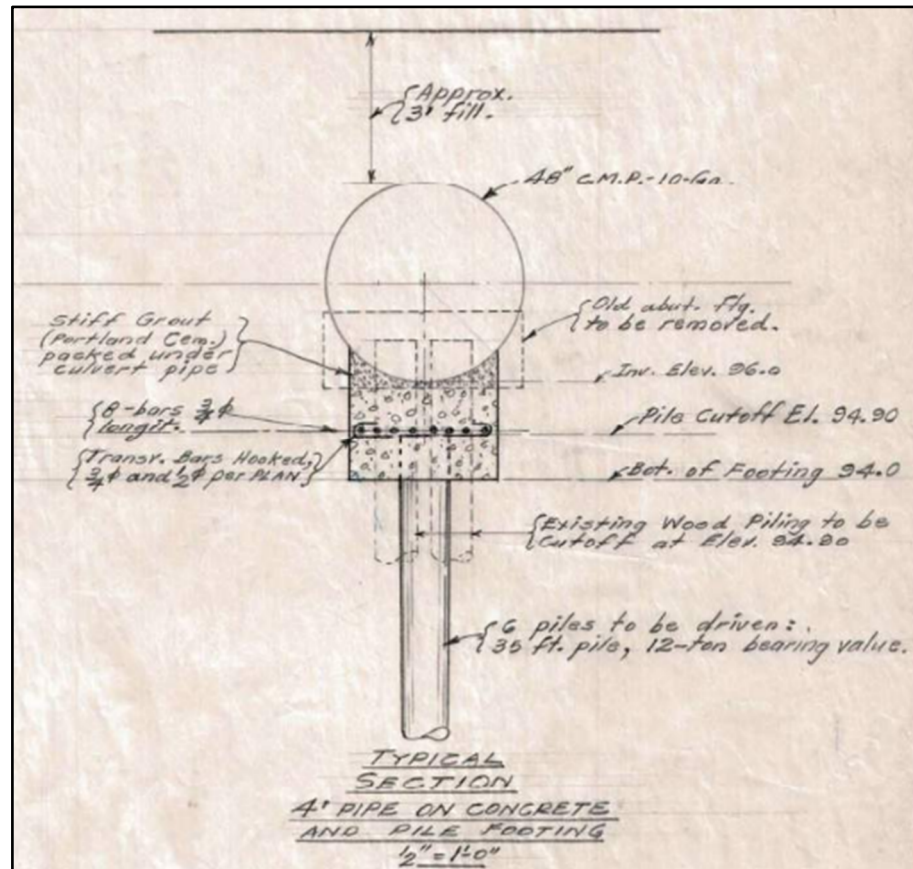


Figure 23 – 48" CMP Culvert 1952 Design

Multiple considerations were evaluated during the design process. To avoid compromising the deep foundation system and potential negative impact to wetlands, the proposed rehabilitation of the culvert includes the installation of a 1-inch-thick liner, with Cured-In-Place Pipe method (CIPP).

The culvert conveys flow from a large sub-watershed area, approximately 890 acres as defined by the MCWD's XPSWMM model; see Figure 25 wetland overview. The MCWD model was analyzed, and multiple scenarios were formulated to determine the diameter of the pipe that would meet regulatory compliance requirements as well as feasibility and constructability considerations.



Figure 24 – North Shore Drive NWI Wetlands Overview

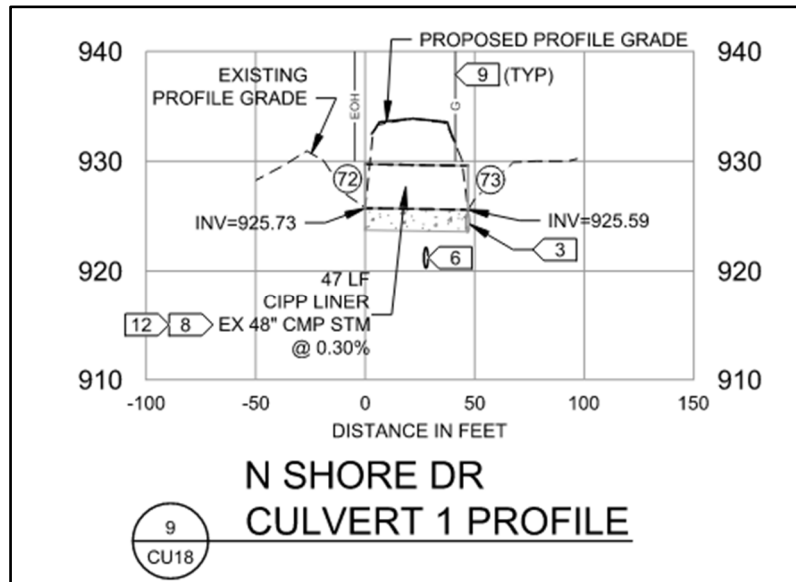


Figure 25 – 48” CMP Proposed Conditions

Considering constructability and complexity of the system, the proposed design includes the installation of a metal plate to restrict flow so the diameter change will not result in upstream or downstream increases in flood stage as required by MCWD.

A geometric analysis was completed to determine the dimensions of the plate. Complete calculations are submitted electronically as part of the modeling files and results as requested by MCWD.

Per discussions with Hennepin County, and based on their maintenance and operations experience, the metal plate installed on the side of the pipe would provide reliable flow control and remain operational even if sediment accumulates overtime at the bottom of the pipe, see Figure 27 and plan sheet CU39.

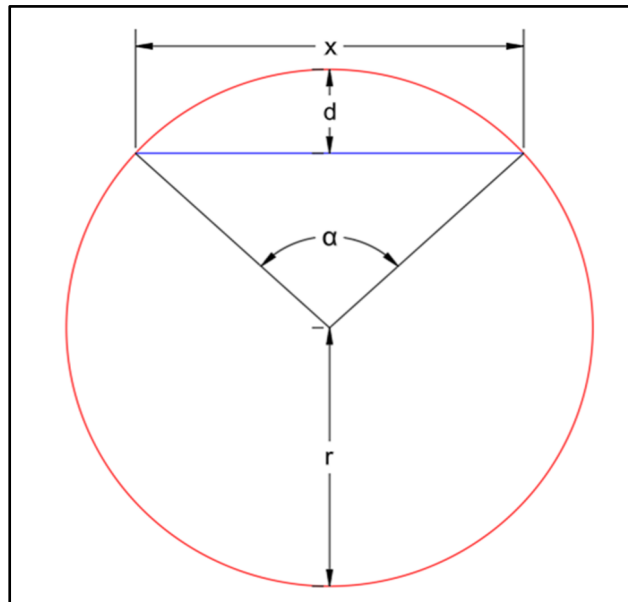


Figure 26 – 48”CMP Culvert Geometric Analysis

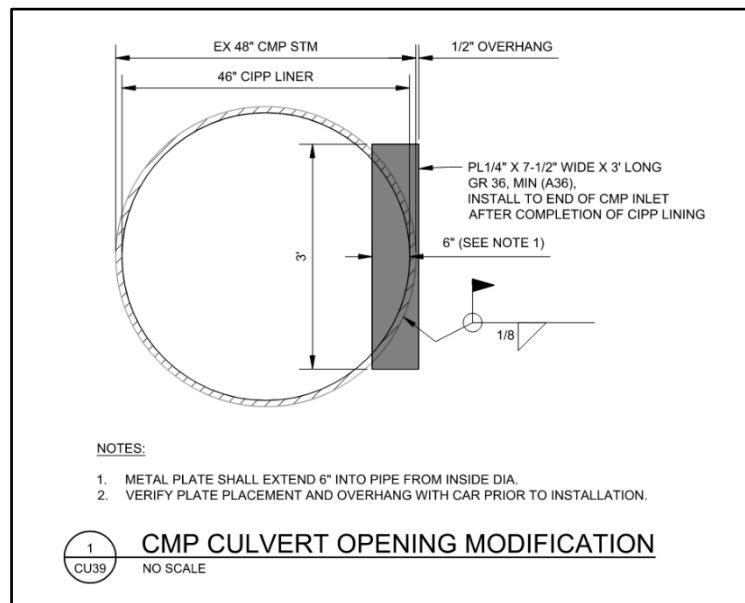


Figure 27 – 48” CMP Culvert Proposed Modification

The XPSWMM model was updated to include the metal plate as requested by MCWD, results indicate the installation of 1-inch-thick liner and metal plate as shown in Figure 27 would result in

a minor flood stage reduction, and No-Rise in flood stage as required by MCWD's Waterbody Crossings and Structures Rule. See modeling results summary in Table 9 and Table 10 and Appendix C. XPSWMM native files electronically submitted as requested by MCWD.

Table 9 – XPSWMM Results 46" Diameter

Existing				Proposed				
Existing 48" CMP				46" Diameter				
	Stage Upstream	Conduit Flow	Stage Downstream	Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
Peak	932.015	96.081	930.582	932.022	94.774	930.596	0.007	0.014

Table 10 – XPSWMM Results 46" Diameter + 6" Metal Plate

Existing				Proposed				
Existing 48" CMP				46" Diameter + 6" Metal Plate				
	Stage Upstream	Conduit Flow	Stage Downstream	Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
Peak	932.015	96.081	930.582	931.677	88.237	930.566	-0.338	-0.016

Culvert Change Analysis

Step 1: Describe the proposed changes of the culvert crossing.

North Shore Drive - Culvert 2

CU7 - Station 63+45 Corrugated Metal Pipe to be replaced with Reinforced Concrete Pipe

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc.) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: *N/A*

Wetland: *N/A*

Downstream Waterbody: *N/A*

Wetland: *N/A*

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	RCP	User Selection
Upstream Invert ¹ (ft)	958.720	958.720	User Input
Downstream Invert (ft)	957.570	958.645	User Input
Length (ft)	42	39	User Input
Size: Inside Diameter ² (in.)	12	15	User Input
Manning's n	0.025	0.012	Calculated
Full Flow Capacity (cfs)	3.07	3.08	Calculated
Change in Full Flow Capacity (%)	0.11%		Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed. [The proposed culvert replacement will not result flood stage changes.](#)

4B. Describe how the changes will not adversely affect water quality. [Culvert replacement will not impact water quality, the proposed improvements are part of Force Main improvement project which requires excavation and associated work, this is the most efficient time to replace the existing culvert to improve conditions and extend service life of the structure. Construction operations SWPPP will be implemented to protect water quality.](#)

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. [1- Replace CMP culvert with RCP of same diameter is not recommended due to maintenance and operations issues. 2- Replace CMP culvert with 15" diameter RCP, reduce pipe length to meet road design requirements, maintain upstream invert and adjust downstream invert to preserve hydraulic capacity represents the minimal impact solution.](#)

Step 1: Describe the proposed changes of the culvert crossing.

Brown Road South Culvert 1

CU8 - Station 78+50. CMP culvert to be replaced with RCP culvert

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc.) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: N/A

Wetland: N/A

Downstream Waterbody: N/A

Wetland: N/A

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	RCP	User Selection
Upstream Invert ¹ (ft)	953.67	953.67	User Input
Downstream Invert (ft)	953.02	953.52	User Input
Length (ft)	53	50	User Input
Size: Inside Diameter ² (in.)	15	15	User Input
Manning's n	0.025	0.012	Calculated
Full Flow Capacity (cfs)	3.73	3.79	Calculated
Change in Full Flow Capacity (%)		1.66%	Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed. N/A

4B. Describe how the changes will not adversely affect water quality. Culvert rehabilitation will not impact water quality. Culvert improvements as part of Force Main installation project which requires excavation and associated work, this project is most efficient time to replace existing culvert to improve conditions and extend service life of the structure. Construction operations SWPPP will be implemented to protect water quality.

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. 1. Replace existing CMP with new RCP maintaining all parameters would result in a higher hydraulic capacity.

2- Replace CMP culvert with new RCP, reduce pipe length to meet road design requirements, maintain upstream invert and adjust downstream invert to preserve hydraulic capacity represents the minimal impact solution.

Culvert Change Analysis

Step 1: Describe the proposed changes of the culvert crossing.

Dakota Trail Culvert 1

CU9 Station 86+80 - Corrugated Metal Pipe will be replaced with Reinforced Concrete Pipe.

Step 2: Describe the waterbodies (i.e. Wetland, stream, Lake, etc) and provide waterbody name and/or Wetland Management Type (i.e. - Manage 1,2,3, or Preserve).

Upstream Waterbody: *N/A*

Wetland : *N/A*

Downstream Waterbody: *N/A*

Wetland: *N/A*

Step 3: Calculate the changes in full flow capacity.

<u>Culvert Characteristics</u>	<u>Existing</u>	<u>Proposed</u>	
Type (RCP, CMP, etc.)	CMP	RCP	User Selection
Upstream Invert ¹ (ft)	940.11	940.11	User Input
Downstream Invert (ft)	939.53	939.81	User Input
Length (ft)	44	46	User Input
Size: Inside Diameter ² (in.)	24	21	User Input
Manning's n	0.025	0.012	Calculated
Full Flow Capacity (cfs)	13.54	13.90	Calculated
Change in Full Flow Capacity (%)	2.64%		Should be < 3%

Step 4: Effects or changes in flood stages, water quality, and aquatic and wildlife passage.

4A. For all changes in full flow capacity, provide an explanation for how the changes will not result in upstream or downstream increases in flood stage. If changes are greater than 3%, an H&H Analysis may be needed. *N/A*

4B. Describe how the changes will not adversely affect water quality. *Culvert replacement will not impact water quality. Culvert replacement as part of Orono Interceptor 7113 improvements project. The force main improvements require excavation and associated work, this is the most efficient time to replace existing culvert to improve conditions and extend service life of the structure. Construction operations SWPPP will be implemented to protect water quality.*

4C. Provide two (2) alternatives to the culvert changes and describe how the proposed change represents the "minimal impact" solution. *1. Replace CMP culvert with RCP of same diameter would increase hydraulic capacity of the culvert, which represents a greater impact. 2. Replace CMP culvert with RCP of smaller diameter to maintain hydraulic capacity, maintain existing length and adjust downstream invert and slope as needed, preserving hydraulic capacity represents the minimal impact solution.*

7.2.13 Dakota Trail Culvert 3

The existing CMP culvert is located at Station 135+00, see figure 28 and plan sheet CU13. National Wetlands Inventory shows a wetland system at this location, see figure 29.

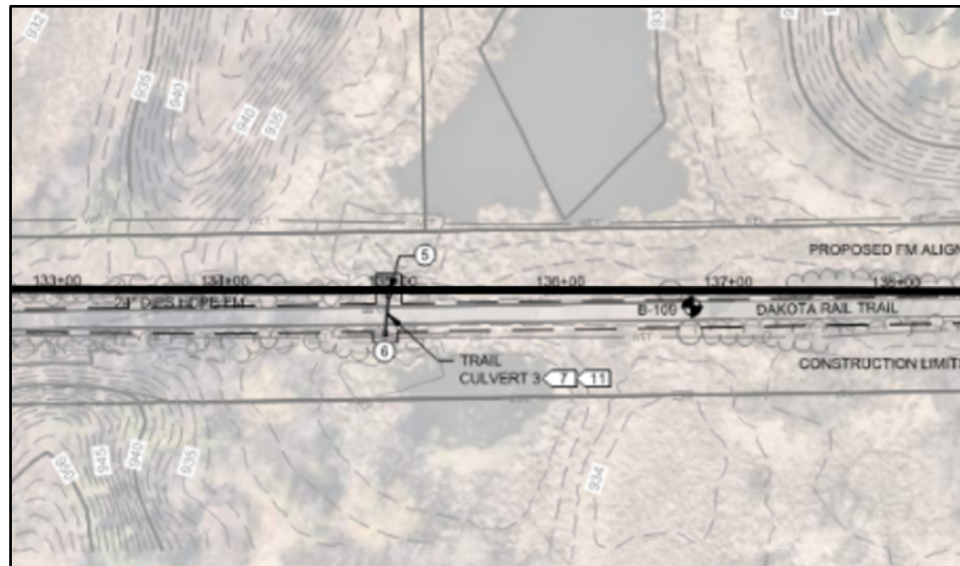


Figure 28 – Dakota Trail Area Culver 3 Location

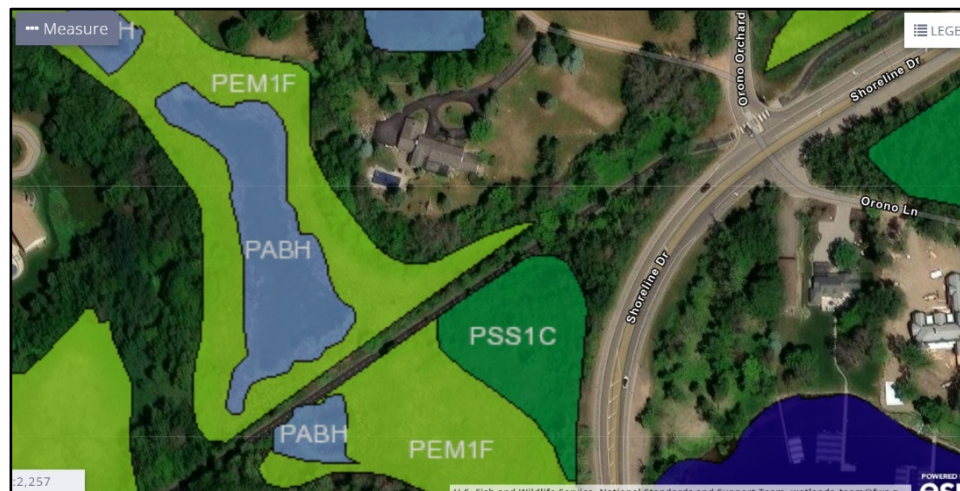


Figure 29 – Dakota Trail Area NWI Wetlands Overview

The MCWD states: “ A watercourse is present at the Dakota Trail Culvert 3 location, as seen on MCWD’s Stream Order layer. In this case, the wetland in the area is acting as part of the mapped watercourse. Due to the presence of a watercourse in the area and the scope of work being conducted (culvert replacement, not in-kind), modeling will be required to demonstrate that there will be no increase in upstream or downstream flood stages. See Figure 30.



Figure 30 – MCWD Stream Order Layer-Dakota Trail Culvert 3

A HydroCAD model has been created to evaluate the proposed culvert replacement. The model results demonstrate no increase in the upstream and downstream flood stage of the watercourse as required by the see MCWD’s Waterbody Crossings and Structures Rule. See Table 11 for modeling results summary and Appendix C for complete model results.

Table 11 – HydroCAD Results Summary

Dakota Trail Culvert 3		Existing	Proposed
U/S WSEL (ft)		933.75	933.75
U/S Storage Volume (af)		35.303	35.303
D/S WSEL (ft)		933.74	933.74
Culvert (Primary)	Outflow (cfs)	7.73	7.24
	High Water (ft)	933.75	933.75
Trail (Secondary)	Outflow (cfs)	212.21	212.33
	High Water (ft)	933.23	933.23

Appendix A

Wetlands Regulatory Compliance

Minnesota Wetland Conservation Act Notice of Decision

Local Government Unit: Minnehaha Creek Watershed District	County: Hennepin
Applicant Name: Leisa Thompson, MCES General Manager	Applicant
Representative: Ashley Mack - SEH	
Project Name: W23-036	
LGU Project No. (if any): W23-036	
Date Complete Application Received by LGU: 8/11/23	
Date of LGU Decision: 10/2/23	
Date this Notice was Sent: 10/2/23	

WCA Decision Type - check all that apply

<input checked="" type="checkbox"/> Wetland Boundary/Type	<input type="checkbox"/> Sequencing	<input type="checkbox"/> Replacement Plan	<input type="checkbox"/> Bank Plan (not credit purchase)
<input type="checkbox"/> No-Loss (8420.0415)	<input type="checkbox"/> Exemption (8420.0420)		
Part: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input checked="" type="checkbox"/> H		Subpart: <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9	

Replacement Plan Impacts (replacement plan decisions only)

Total WCA Wetland Impact Area:
Wetland Replacement Type: <input type="checkbox"/> Project Specific Credits: <input type="checkbox"/> Bank Credits:
Bank Account Number(s):

Technical Evaluation Panel Findings and Recommendations (attach if any)

<input checked="" type="checkbox"/> Approve <input type="checkbox"/> Approve w/Conditions <input type="checkbox"/> Deny <input type="checkbox"/> No TEP Recommendation
--

LGU Decision

<input type="checkbox"/> Approved with Conditions (specify below) ¹ List Conditions:	<input checked="" type="checkbox"/> Approved ¹	<input type="checkbox"/> Denied
Decision-Maker for this Application: <input checked="" type="checkbox"/> Staff <input type="checkbox"/> Governing Board/Council <input type="checkbox"/> Other:		
Decision is valid for: <input checked="" type="checkbox"/> 5 years (default) <input type="checkbox"/> Other (specify):		

¹ *Wetland Replacement Plan approval is not valid until BWSR confirms the withdrawal of any required wetland bank credits. For project-specific replacement a financial assurance per MN Rule 8420.0522, Subp. 9 and evidence that all required forms have been recorded on the title of the property on which the replacement wetland is located must be provided to the LGU for the approval to be valid.*

LGU Findings – Attach document(s) and/or insert narrative providing the basis for the LGU decision¹.

<input type="checkbox"/> Attachment(s) (specify): <input type="checkbox"/> Summary: MCES has applied for Boundary/Type approval/confirmation for the wetlands located along Old Crystal Bay Road, North Shore Drive, and Shoreline Drive in Orono. See location map for details. A wetland delineation was conducted by SEH on 8/7. The delineation shows 37 wetlands within the project area. See table 1 within the report for details.
--

MCWD, Hennepin County, and SEH Staff reviewed the boundaries in the field on 9/15/23. MCWD and BWSR were in agreement with the wetland boundaries and types identified on site and shown in the delineation report.

MCWD approves the wetland boundaries and types as shown in the delineation report. This decision is valid for five years. A future project located on this property may require a permit from the MCWD.

¹ Findings must consider any TEP recommendations.

Attached Project Documents

Site Location Map Project Plan(s)/Descriptions/Reports (specify):

Appeals of LGU Decisions

If you wish to appeal this decision, you must provide a written request within 30 calendar days of the date you received the notice. All appeals must be submitted to the Board of Water and Soil Resources Executive Director along with a check payable to BWSR for \$500 *unless* the LGU has adopted a local appeal process as identified below. The check must be sent by mail and the written request to appeal can be submitted by mail or e-mail. The appeal should include a copy of this notice, name and contact information of appellant(s) and their representatives (if applicable), a statement clarifying the intent to appeal and supporting information as to why the decision is in error. Send to:

Appeals & Regulatory Compliance Coordinator
Minnesota Board of Water & Soils Resources
520 Lafayette Road North
St. Paul, MN 55155
travis.germundson@state.mn.us

Does the LGU have a local appeal process applicable to this decision?

Yes¹ No

¹If yes, all appeals must first be considered via the local appeals process.

Local Appeals Submittal Requirements (LGU must describe how to appeal, submittal requirements, fees, etc. as applicable)

--

Notice Distribution (include name)

Required on all notices:

<input checked="" type="checkbox"/> SWCD TEP Member: Stacey Lijewski- stacey.lijewski@co.hennepin.mn.us
<input checked="" type="checkbox"/> BWSR TEP Member: jed.chestnut@state.mn.us
<input type="checkbox"/> LGU TEP Member (if different than LGU contact):
<input checked="" type="checkbox"/> DNR Representative: Wes.Saunders-pearce@state.mn.us
<input type="checkbox"/> Watershed District or Watershed Mgmt. Org.:
<input checked="" type="checkbox"/> Applicant: leisa.thompson@metc.state.mn.us
<input checked="" type="checkbox"/> Agent/Consultant: amack@sehinc.com

Optional or As Applicable:

<input type="checkbox"/> Corps of Engineers:
<input type="checkbox"/> BWSR Wetland Mitigation Coordinator (required for bank plan applications only):

Members of the Public (notice only):

Other:

Signature:

A handwritten signature in black ink that reads "Tracy Jonas". The signature is written in a cursive style with a long horizontal stroke at the end.

Date: 10/2/23

This notice and accompanying application materials may be sent electronically or by mail. The LGU may opt to send a summary of the application to members of the public upon request per 8420.0255, Subp. 3.



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. PAUL DISTRICT
332 MINNESOTA STREET, SUITE E1500
ST. PAUL, MN 55101-1323

September 22, 2023

Regulatory File No. MVP-2022-00094-MJG

Metropolitan Council Environmental Services
c/o Leisa Thompson
390 Robert St N
St. Paul, MN 55101
Leisa.thompson@metc.state.mn.us

Dear Leisa Thompson:

We are responding to your request, submitted by SEH Inc. on your behalf, for Corps of Engineers (Corps) concurrence with the delineation of aquatic resources completed on the Forcemain 7113 Relocation Project site located in the City of Orono. The project site is in Sections 2, 9, 10, and 11, Township 117 North, Range 23 West, Hennepin County, Minnesota.

We have reviewed the delineation report dated August 7, 2023 and concur that Figure 6 – Level 1 Delineation Results Pages 1-6 of 6 depicts a reasonable approximation of the location and boundaries of aquatic resources. This delineation can be used for planning and will generally be sufficient for Corps permitting purposes. However, this “reasonable approximation” concurrence may not fulfill state or local delineation requirements. It may be necessary to review this determination in response to changing site conditions or new information.

Additional Information regarding Jurisdiction and Permitting:

No jurisdictional determination was prepared for this project, nor is one required to support a permit application. If you submit a permit application, we will assist you in identifying aquatic resources that are not subject to Corps regulation to exclude those resources from the permit evaluation. A permit application should include this delineation, any subsequent revisions, and any state or local delineation approvals. You are advised that a permit or exemption from a state or local agency does not satisfy the requirement to obtain a Corps permit where one is needed.

Please note that the Corps has issued Nationwide General Permits and Regional General Permits that provide authorization for many minor activities. Many of those general permits require a pre-construction notification and Corps verification prior to starting work. However, several general permits also have “self-certifying” provisions that eliminate the need to provide notice to the Corps, provided the permittee complies with the terms and conditions of the general permit. Current general permit terms and conditions can be found at:
<https://www.mvp.usace.army.mil/Missions/Regulatory/Permitting-Process-Procedures/>.

Regulatory Division (File No. MVP-2022-00094-MJG)

If you have any questions, please contact me in our St. Paul office at (651) 290-5363 or mallory.j.gross@usace.army.mil. In any correspondence or inquiries, please refer to the Regulatory file number shown above.

Sincerely,

A handwritten signature in black ink that reads "Mallory J. Gross". The signature is written in a cursive style with a large initial 'M' and 'G'.


Mallory Gross
Regulatory Specialist

cc:

Trey Jonas, (LGU – Minnehaha Creek WD)
Jed Chesnut, BWSR (jed.chesnut@state.mn.us)
Ashley Mack, SEH Inc. (amack@sehinc.com)



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ST. PAUL, MN 55110
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FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: MCES0 156151
Print Date: 8/7/2023

Map by: amack
Projection: NAD83 UTM Zone 15N
Source: SEH, ESRI, Google,
Hennepin Co

Level 1 Delineation Results

FM 7113 Relocation Project
Hennepin County, Minnesota

Figure
6
Page 1 of 6

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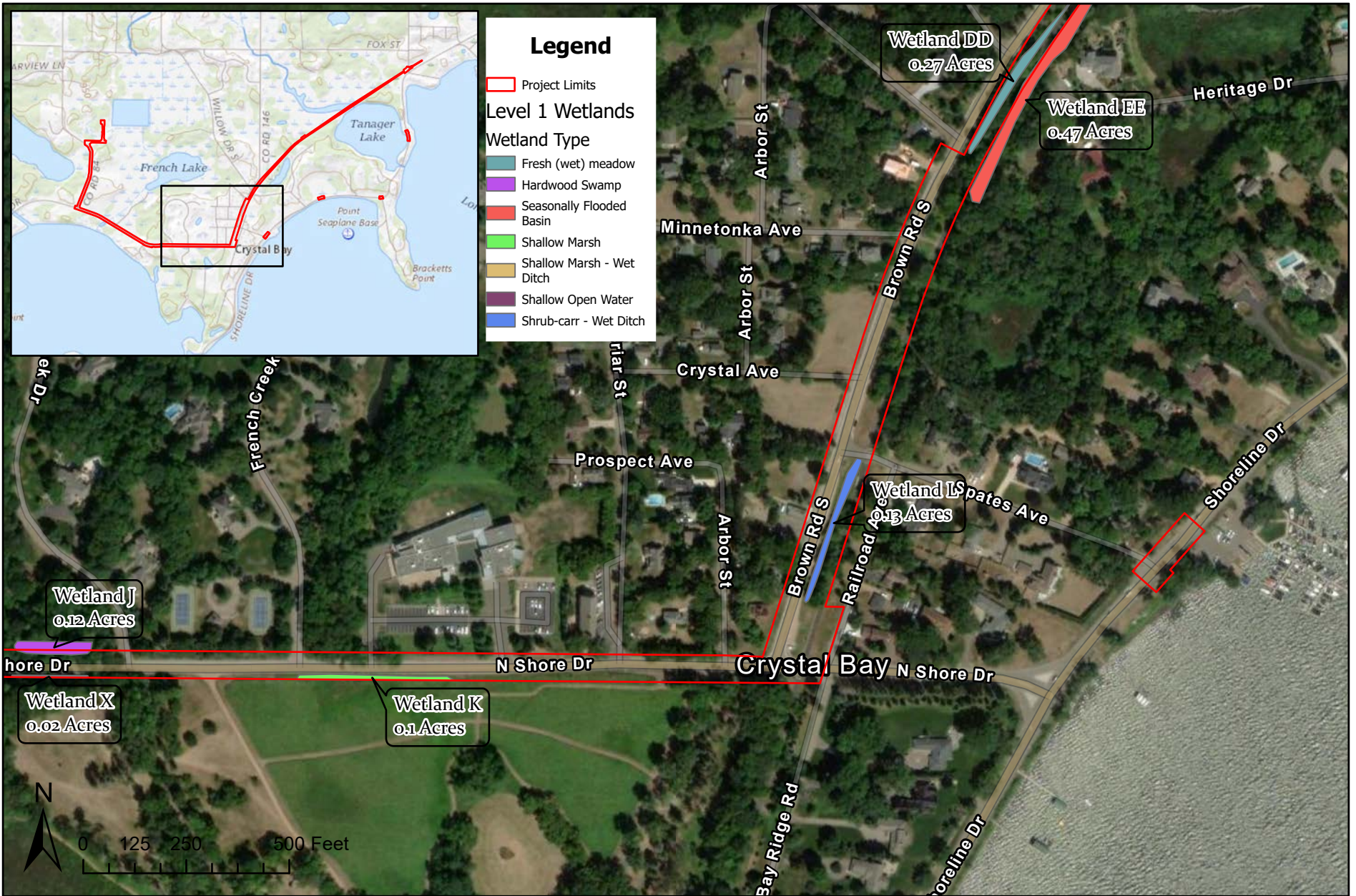
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Legend

- Project Limits
- Level 1 Wetlands**
- Wetland Type**
- Fresh (wet) meadow
- Hardwood Swamp
- Seasonally Flooded Basin
- Shallow Marsh
- Shallow Marsh - Wet Ditch
- Shallow Open Water
- Shrub-carr - Wet Ditch

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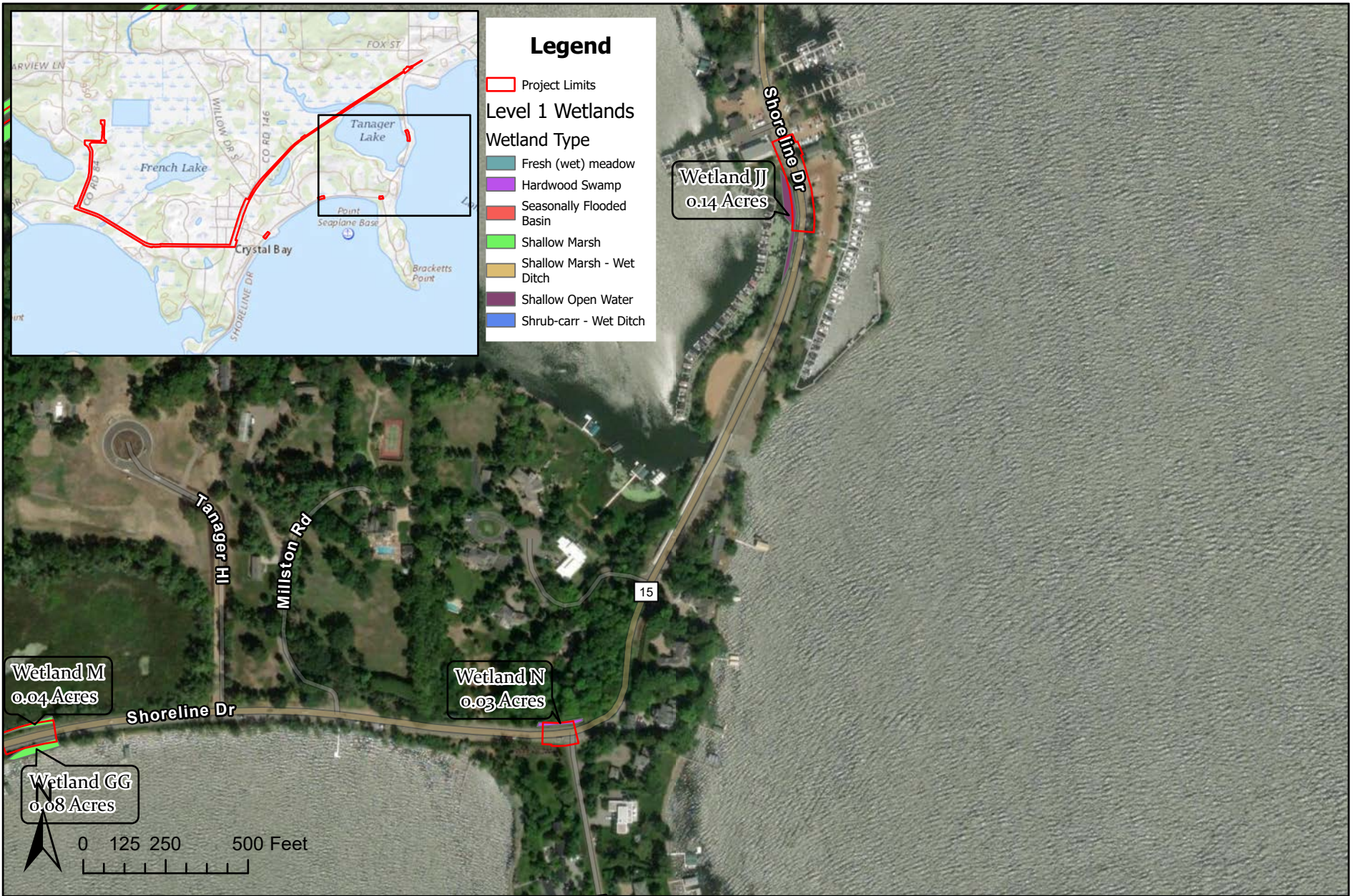
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Page 3 of 6

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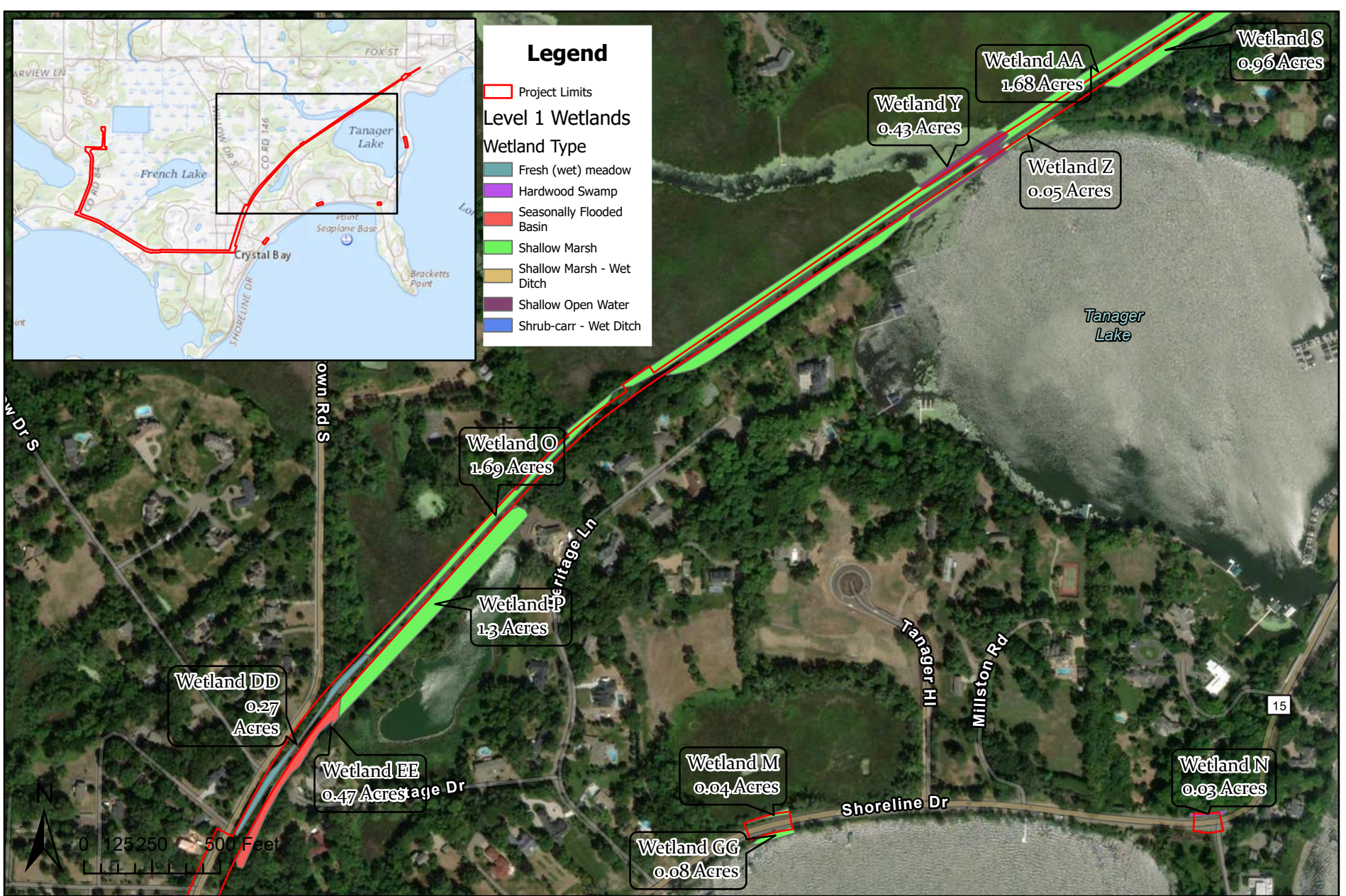
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Level 1 Delineation Results

FM 7113 Relocation Project
Hennepin County, Minnesota

Figure
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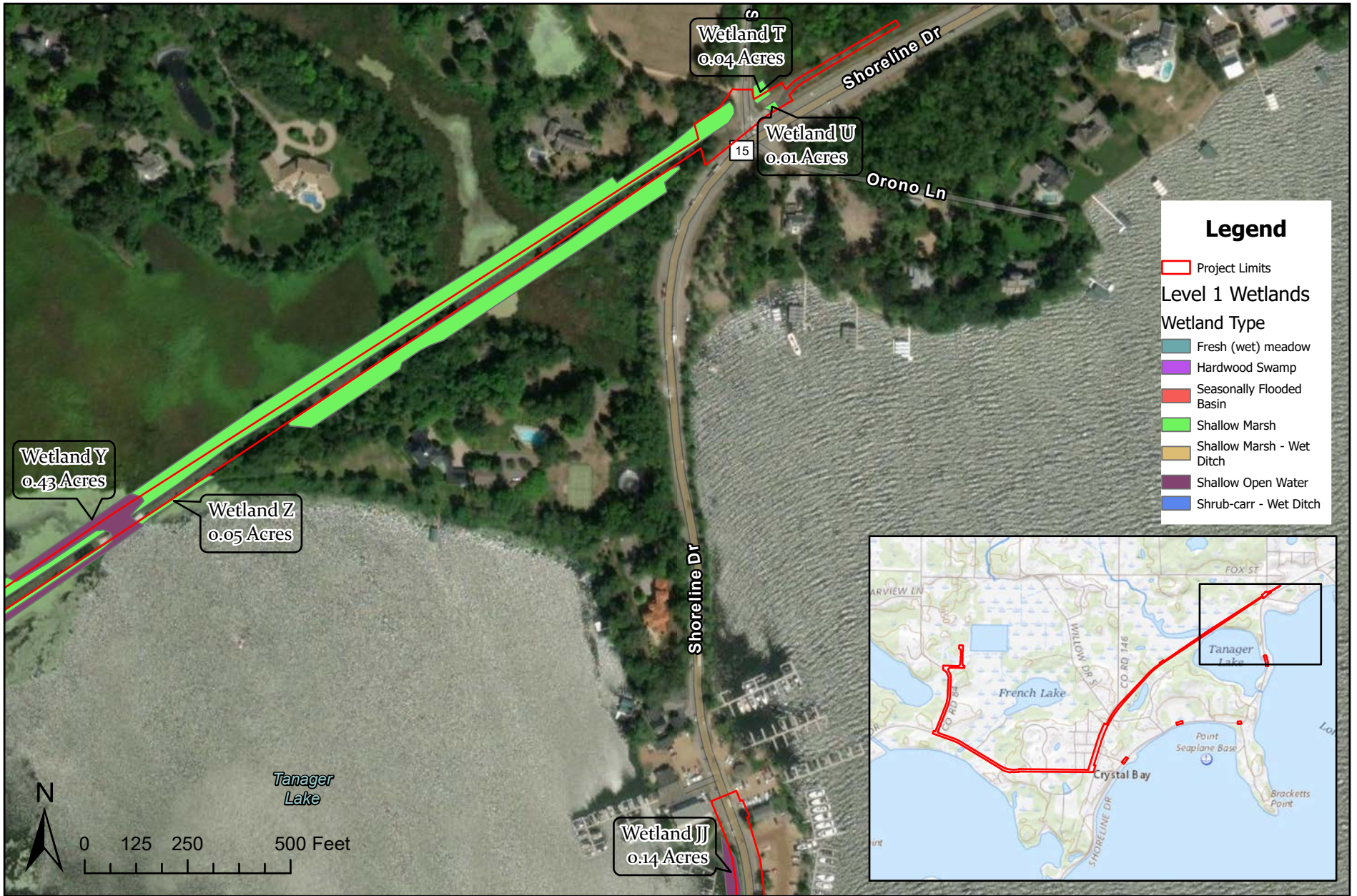
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FM 7113 Relocation Project
Hennepin County, Minnesota

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Page 5 of 6

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Level 1 Delineation Results
FM 7113 Relocation Project
Hennepin County, Minnesota

Figure
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Page 6 of 6

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Building a Better World
for All of Us®

TECHNICAL MEMORANDUM

TO: Metropolitan Council Environmental Services

FROM: Ashley Mack, CMWP, SEH Graduate Scientist

DATE: August 7, 2023

RE: FM 7113 Relocation Project
SEH No. MCESO 155903

Introduction

The purpose of this study was to identify areas meeting the technical criteria for wetlands, delineate the jurisdictional extent of the wetland basins, and classify the wetland habitat within the study area. This investigation serves to determine if permits may be required under the Wetland Conservation Act and Section 404 of the Clean Water Act and to request a wetland Type/Boundary approval

Wetlands are defined in federal Executive Order 11990 as *“areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation or aquatic life typically adapted for saturated soil conditions.”*

Project Overview

The site is located in sections 2, 9, 10, and 11 in Township 117N, Range 23W in the City of Orono, Hennepin County, Minnesota (**Figure 1**). The project follows the proposed forcemain alignment from Lift Station L59 in Orono to the 7113A junction structure at the intersection of Orono Orchard Road and Shoreline Drive (CSAH 15).

Methodology

This project was delineated according to U.S. Army Corps of Engineers *Wetlands Delineation Manual* (USACE 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region* (USACE 2010).

Methodology was selected based on the *BWSR 2010 Technical Guidance for Wetland Delineations: Choosing the Appropriate Method*:

“A project that proposes to temporarily impact a wetland and then restore it back to its original condition in accordance with WCA No-Loss criteria. In many of these cases it is only necessary to determine that the project will in fact occur in a wetland, and the characteristics of the wetland that will need to be restored. It is not necessary to define exact boundaries of the wetland if they are clearly outside the project area.”

This project meets the above stated criteria, and therefore, wetlands within the project area were delineated using the *1987 Manual: Level 1 (Offsite Inspection Unnecessary) Routine Wetland Determination Method*. Data sources utilized by SEH for the remote sensing analysis of wetlands and aquatic resources within the project area included:

- Aerial photography (**Figure 2**)
- U.S. Fish & Wildlife Service National Wetlands Inventory (NWI) (**Figure 4**)

- Minnesota Department of Natural Resources (MNDNR) Public Waters Inventory (PWI) map (**Figure 5**)
- Natural Resources Conservation Service (NRCS) Soil Survey Geographic Maps (SSURGO) for Hennepin County (**Figure 6**)
- MNDNR Lidar elevation data including a digital elevation model (DEM) with 1-meter spatial resolution and 2-ft contours (**Figure 7**)

Results

The remote sensing analysis identified 37 wetland basins within the delineation corridor. The delineated wetlands within the project area are shown on **Figure 8**, and basin classification and acreage within the delineation corridor are summarized in **Table 1** below.

Additionally, a number of Public Waters basins and one Public Watercourse (Long Lake Creek) are located in the vicinity of the project (**Figure 5**).

Basin ID ¹	Size (acres) ²	Eggers & Reed Classification	Circular 39 / Cowardin Classification	Assumed Jurisdiction		
				DNR (PWI) Below OHWL	Minnehaha Creek	USACE
A (43)	0.04	Shallow Marsh	Type 3 / PEM1C		Yes	
B (44)	0.12	Shallow Marsh	Type 3 / PEM1C		Yes	
C (45)	0.09	Shallow Marsh	Type 3 / PEM1C	27-133 P	Above OHWL	
D (46)	0.23	Shallow Marsh	Type 3 / PEM1C		Yes	
E (48)	0.82	Shallow Marsh	Type 3 / PEM1C	27-140 P	Above OHWL	Yes
F (30)	0.05	Shallow Marsh	Type 3 / PEM1C	27-133 P	Above OHWL	Yes
G (49)	0.06	Shallow Marsh	Type 3 / PEM1C		Yes	Yes
H (50)	0.12	Shallow Marsh	Type 3 / PEM1C		Yes	
I (51)	0.11	Shallow Marsh	Type 3 / PEM1C		Yes	Yes
J (53)	0.12	Hardwood Swamp	Type 7 / PFO1B		Yes	
K (54)	0.10	Shallow Marsh	Type 3 / PEM1C		Yes	
L (55)	0.13	Shrub-carr	Type 6 / PSS1B		Yes	
M (60)	0.04	Shallow Marsh	Type 3 / PEM1C	27-866 W	Above OHWL	Yes
N (61)	0.03	Hardwood Swamp	Type 7 / PFO1B		Yes	

O (57)	1.69	Shallow Marsh	Type 3 / PEM1C	27-859 W, 27-865 W, Long Lake Creek	Above OHWL	Yes
P (56)	1.30	Shallow Marsh	Type 3 / PEM1C	27-865 W	Above OHWL	
R (63)	0.95	Shallow Marsh	Type 3 / PEM1C	27-141 P, Long Lake Creek	Above OHWL	Yes
S (64)	0.96	Shallow Marsh	Type 3 / PEM1C	27-855 W	Above OHWL	
T (65)	0.04	Shallow Marsh	Type 3 / PEM1C		Yes	
U (66)	0.01	Shallow Marsh	Type 3 / PEM1C		Yes	
W (47)	0.01	Shallow Marsh	Type 3 / PEM1C		Yes	Yes
X (52)	0.02	Fresh (wet) Meadow	Type 2 / PEM1B		Yes	
Y (38)	0.43	Shallow Open Water Community	Type 5 / PUBH	27-141 P, 17-859 W, Long Lake Creek	Above OHWL	Yes
Z (63)	0.05	Shallow Marsh	Type 3 / PEM1C	27-141 P, Long Lake Creek	Above OHWL	Yes
AA (57)	1.68	Shallow Marsh	Type 3 / PEM1C	27-855 W, 27-859 W, Long Lake Creek	Above OHWL	Yes
DD (57)	0.27	Fresh (wet) Meadow	Type 2 / PEM1B		Yes	
EE (56)	0.47	Seasonally Flooded Basin	Type 1 / PEM1A		Yes	
GG	0.08	Shallow Marsh	Type 3 / PEM1C	27-133 P	Above OHWL	Yes
JJ	0.14	Shallow Open Water Community	Type 5 / PUBH	27-141 P	Above OHWL	Yes
Total	10.16					
<p>¹Some wetlands were delineated for a previous project (Lake Minnetonka Area Interceptor Improvements MCESO 156151). Prior basin ID included in parentheses.</p> <p>²Size includes areas of wetland within the area of investigation only. Wetlands may extend beyond the limits of the area investigated and actual wetland size may be larger than that indicated.</p>						

Regulatory Considerations

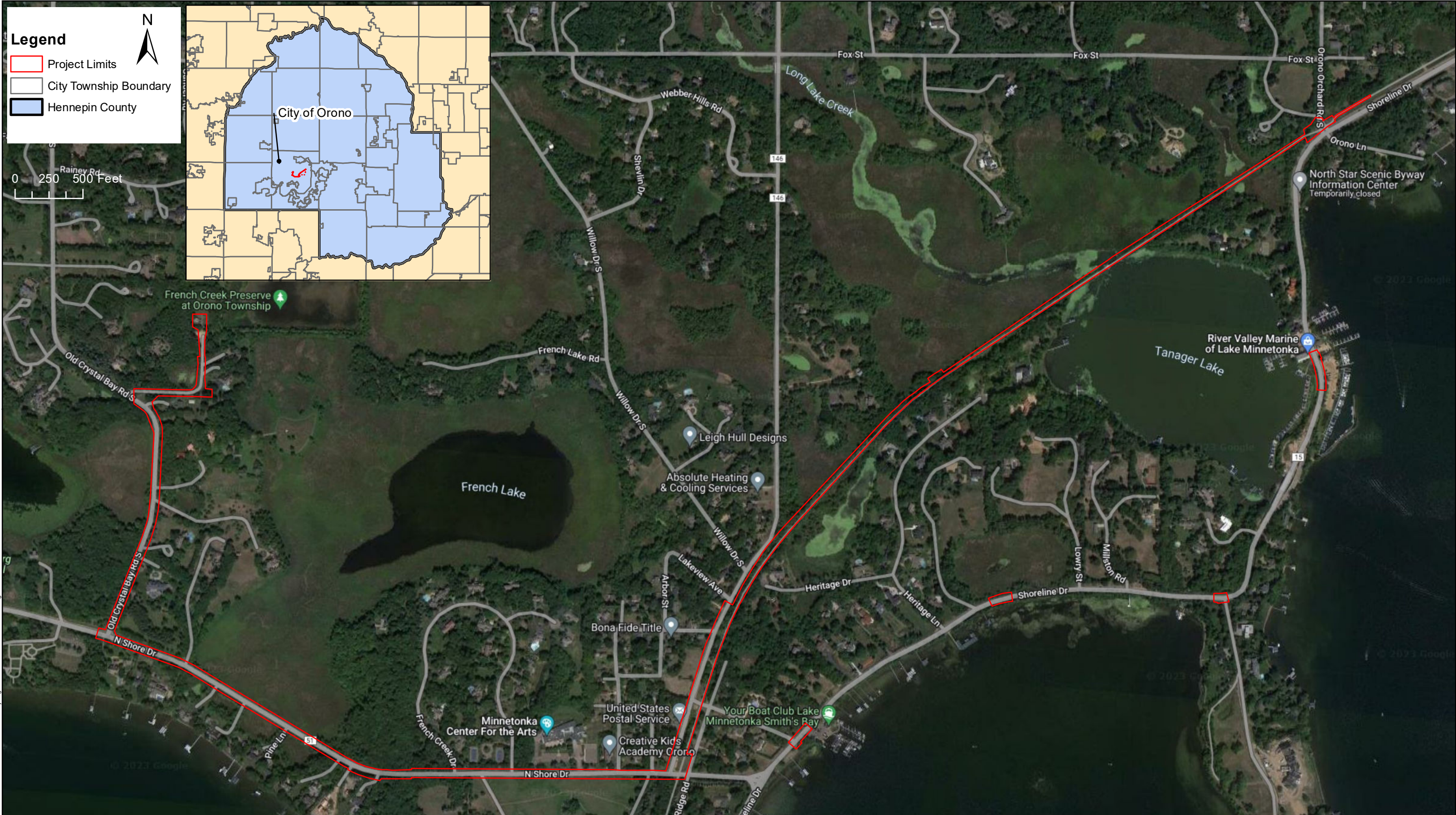
Wetlands in the project area are regulated by agencies at the local, regional, state, and federal levels including the USACE and the EPA at the federal level, the Minnesota Board of Water and Soil Resources (BWSR) and the Minnesota Pollution Control Agency (MPCA) at the state level, and the Minnehaha Creek Watershed District at the local level. The Minnehaha Creek Watershed District has accepted the responsibility for the administration of the Minnesota Wetland Conservation Act (WCA) of 1991. The MNDNR has responsibility for the administration of wetlands and watercourses identified in the PWI.

Construction plans that propose any direct alteration or indirect impact to wetlands or watercourses within the project area will require permits from the appropriate regulatory agencies. Violation of wetland regulations can result in substantial civil and/or criminal penalties.

Contact

Please contact Ashley Mack directly with any questions regarding this level 1 investigation at 612.428.1965 or via e mail at amack@sehinc.com. Thank you for this opportunity to provide wetland services.

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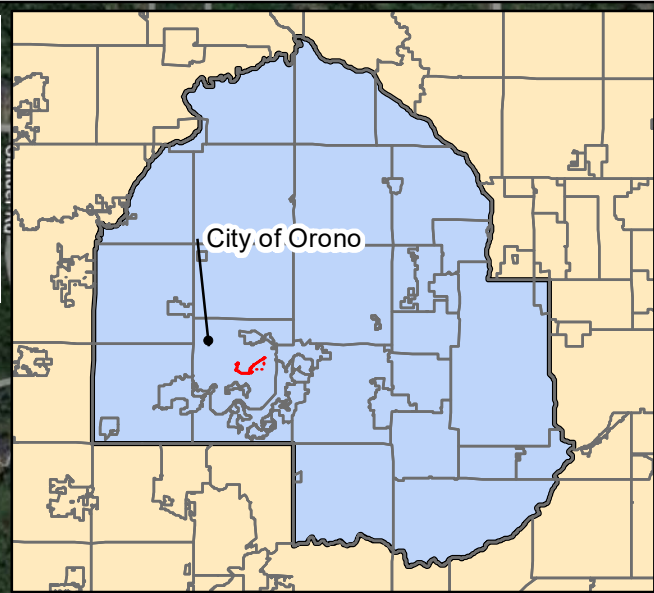


Legend

- Project Limits
- City Township Boundary
- Hennepin County



0 250 500 Feet




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	3535 VADNAIS CENTER DR. ST. PAUL, MN 55110 PHONE: (651) 490-2000 FAX: (888) 908-6166 TF: (800) 325-2055 www.sehinc.com	Project: MCES0 156151 Print Date: 8/7/2023 User Name: amack Projection: NAD 1983 UTM Zone 15N Source: SEH, ESRI, Google, Hennepin Co	<h2 style="margin: 0;">Site Location</h2> <h1 style="margin: 0;">FM 7113 Relocation Project</h1> <h3 style="margin: 0;">Hennepin County, Minnesota</h3>	<h1 style="font-size: 2em; margin: 0;">Figure</h1> <h2 style="font-size: 3em; margin: 0;">1</h2>
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This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.

Legend

 Project Limits



0 250 500 Feet



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	3535 VADNAIS CENTER DR. ST. PAUL, MN 55110 PHONE: (651) 490-2000 FAX: (888) 908-6166 TF: (800) 325-2055 www.sehinc.com	Project: MCES0 156151 Print Date: 8/7/2023	<p>2020 Aerial Photography FM 7113 Relocation Project Hennepin County, Minnesota</p>	<p>Figure 2</p>
	User Name: amack Projection: NAD 1983 UTM Zone 15N Source: SEH, ESRI, Google, Hennepin Co, MnGEO WMS			

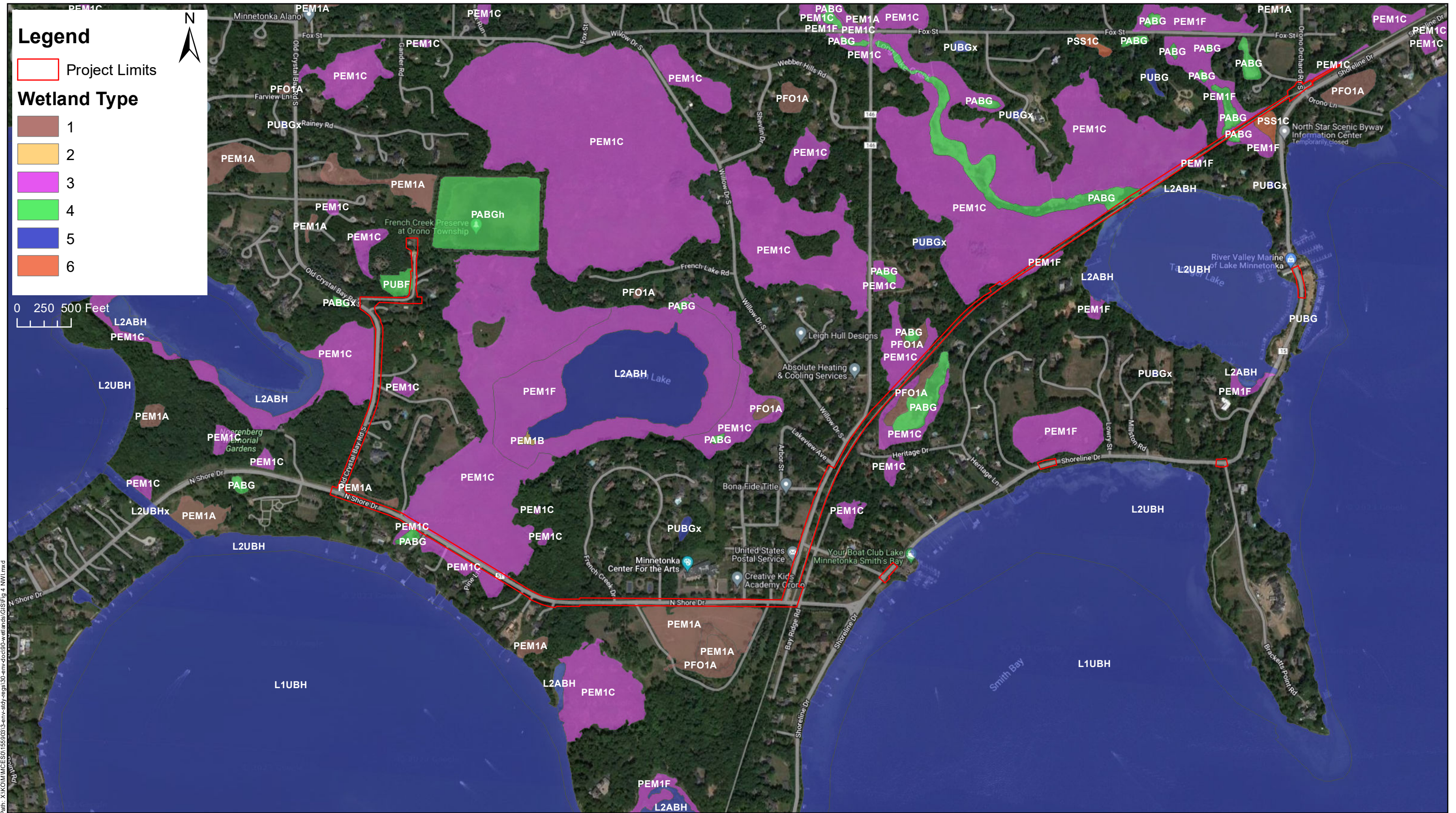
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	User Name: amack Projection: NAD 1983 UTM Zone 15N Source: SEH, ESRI, Google, Hennepin Co, MnGEO WMS			

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Project: MCES0 156151
Print Date: 8/7/2023

User Name: amack
Projection: NAD 1983 UTM Zone 15N
Source: SEH, ESRI, Google, Hennepin Co, MnGEO WMS

National Wetland Inventory (NWI) FM 7113 Relocation Project Hennepin County, Minnesota

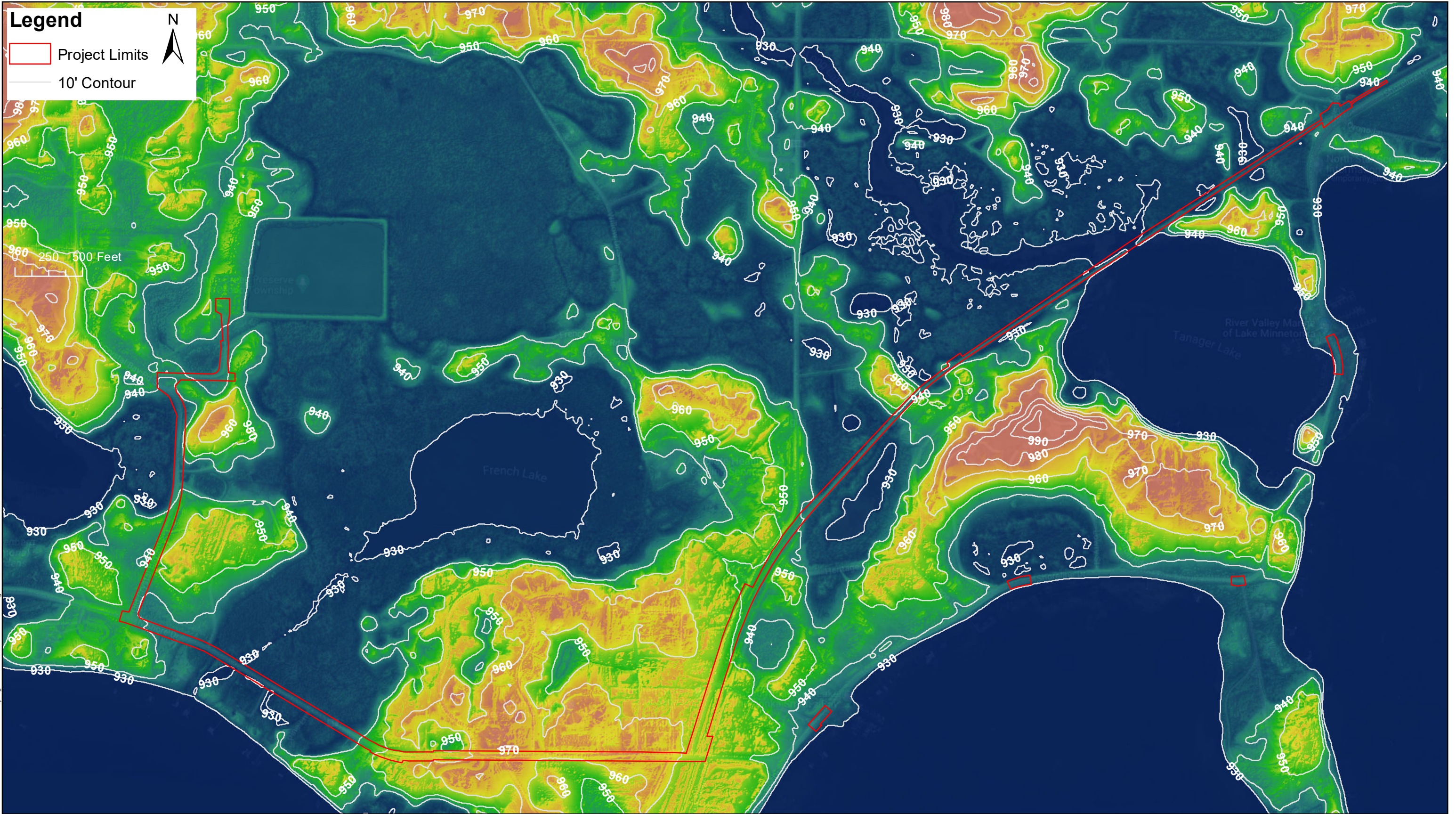
Figure
4

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 <p>3535 VADNAIS CENTER DR. ST. PAUL, MN 55110 PHONE: (651) 490-2000 FAX: (888) 908-6166 TF: (800) 325-2055 www.sehinc.com</p>	<p>Project: MCES0 156151 Print Date: 8/7/2023</p>	<h2>Hennepin County Soil Survey</h2> <h3>FM 7113 Relocation Project</h3> <p>Hennepin County, Minnesota</p>	<h1>Figure 6</h1>
	<p>User Name: amack Projection: NAD 1983 UTM Zone 15N Source: SEH, ESRI, Google, Hennepin Co, MnGEO WMS</p>		

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TF: (800) 325-2055
www.sehinc.com

Project: MCES0 156151
Print Date: 8/7/2023

User Name: amack
Projection: NAD 1983 UTM Zone 15N
Source: SEH, ESRI, Google, Hennepin Co, MnGEO WMS

10-FT LiDAR Topography FM 7113 Relocation Project

Hennepin County, Minnesota

Figure
7

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Appendix B

MnDNR License for utility to Cross Public Waters

LICENSE FOR UTILITY TO CROSS PUBLIC WATERS

This license is issued by the State of Minnesota, acting by and through its commissioner of natural resources, and hereafter called the "State", under authority and subject to Minnesota Statutes, section 84.415, and Minnesota Rules Chapter 6135 and other applicable law, to the Licensee as named and for the fee and term as specified below.

Name and Address of Licensee: Metropolitan Council Environmental Services
390 Robert Street North
St Paul, MN 55101

License Fee: Five hundred seven and NO/100 Dollars (\$507.00)

Term (years): 50 Years

Effective Date: February 1, 2025

Expiration Date: January 31, 2075

Purpose of License: Construction, maintenance and operation of a solids in suspension pipeline under water under the covenants and agreements of the Licensee to use the following described waters:

That part of the following descriptions as shown on the attached application and map, all of which are made a part hereof by reference.

Long Lake Creek in Government Lot 1 in Section 10, Township 117 North, Range 23 West, in Hennepin County

This license is granted subject to the following provisions:

1. Use of premises.

- A. This license is subject to the provisions of Minnesota Statutes, section 84.415 and Minnesota Rules Chapter 6135. All standards of Chapter 6135 are incorporated as terms and conditions of this license, except such variations as are identified and approved by the State in the license applications, plans and specifications which are attached and made part of the terms and conditions of this license. The Licensee is bound by the crossing location and installation method as detailed in the application and approved by the State. The Licensee shall not deviate from the terms and conditions of this license or the application as approved by the State unless it has first obtained written permission from the State.
- B. When the installation occurs more than six months after the issuance of the license, the Licensee shall contact the State 20 days prior to installation.
- C. No merchantable timber shall be cut, used, removed or destroyed without first paying the State the timber value in the sum stated above as determined by the State. Slash material on state water crossings must be disposed of within 30 days of clearing activities.
- D. For overhead crossings of state waters, lines shall have a minimum clearance of 25 feet above the water, unless otherwise approved by the State.
- E. When directed by the State as a condition of the license, flight diverters shall be placed on overhead utility lines.
- F. Any cable or conduit located at a shoreline shall be sufficiently buried so that it does not become exposed.
- G. When directed by the State as a condition of the license, underwater crossings shall be marked by permanent signs on the banks at the points where the line enters and leaves the public waters.
- H. To protect fish spawning activities, the State may prohibit work in the public water or within a specified distance of the public water during the spawning season.

- 2. State's rights and reservations.** The use of these waters by the Licensee in constructing or maintaining the lines for which this license is granted shall be subject to the use, sale, or leasing for mineral or other legal purposes. The Licensee will not cause any unnecessary hindrance to the activities of the State and shall allow access across the license area by the State when needed.

3. **Erosion and Revegetation.**

- A. Erosion control measures shall be adequately designed for site characteristics. They shall be installed prior to commencement of construction and maintained for as long as needed. All erosion control measures installed next to a water body shall run parallel to the contours.
- B. All disturbed areas shall be restored to original contours and elevations and stabilized as soon as possible following construction. Areas of subsidence and crowning shall be repaired. Topsoil shall be reserved on site and used to re-dress disturbed areas.
- C. All disturbed areas shall be revegetated using state approved seed mixes. All seed and plant materials shall be certified weed-free. Weed-free straw or hay shall be used for mulching and erosion control. Native species plants should be used, whenever possible, to revegetate disturbed areas. This revegetation should occur as early in the season as possible to permit adequate regrowth.
- D. The Licensee shall monitor revegetation at state water crossings until the site is stabilized and the vegetation is self-sustaining. Where severe or repeated damage is occurring or where measures have not been successful, preventative and corrective actions shall be taken by the Licensee, including construction of appropriate barriers, installation of warning signs, and other methods in consultation with the State.
- E. The Licensee shall routinely inspect for erosion that may develop during the term of the license. Areas of erosion shall be stabilized by the Licensee.
- F. If a disturbed area cannot be stabilized with vegetation before September 15 in the year that the utility was installed, the Licensee shall submit a written site stabilization plan to the State for approval. This plan shall describe erosion control, mulching, dormant seeding and monitoring. Seeding shall occur as soon as soil conditions are suitable.
- G. Excavated materials shall not be deposited or stored alongside public water in a manner where the materials can be redeposited into the public water by reasonably expected high water or storm run-off.

4. **Herbicides and Pesticides.**

- A. The Licensee must request and obtain written permission to apply herbicides or pesticides to state waters from the State prior to treatment. This request shall consist of (1) a map identifying proposed treatment areas and (2) a description of the proposed treatment plan, including target species, herbicide or pesticide name, rate of application, a description of application method, and beginning and end dates. All applications must be according to label regulations and as otherwise specified by the State. The Licensee shall not apply pesticides that are restricted for use on certified state forest land administered by the State.
- B. The Licensee must submit annual reports detailing herbicide or pesticide application on areas covered under the license. The report must include the dates, acres, location expressed as quarter-quarter section, township and range, herbicide or pesticide used, target species, and such other information as may be reasonably required by the State for the purpose of verifying herbicide or pesticide use.
- C. The Licensee shall post all places commonly used by the public for access along the utility corridors treated with herbicides or pesticides.

5. **Invasive Species.**

- A. The Licensee shall inspect all state water crossings for the presence of invasive species and noxious weeds prior to commencing clearing activities and take action to prevent their spread. For installation of the utility line, the State will identify on a map the known infested sites to be avoided. For maintenance and operation, the Licensee is responsible for obtaining updated information on known infested sites.
- B. If the State or the Licensee discover additional invasive species infestation areas on state water crossings during construction, the Licensee shall immediately take action to prevent spread from the newly discovered infested area and then consult with the State on a resolution.
- C. The Licensee shall prevent invasive species from entering into or spreading within state water crossing by cleaning equipment and clothing prior to arriving at the license area. The Licensee shall legally dispose of material cleaned from equipment and clothing at a location offsite and the materials must be secured prior to transport to avoid dispersal.
- D. Whenever possible, parking, staging areas and travel routes shall not be within known infested sites. Where there are multiple state water crossings and at least one contains invasive species, the Licensee shall to the extent practicable start work at the site with the fewest number of invasive plants, leaving the most heavily infested sites to last. The Licensee shall make every effort to schedule operations and site visits to avoid the spread of weed seed.

- E. The Licensee shall continue to control invasive species on state water crossings for the terms of the license using methods approved by the State.
6. **Crossing of State Trail.**
- A. The location of any crossing of a state trail must be approved in advance by the State. The State may provide written instructions as to specific construction standards to be followed for the crossing of the state trail.
 - B. Utility installation and maintenance activities shall be conducted in a manner so as to minimize disturbance of state trail use and to separate the public from work areas. The Licensee must provide signs to warn state trail users of construction hazards.
 - C. The Licensee is responsible for repairing any damage to the state trail in a manner satisfactory to the State.
 - D. For maintenance and operations, prior approval must be obtained from the State for the cutting or trimming of trees within the state trail right-of-way.
 - E. The Licensee may not close the state trail right-of-way without the prior written approval of the State.
7. **Maintenance, operations and repairs.**
- A. The Licensee must keep the premises in a neat and orderly condition, and shall remove all refuse and debris that may accumulate thereon.
 - B. After initial installation, no merchantable timber shall be cut, used, removed or destroyed by the Licensee without first contacting the State at least 60 days in advance to determine if a timber payment is needed. Slash material on state water crossings must be disposed of within 30 days of maintenance activities.
 - C. Emergency repairs and replacements may be made without prior notification to the State by the Licensee according to conditions and standards prescribed by Minnesota Rules, Chapter 6135 and the method of installation identified in this license. The Licensee shall notify the State of this activity as soon as practicable.
 - D. The Licensee shall employ appropriate erosion and sedimentation measures at the site during any emergency repairs. The State must approve plans for restoration of the site after the emergency repairs are conducted.
 - E. Other than the herbicide or pesticide application reporting as provided in paragraph 4, the Licensee shall notify the State of the extent and method of any routine maintenance and the proposed schedule. The notification must be in writing and must be provided either annually or at least 20 days prior to commencing any routine maintenance work on state water crossings subject to this license. The Licensee shall include a specific description of the proposed maintenance activities including location, clearing methods, erosion and sedimentation control measures, removal of merchantable timber, revegetation plans, and plans for preventing the spread of invasive species. The Licensee may commence any routine maintenance work unless notified to the contrary by the State within 20 days after the State's receipt of the maintenance plan. The State may require the Licensee to adjust its maintenance plans due to natural resource management concerns.
8. **State inspection.** The project hereunder shall at all times during and after construction be subject to inspection by the State and for that purpose the Licensee shall grant access to the premises at all reasonable times.
9. **Compliance with laws.** The Licensee shall comply with all federal, state and local laws and regulations, including municipal ordinances, affecting said lands or the area in which they are situated.
10. **Taxes and assessments.** The Licensee will pay when due all taxes and assessments levied against said waters or any improvements owned, used, or controlled by the Licensee, provided that the taxes or assessments are imposed due to this license.
11. **Enforcement.** No delay by the State in enforcing any of the conditions of this license shall operate as a waiver of any of its rights.
12. **Liability.** This license is permissive only. No liability shall be imposed upon or incurred by the State of Minnesota or any of its officers, agents, or employees, officially or personally, on account of the granting of the license or on account of any damage to any person or property resulting from any act or omission of the Licensee or any of its agents, employees, or contractors relating to any license matter. This license shall not be construed as estopping or limiting any legal claims or right of action of any person against the Licensee, its agents, employees, or contractors for any damage or injury resulting from any such act or omission, or as estopping or limiting any legal claim or right of action of the State against the Licensee, its agents, employees, or contractors, for violation of or failure to comply with the provisions of the license or applicable provisions of law. The Licensee shall indemnify and hold harmless the State from all claims arising out of the Licensee's use of the above described lands whether such claims are asserted by civil action or otherwise.

13. **Termination and cancellation.**

- A. At the end of the license period and if both parties wish to renew, the renewal fee will be determined by the State.
- B. This license shall be cancelable upon reasonable notice by the State for violation of any of its terms, or if at any time its continuance will conflict with a public use of the land over or upon which it is granted, or for any other reason. Licensee shall ensure that Licensee's employees, agents and contractors have received and thoroughly understand all conditions of this license.
- C. Unless otherwise authorized by the State, upon the surrender, expiration or cancellation of this license, the Licensee shall remove from the above described lands all the utility lines and related structures owned by it. If Licensee does not remove such lines or related structures, all such lines or structures remaining shall become the property of the State, to be used or disposed of as the State elects. If the State requires the Licensee to remove utility lines and related structures and Licensee fails to do so, the Licensee agrees to pay the State for the costs of removing and disposing of such lines or structures.

14. **Assignment or transfer.** The Licensee shall not without the State's prior written consent: a) assign, convey or otherwise transfer this license or any interest under it; b) sublet the license corridor or any part thereof; or c) permit the use or occupancy of the license corridor or any part thereof by anyone other than the Licensee. This license shall extend to, and bind the successors, heirs, legal representatives and assigns of the Licensee, if any. The State may require a party who has requested to sublet, use or occupy the license corridor to obtain a separate license from the State prior to occupying or using the license corridor.

15. **Reports.** The Licensee must submit reports on herbicide and pesticide use as provided in paragraph 4 and maintenance and repair work as provided in paragraph 7.

16. **Contacts.** The contact for the State is the Regional Lands and Minerals Manager, who is at the time of license issuance Joe Rokala at 218-328-8923. Any questions about this license shall be directed to the Regional Lands and Minerals Manager. The Regional Lands and Minerals Manager may direct the Licensee to contact additional State staff for reviews and approvals.

17. **Special provisions.** This license is subject to the SPECIAL PROVISIONS.

- A. **Permits Required.** Per Section 9 of the License, Licensee will be required to obtain a DNR Water Appropriation Permit if Licensee's actions include appropriating water that exceeds an amount of 10,000 gallons in one day or one million gallons of water in one year.

ACCEPTED AND ACKNOWLEDGED

METROPOLITAN COUNCIL ENVIRONMENTAL SERVICES
Licensee


By 

Name Leisa Thompson

Title General Manager
Environmental Services

Date Jan 17, 2025

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

By  Joey Rokala
Regional Manager
Lands and Minerals Division

Date _____

Digitally signed by Joey Rokala
Date: 2025.02.03 08:06:57
-06'00'

Form approved by Lands and Minerals Division, DNR, March 5, 2015.



Application for Utility License to Cross State Lands or Public Waters

The Applicant, pursuant to Minnesota Statutes section 84.415 and Minnesota Rules chapter 6135, applies for a license to cross state lands or public waters as described below and in the maps, plans, specifications, and other supporting data submitted with this application.

Application Number: ULA241023

Applicant

Name:

Metropolitan Council Environmental Services

Address:

390 Robert St. North, St. Paul, MN 55101

Contact Person:

Leisa Thompson

Email address:

leisa.thompson@metc.state.mn.us

Office phone:

(651) 602-1000

Alternate phone:

Agent

Name:

Short Elliott Hendrickson Inc.

Address:

3535 Vadnais Center Dr. St. Paul, MN, 55110

Contact Person:

Luis Sandia Rodriguez

Email address:

lsandia@sehinc.com

Office phone:

(952) 912-2609

Alternate phone:

(612) 590-8719

Utility Type

Utility type:

Pipeline, solids in suspension

Pipeline diameter:

24 inches

Is this application for main pipeline crossing(s) pursuant to Minnesota Statutes section 84.415, subd. 7?:

Yes

License Detail

License term:

50 years

Is this a renewal of an existing license?

No

Is this project funded in whole or in part by a state or federal grant?

No

Project description

Applicant Project Number: **802897**

MCES proposes sanitary sewer forcemain, gravity main, and lift station rehabilitation and improvements around the Lake Minnetonka Area. Projects include: Forcemain 7113 Improvements, L46 and L49 Improvements, L48 Improvements, L19 and L20 Improvements, and L21 Improvements.

Land crossings in existing right of way

Pursuant to Minnesota Rules chapter 6135, the license fee for a land crossing may be reduced by 50 percent if an additional crossing is to be placed in an existing right-of-way as if the additional crossing were the original crossing in the right-of-way. This fee reduction applies to the original Applicant or any other Applicant. Does this application include one or more crossing(s) that are within an existing utility license right-of-way?

No

Environmental Review

Has this project been reviewed pursuant to Minnesota Rules chapter 4410, the National Environmental Policy Act (NEPA), a conditional use permit, Natural Heritage Information System (NHIS) Information Request, or other similar reviews?

Yes

Do the proposed crossings comply with the environmental standards in Minnesota Rules 6135.1100? If no, please provide an explanation of the conflict or discrepancy.

Yes

Joint Application

Is this a joint application for residential use pursuant to Minnesota Statutes section 84.415, subd. 3a?

No

Supporting Documents

Cover Letter 11-18-24.pdf

C.1 PWI Route Map.pdf

C.2 Plan View.pdf

C.3 CU10 - CU12 Plan and Profile.pdf

D. EIW from Lake Mtka Facility Plan.pdf

Crossings

Number of crossings: 2

#	Public Water	Crossing Start	Crossing End
---	--------------	----------------	--------------

Name

Construction Details

1 M-056-007 Long Lake Creek	G. Lot: 1 Section: 10 Township: 117N Range: 23W County: Hennepin	G. Lot: 1 Section: 10 Township: 117N Range: 23W County: Hennepin	Crossing Method: Under Construction Method: Boring or Jacking Right-of-way (ft): Width: 21 Length: 370 Number of lines, cables, conduits, or pipelines: 1 Calculated length for license fee: 370
- M-056-007 Long Lake Creek	G. Lot: 1 Section: 10 Township: 117N Range: 23W County: Hennepin	G. Lot: 1 Section: 10 Township: 117N Range: 23W County: Hennepin	This is not a valid crossing.

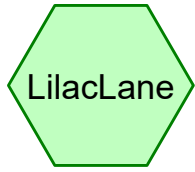
Certification

This application and the information submitted with this application will become part of the utility license, if issued. Applicant certifies that the information submitted with this application is true and correct. Applicant agrees to comply with the requirements of Minnesota Statutes section 84.415, Minnesota Rules chapter 6135, and the terms and conditions of the license. Applicant acknowledges that no work will take place before receiving the fully executed DNR utility license.

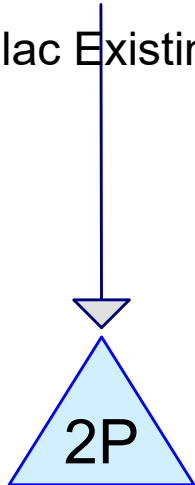
/s/ Terrie DeBaker, 01/15/2025 03:38 PM

Appendix C

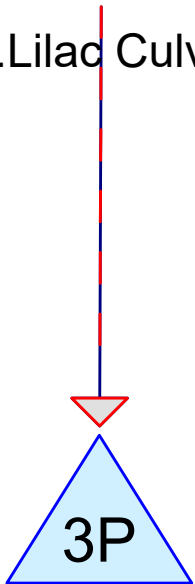
Stormwater Culvert Change Analysis



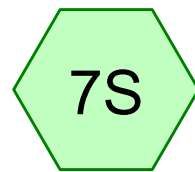
Lilac Existing



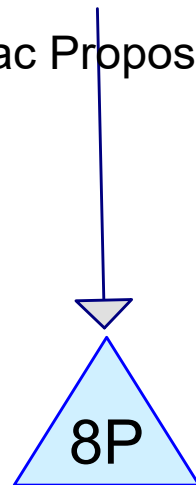
Ex.Lilac Culvert



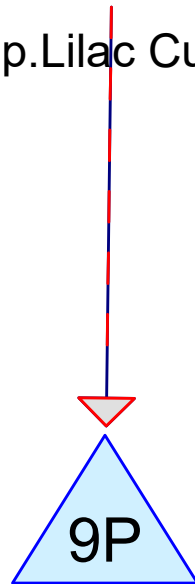
Ex. Pond



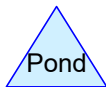
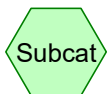
Lilac Proposed



Prop.Lilac Culvert



Prop. Pond



LilacLaneCulvert01.27.26Rev

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-Year	MSE 24-hr	3	Default	24.00	1	7.30	2

LilacLaneCulvert01.27.26Rev

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
74.120	73	Woods, Fair, HSG C (7S, LilacLane)
74.120	73	TOTAL AREA

LilacLaneCulvert01.27.26Rev

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
74.120	HSG C	7S, LilacLane
0.000	HSG D	
0.000	Other	
74.120		TOTAL AREA

LilacLaneCulvert01.27.26Rev

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	74.120	0.000	0.000	74.120	Woods, Fair	7S, LilacLane
0.000	0.000	74.120	0.000	0.000	74.120	TOTAL AREA	

LilacLaneCulvert01.27.26Rev

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	2P	934.72	935.17	24.0	-0.0187	0.025	0.0	24.0	0.0	
2	8P	934.56	935.17	37.0	-0.0165	0.025	0.0	24.0	0.0	

LilacLaneCulvert01.27.26Rev

MSE 24-hr 3 100-Year Rainfall=7.30"

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Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment7S: Lilac Proposed Runoff Area=37.060 ac 0.00% Impervious Runoff Depth=4.20"
Flow Length=2,750' Tc=219.4 min CN=73 Runoff=34.58 cfs 12.956 af

SubcatchmentLilacLane: Lilac Existing Runoff Area=37.060 ac 0.00% Impervious Runoff Depth=4.20"
Flow Length=2,750' Tc=219.4 min CN=73 Runoff=34.58 cfs 12.956 af

Pond 2P: Ex.Lilac Culvert Peak Elev=937.60' Storage=7.154 af Inflow=34.58 cfs 12.956 af
Primary=13.62 cfs 12.893 af Secondary=0.00 cfs 0.000 af Outflow=13.62 cfs 12.893 af

Pond 3P: Ex. Pond Peak Elev=932.73' Storage=12.892 af Inflow=13.62 cfs 12.893 af
Outflow=0.00 cfs 0.000 af

Pond 8P: Prop.Lilac Culvert Peak Elev=937.60' Storage=7.169 af Inflow=34.58 cfs 12.956 af
Primary=13.55 cfs 12.893 af Secondary=0.00 cfs 0.000 af Outflow=13.55 cfs 12.893 af

Pond 9P: Prop. Pond Peak Elev=932.73' Storage=12.892 af Inflow=13.55 cfs 12.893 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 74.120 ac Runoff Volume = 25.912 af Average Runoff Depth = 4.20"
100.00% Pervious = 74.120 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 7S: Lilac Proposed

Runoff = 34.58 cfs @ 14.88 hrs, Volume= 12.956 af, Depth= 4.20"
 Routed to Pond 8P : Prop.Lilac Culvert

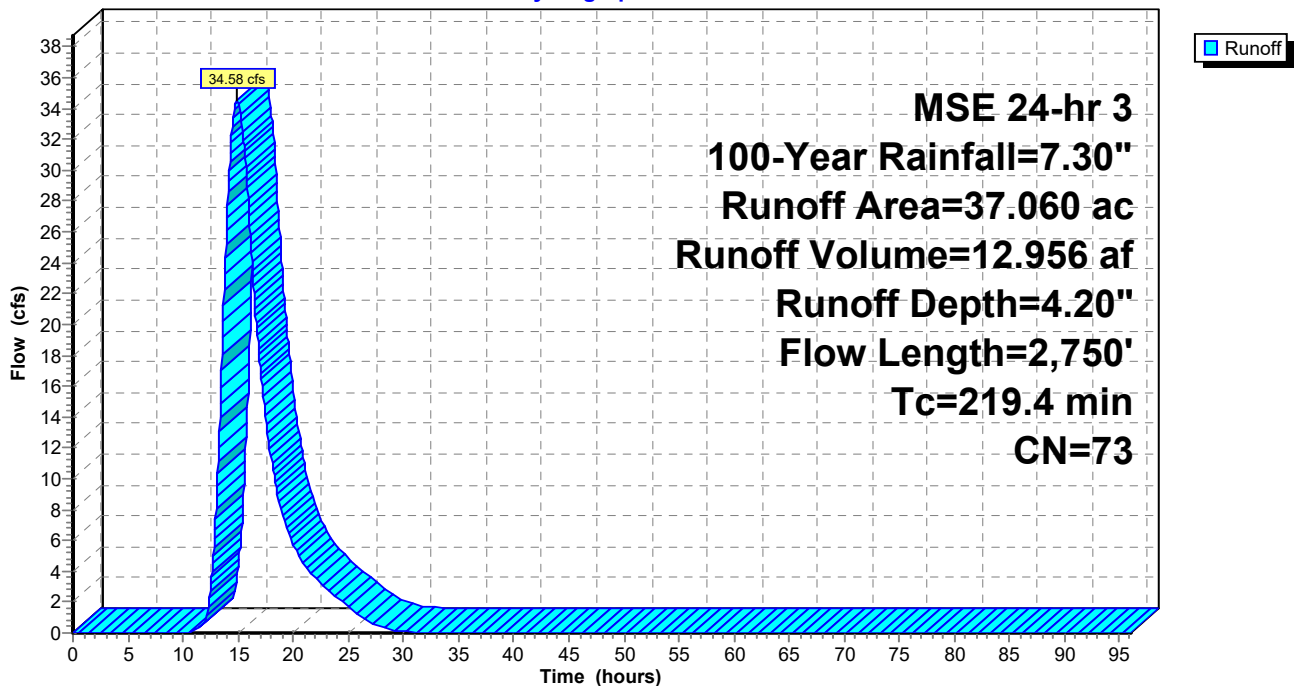
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 100-Year Rainfall=7.30"

Area (ac)	CN	Description
37.060	73	Woods, Fair, HSG C
37.060		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
167.0	300	0.0050	0.03		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.82"
52.4	2,450	0.0027	0.78		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
219.4	2,750	Total			

Subcatchment 7S: Lilac Proposed

Hydrograph



LilacLaneCulvert01.27.26Rev

MSE 24-hr 3 100-Year Rainfall=7.30"

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Summary for Subcatchment LilacLane: Lilac Existing

Runoff = 34.58 cfs @ 14.88 hrs, Volume= 12.956 af, Depth= 4.20"
 Routed to Pond 2P : Ex.Lilac Culvert

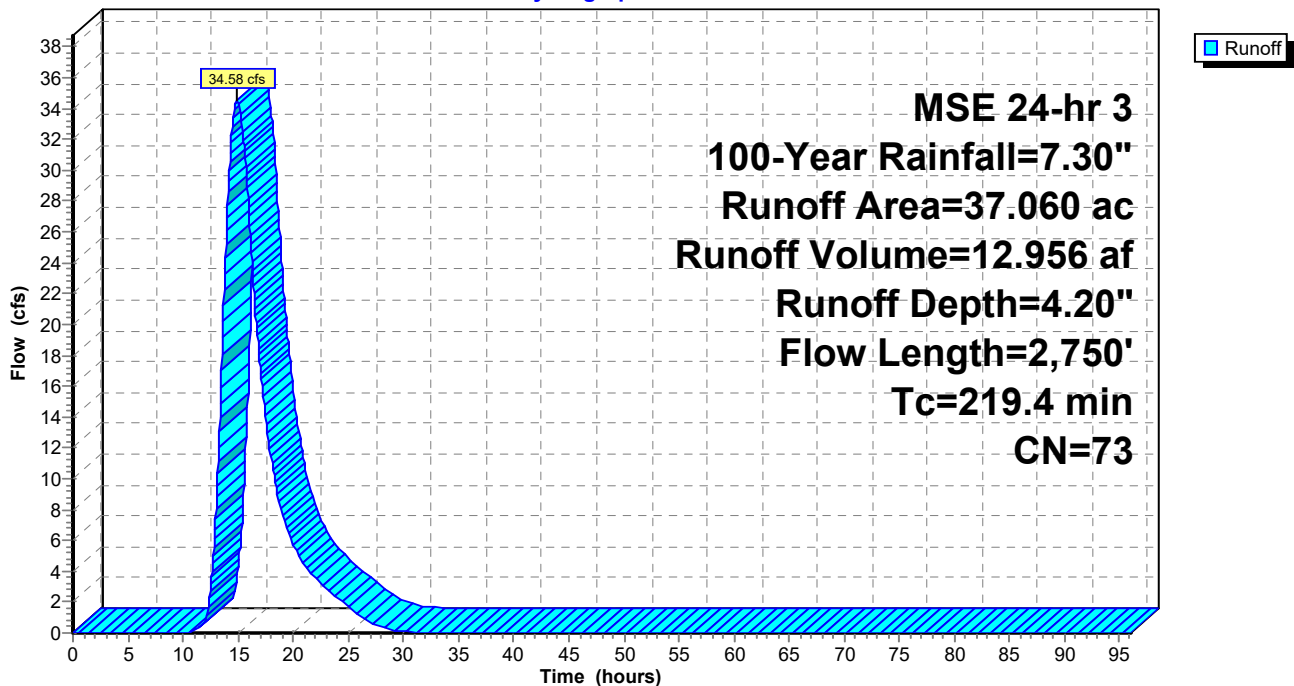
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 3 100-Year Rainfall=7.30"

Area (ac)	CN	Description
37.060	73	Woods, Fair, HSG C
37.060		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
167.0	300	0.0050	0.03		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.82"
52.4	2,450	0.0027	0.78		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
219.4	2,750	Total			

Subcatchment LilacLane: Lilac Existing

Hydrograph



Summary for Pond 2P: Ex.Lilac Culvert

Inflow Area = 37.060 ac, 0.00% Impervious, Inflow Depth = 4.20" for 100-Year event
 Inflow = 34.58 cfs @ 14.88 hrs, Volume= 12.956 af
 Outflow = 13.62 cfs @ 17.56 hrs, Volume= 12.893 af, Atten= 61%, Lag= 160.9 min
 Primary = 13.62 cfs @ 17.56 hrs, Volume= 12.893 af
 Routed to Pond 3P : Ex. Pond
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond 3P : Ex. Pond

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 935.17' Surf.Area= 1.312 ac Storage= 0.984 af
 Peak Elev= 937.60' @ 17.56 hrs Surf.Area= 4.033 ac Storage= 7.154 af (6.170 af above start)

Plug-Flow detention time= 396.7 min calculated for 11.909 af (92% of inflow)
 Center-of-Mass det. time= 320.9 min (1,317.7 - 996.8)

Volume	Invert	Avail.Storage	Storage Description
#1	934.00'	8.880 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
934.00	0.370	0.000	0.000
936.00	1.980	2.350	2.350
938.00	4.550	6.530	8.880

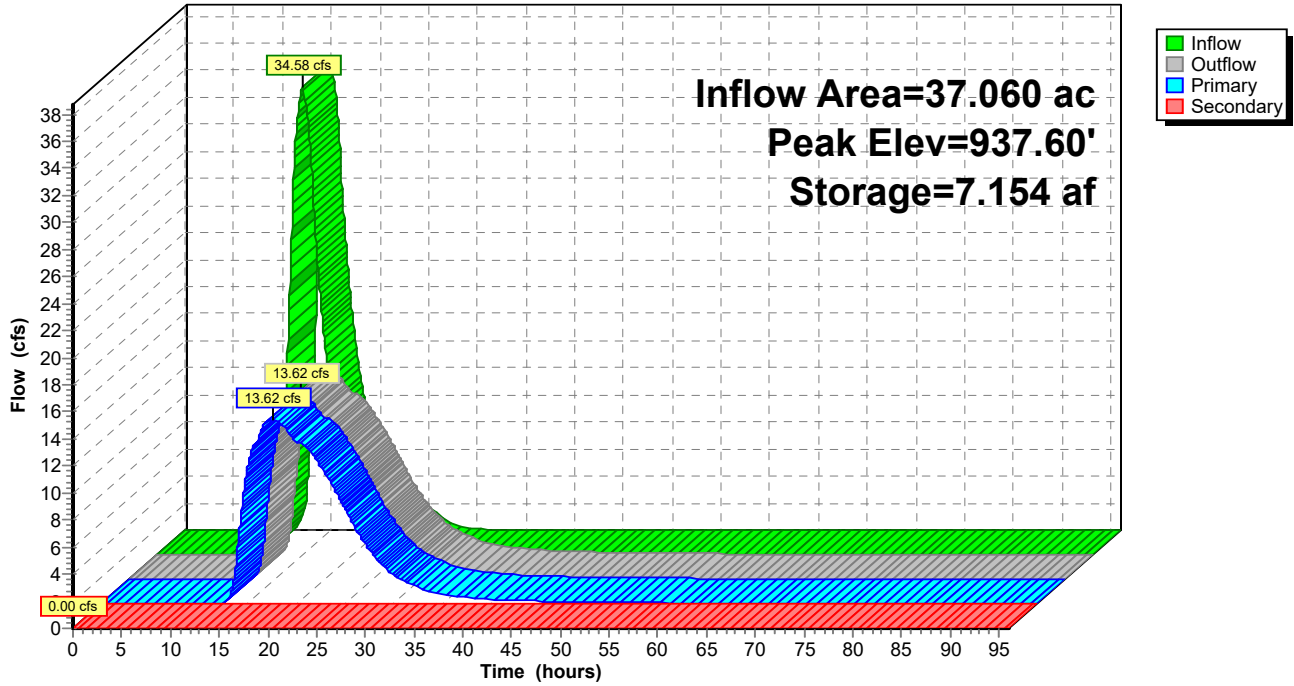
Device	Routing	Invert	Outlet Devices
#1	Primary	935.17'	24.0" Round E.Culvert L= 24.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 934.72' / 935.17' S= -0.0187 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Secondary	937.60'	100.0' long x 24.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.62 cfs @ 17.56 hrs HW=937.60' (Free Discharge)
 ↑1=**E.Culvert** (Barrel Controls 13.62 cfs @ 4.34 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=935.17' (Free Discharge)
 ↑2=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Ex.Lilac Culvert

Hydrograph



Summary for Pond 3P: Ex. Pond

Inflow Area = 37.060 ac, 0.00% Impervious, Inflow Depth > 4.17" for 100-Year event
 Inflow = 13.62 cfs @ 17.56 hrs, Volume= 12.893 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

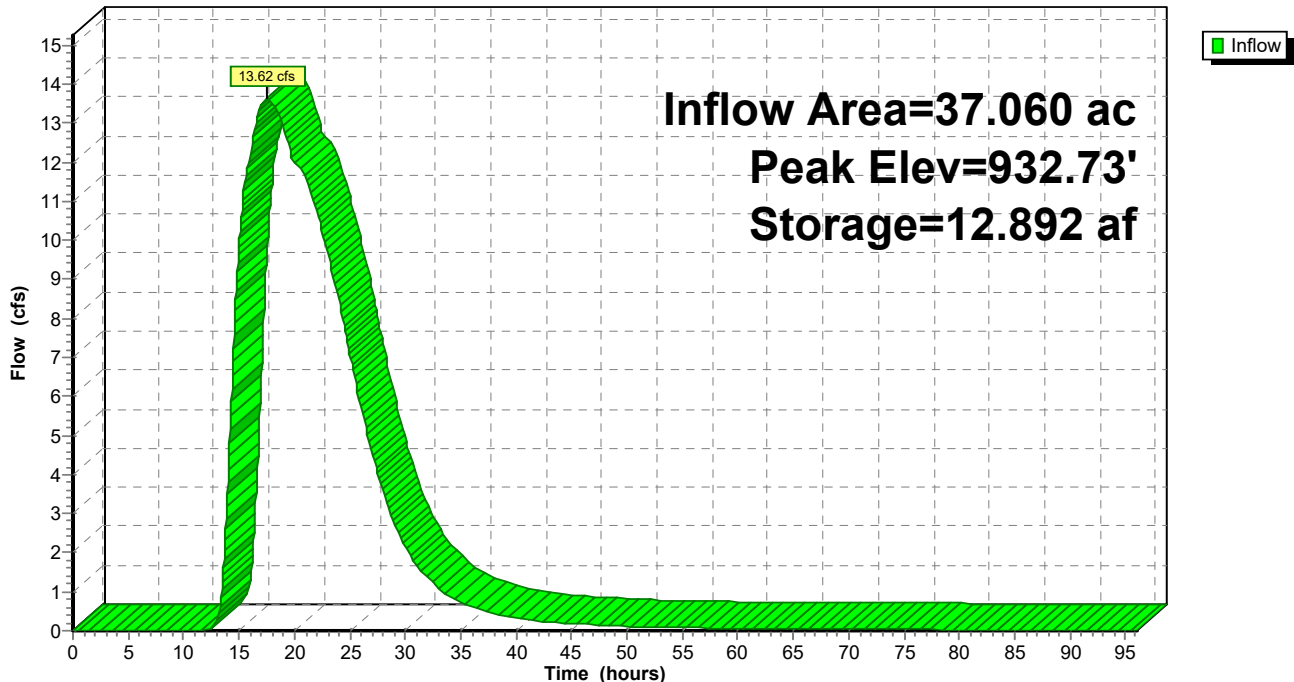
Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 932.73' @ 96.00 hrs Surf.Area= 20.454 ac Storage= 12.892 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	932.00'	175.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
932.00	15.000	0.000	0.000
934.00	30.000	45.000	45.000
936.00	100.000	130.000	175.000

Pond 3P: Ex. Pond

Hydrograph



Summary for Pond 8P: Prop.Lilac Culvert

Inflow Area = 37.060 ac, 0.00% Impervious, Inflow Depth = 4.20" for 100-Year event
 Inflow = 34.58 cfs @ 14.88 hrs, Volume= 12.956 af
 Outflow = 13.55 cfs @ 17.57 hrs, Volume= 12.893 af, Atten= 61%, Lag= 161.7 min
 Primary = 13.55 cfs @ 17.57 hrs, Volume= 12.893 af
 Routed to Pond 9P : Prop. Pond
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond 9P : Prop. Pond

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 935.17' Surf.Area= 1.312 ac Storage= 0.984 af
 Peak Elev= 937.60' @ 17.57 hrs Surf.Area= 4.038 ac Storage= 7.169 af (6.185 af above start)

Plug-Flow detention time= 396.3 min calculated for 11.903 af (92% of inflow)
 Center-of-Mass det. time= 322.5 min (1,319.3 - 996.8)

Volume	Invert	Avail.Storage	Storage Description
#1	934.00'	8.880 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
934.00	0.370	0.000	0.000
936.00	1.980	2.350	2.350
938.00	4.550	6.530	8.880

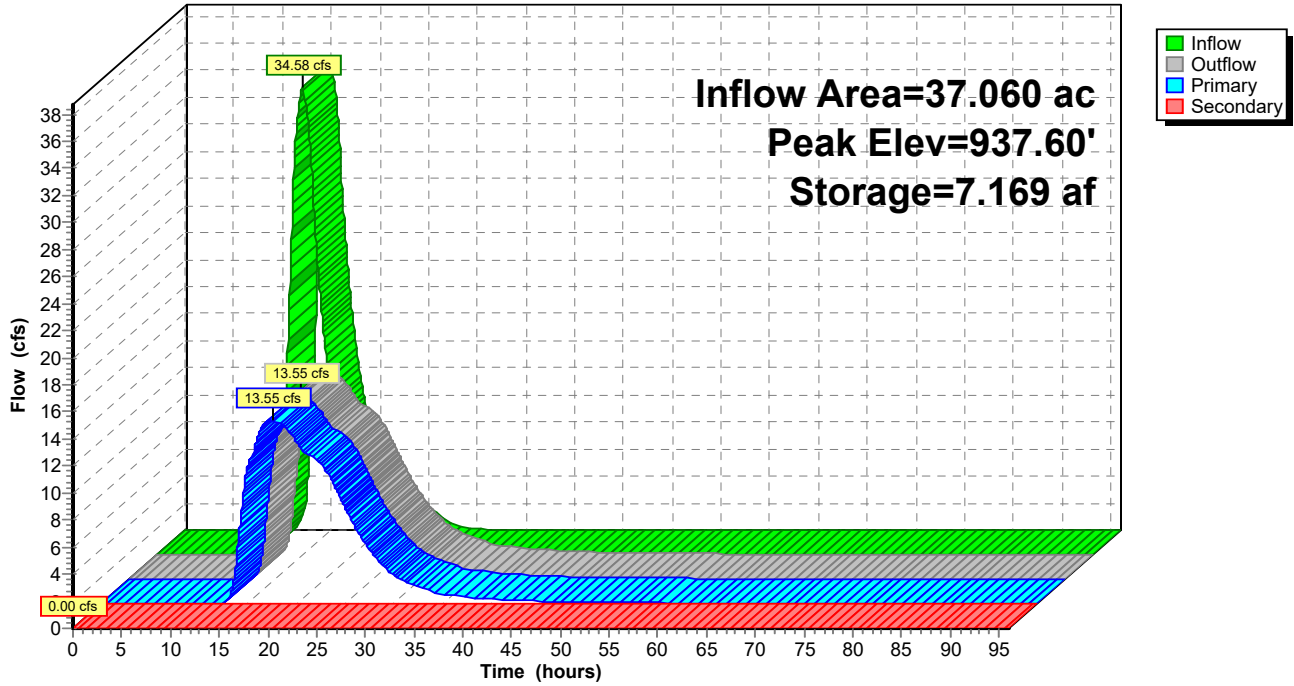
Device	Routing	Invert	Outlet Devices
#1	Primary	935.17'	24.0" Round CMP_Round 24" L= 37.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 934.56' / 935.17' S= -0.0165 '/' Cc= 0.900 n= 0.025, Flow Area= 3.14 sf
#2	Secondary	937.80'	100.0' long x 37.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 17.57 hrs HW=937.60' (Free Discharge)
 ↑1=CMP_Round 24" (Barrel Controls 13.55 cfs @ 4.31 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=935.17' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir(Controls 0.00 cfs)

Pond 8P: Prop.Lilac Culvert

Hydrograph



Summary for Pond 9P: Prop. Pond

Inflow Area = 37.060 ac, 0.00% Impervious, Inflow Depth > 4.17" for 100-Year event
 Inflow = 13.55 cfs @ 17.57 hrs, Volume= 12.893 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

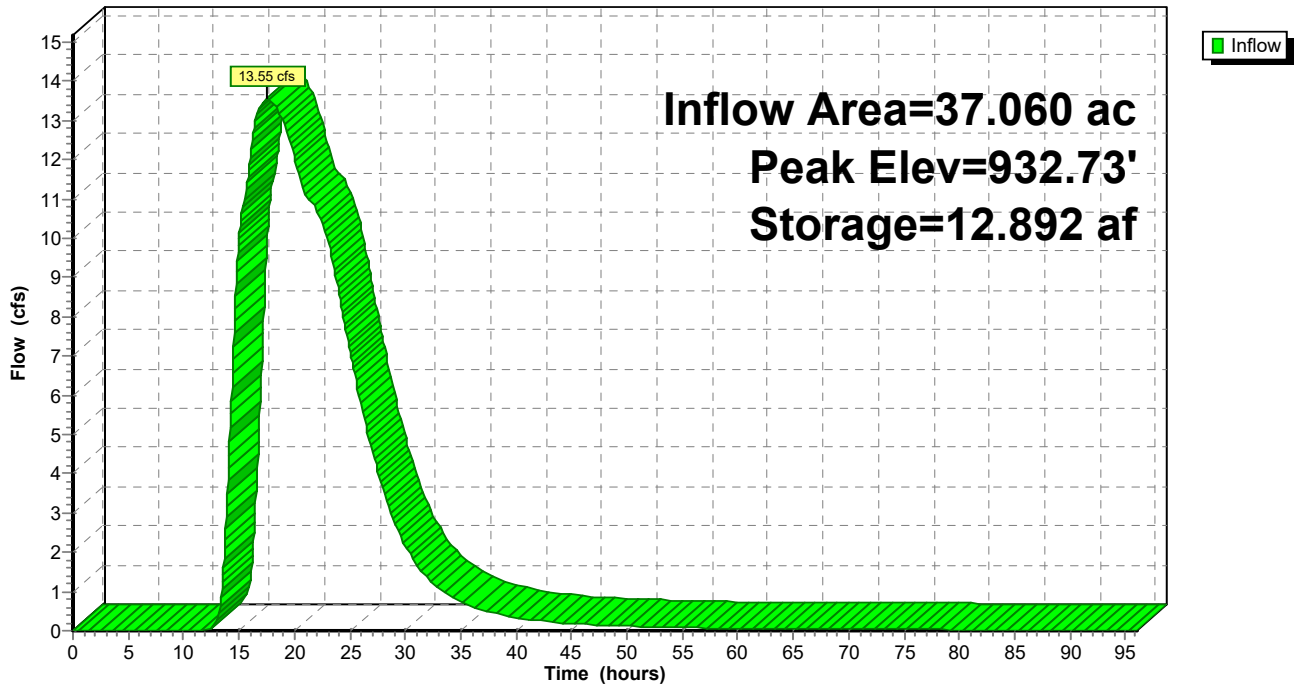
Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 932.73' @ 96.00 hrs Surf.Area= 20.454 ac Storage= 12.892 af

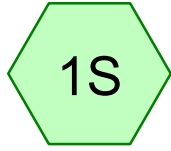
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	932.00'	175.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
932.00	15.000	0.000	0.000
934.00	30.000	45.000	45.000
936.00	100.000	130.000	175.000

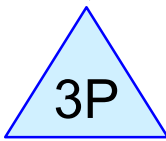
Pond 9P: Prop. Pond

Hydrograph

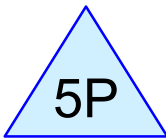




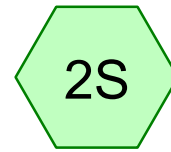
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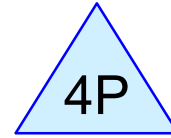
Dakota Trail Culvert Ex



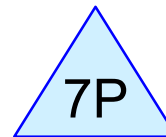
(new Pond)



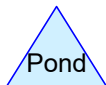
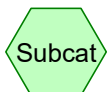
(new Subcat)



Dakota Trail Culvert Prop



(new Pond)



DakotaTrail_20260203

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-yr	MSE 24-hr	3	Default	24.00	1	7.30	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
163.000	82	(1S, 2S)
163.000	82	TOTAL AREA

DakotaTrail_20260203

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
163.000	Other	1S, 2S
163.000		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	163.000	163.000		1S, 2S
0.000	0.000	0.000	0.000	163.000	163.000	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	3P	930.36	930.29	23.0	0.0030	0.025	0.0	18.0	0.0	
2	4P	930.36	930.31	25.0	0.0020	0.012	0.0	15.0	0.0	

DakotaTrail_20260203

MSE 24-hr 3 100-yr Rainfall=7.30"

Prepared by Short Elliott Hendrickson Inc

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (new Subcat) Runoff Area=81.500 ac 0.00% Impervious Runoff Depth=5.20"
Flow Length=2,180' Slope=0.0311 '/' Tc=31.6 min CN=82 Runoff=363.11 cfs 35.303 af

Subcatchment 2S: (new Subcat) Runoff Area=81.500 ac 0.00% Impervious Runoff Depth=5.20"
Flow Length=2,180' Slope=0.0311 '/' Tc=31.6 min CN=82 Runoff=363.11 cfs 35.303 af

Pond 3P: Dakota Trail Culvert Ex Peak Elev=933.75' Storage=15.048 af Inflow=363.11 cfs 35.303 af
Primary=7.92 cfs 0.640 af Secondary=218.97 cfs 21.584 af Outflow=224.00 cfs 22.224 af

Pond 4P: Dakota Trail Culvert Prop Peak Elev=933.75' Storage=15.049 af Inflow=363.11 cfs 35.303 af
Primary=7.39 cfs 0.625 af Secondary=219.11 cfs 21.599 af Outflow=223.53 cfs 22.224 af

Pond 5P: (new Pond) Peak Elev=933.74' Storage=7.469 af Inflow=224.00 cfs 22.224 af
Outflow=82.05 cfs 15.796 af

Pond 7P: (new Pond) Peak Elev=933.74' Storage=7.469 af Inflow=223.53 cfs 22.224 af
Outflow=82.05 cfs 15.796 af

Total Runoff Area = 163.000 ac Runoff Volume = 70.605 af Average Runoff Depth = 5.20"
100.00% Pervious = 163.000 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (new Subcat)

Runoff = 363.11 cfs @ 12.43 hrs, Volume= 35.303 af, Depth= 5.20"
 Routed to Pond 3P : Dakota Trail Culvert Ex

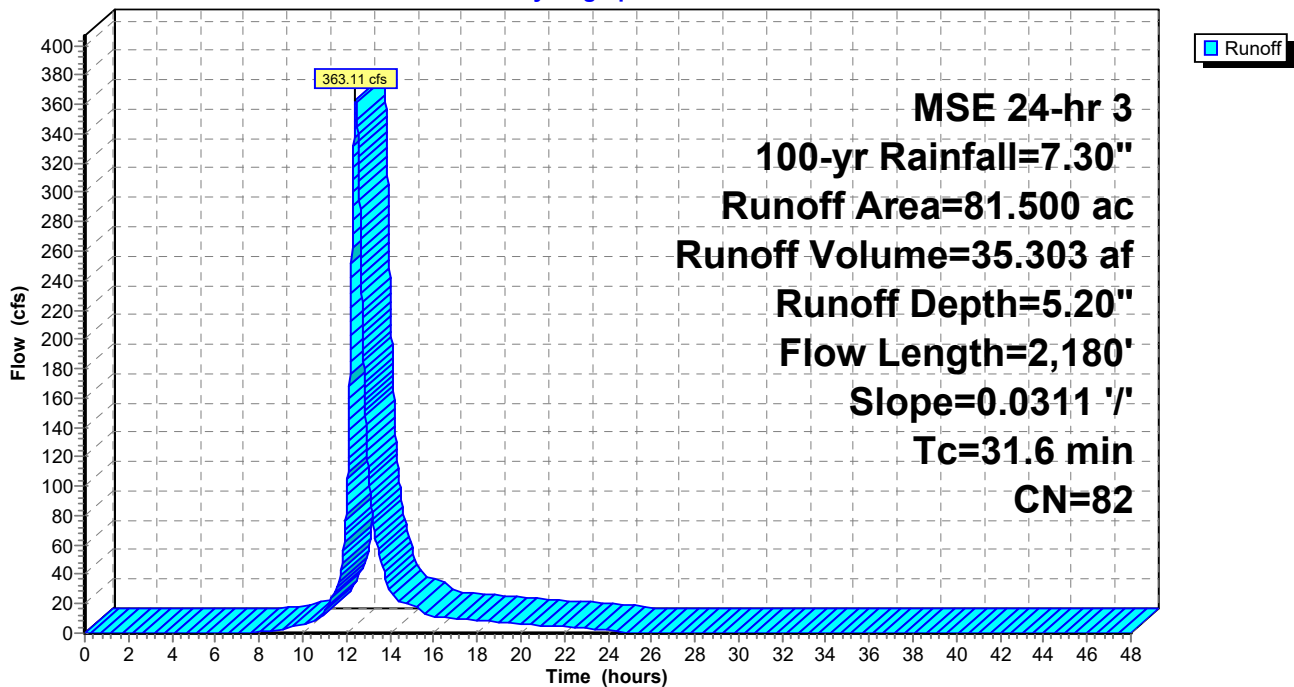
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=7.30"

Area (ac)	CN	Description
* 81.500	82	
81.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.6	2,180	0.0311	1.15		Lag/CN Method, Contour Length= 55,128' Interval= 2'

Subcatchment 1S: (new Subcat)

Hydrograph



Summary for Subcatchment 2S: (new Subcat)

Runoff = 363.11 cfs @ 12.43 hrs, Volume= 35.303 af, Depth= 5.20"

Routed to Pond 4P : Dakota Trail Culvert Prop

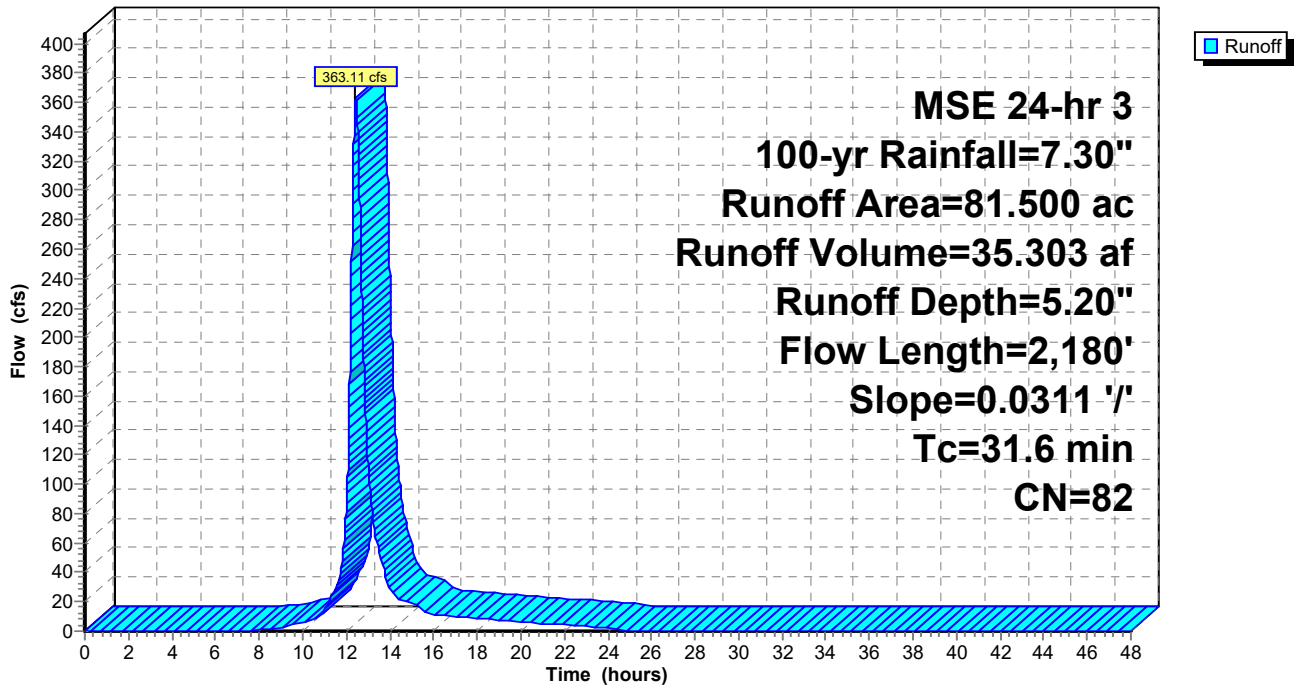
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=7.30"

Area (ac)	CN	Description
* 81.500	82	
81.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.6	2,180	0.0311	1.15		Lag/CN Method, Contour Length= 55,128' Interval= 2'

Subcatchment 2S: (new Subcat)

Hydrograph



Summary for Pond 3P: Dakota Trail Culvert Ex

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=132)

Inflow Area = 81.500 ac, 0.00% Impervious, Inflow Depth = 5.20" for 100-yr event
 Inflow = 363.11 cfs @ 12.43 hrs, Volume= 35.303 af
 Outflow = 224.00 cfs @ 12.53 hrs, Volume= 22.224 af, Atten= 38%, Lag= 5.5 min
 Primary = 7.92 cfs @ 12.37 hrs, Volume= 0.640 af
 Routed to Pond 5P : (new Pond)
 Secondary = 218.97 cfs @ 12.53 hrs, Volume= 21.584 af
 Routed to Pond 5P : (new Pond)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 933.75' @ 13.18 hrs Surf.Area= 8.110 ac Storage= 15.048 af

Plug-Flow detention time= 146.9 min calculated for 22.220 af (63% of inflow)
 Center-of-Mass det. time= 72.1 min (881.1 - 809.0)

Volume	Invert	Avail.Storage	Storage Description
#1	930.00'	17.130 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
930.00	0.830	0.000	0.000
932.00	3.790	4.620	4.620
934.00	8.720	12.510	17.130

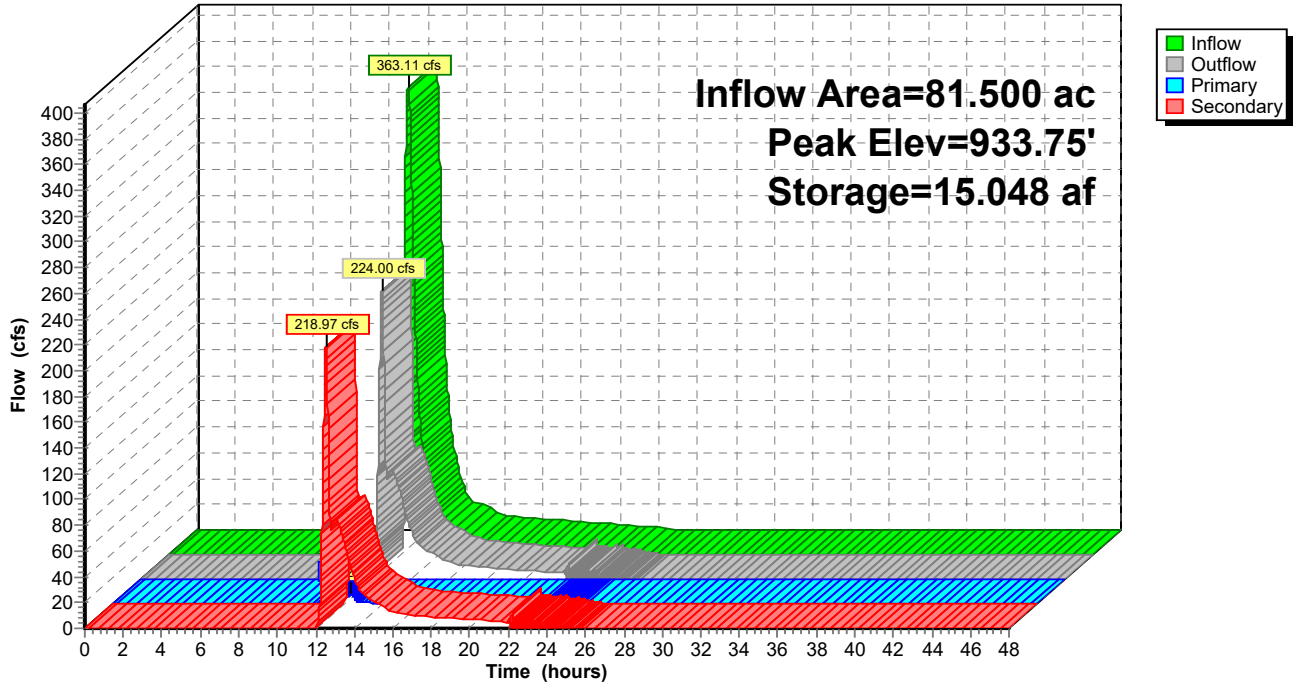
Device	Routing	Invert	Outlet Devices
#1	Primary	930.36'	18.0" Round CMP_Round 18" L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 930.36' / 930.29' S= 0.0030 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Secondary	932.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 2.00 Width (feet) 20.00 160.00

Primary OutFlow Max=7.73 cfs @ 12.37 hrs HW=932.88' TW=931.55' (Dynamic Tailwater)
 ↑1=CMP_Round 18" (Inlet Controls 7.73 cfs @ 4.37 fps)

Secondary OutFlow Max=212.21 cfs @ 12.53 hrs HW=933.23' TW=932.73' (Dynamic Tailwater)
 ↑2=Custom Weir/Orifice (Weir Controls 212.21 cfs @ 2.75 fps)

Pond 3P: Dakota Trail Culvert Ex

Hydrograph



Summary for Pond 4P: Dakota Trail Culvert Prop

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=141)

Inflow Area = 81.500 ac, 0.00% Impervious, Inflow Depth = 5.20" for 100-yr event
 Inflow = 363.11 cfs @ 12.43 hrs, Volume= 35.303 af
 Outflow = 223.53 cfs @ 12.53 hrs, Volume= 22.224 af, Atten= 38%, Lag= 5.5 min
 Primary = 7.39 cfs @ 12.31 hrs, Volume= 0.625 af
 Routed to Pond 7P : (new Pond)
 Secondary = 219.11 cfs @ 12.53 hrs, Volume= 21.599 af
 Routed to Pond 7P : (new Pond)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 933.75' @ 13.18 hrs Surf.Area= 8.110 ac Storage= 15.049 af

Plug-Flow detention time= 146.8 min calculated for 22.220 af (63% of inflow)
 Center-of-Mass det. time= 72.1 min (881.0 - 809.0)

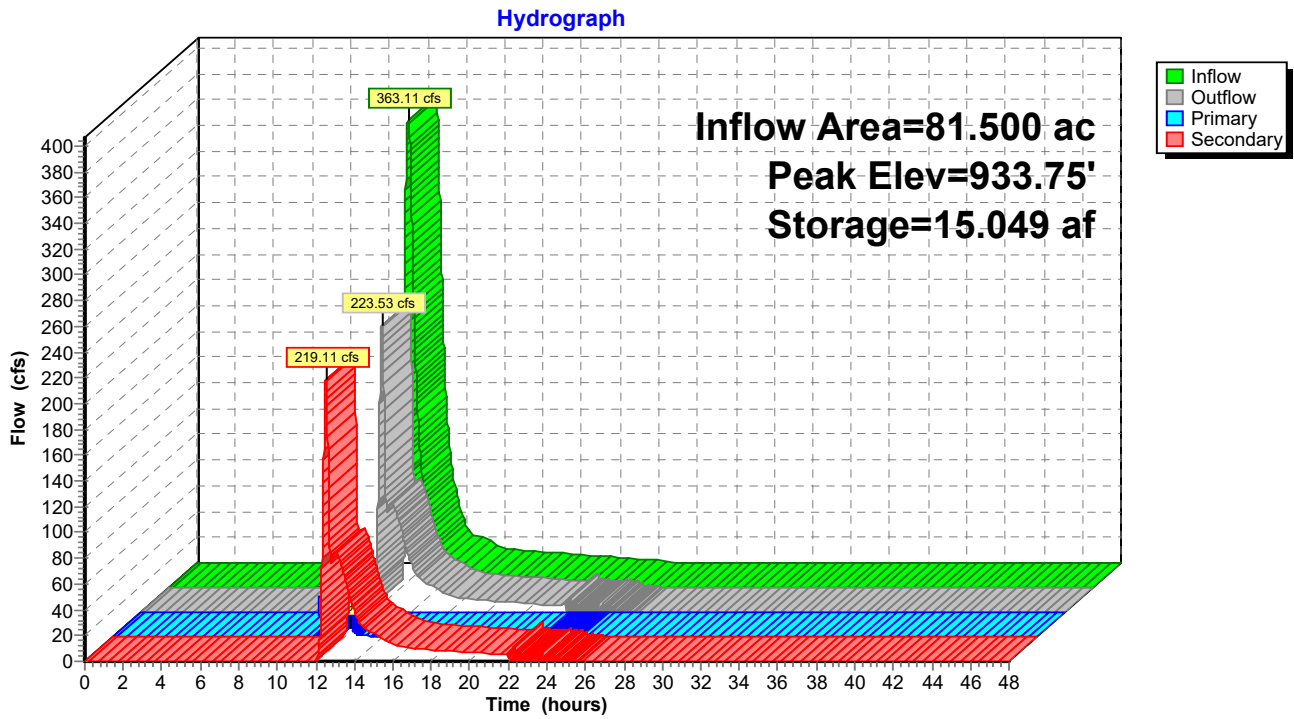
Volume	Invert	Avail.Storage	Storage Description
#1	930.00'	17.130 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
930.00	0.830	0.000	0.000
932.00	3.790	4.620	4.620
934.00	8.720	12.510	17.130

Device	Routing	Invert	Outlet Devices
#1	Primary	930.36'	15.0" Round RCP_Round 15" L= 25.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 930.36' / 930.31' S= 0.0020 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Secondary	932.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 2.00 Width (feet) 20.00 160.00

Primary OutFlow Max=7.24 cfs @ 12.31 hrs HW=932.69' TW=931.19' (Dynamic Tailwater)
 ↑1=RCP_Round 15" (Inlet Controls 7.24 cfs @ 5.90 fps)

Secondary OutFlow Max=212.33 cfs @ 12.53 hrs HW=933.23' TW=932.74' (Dynamic Tailwater)
 ↑2=Custom Weir/Orifice (Weir Controls 212.33 cfs @ 2.75 fps)

Pond 4P: Dakota Trail Culvert Prop



Summary for Pond 5P: (new Pond)

Inflow Area = 81.500 ac, 0.00% Impervious, Inflow Depth = 3.27" for 100-yr event
 Inflow = 224.00 cfs @ 12.53 hrs, Volume= 22.224 af
 Outflow = 82.05 cfs @ 13.19 hrs, Volume= 15.796 af, Atten= 63%, Lag= 39.6 min
 Primary = 82.05 cfs @ 13.19 hrs, Volume= 15.796 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 933.74' @ 13.19 hrs Surf.Area= 4.549 ac Storage= 7.469 af

Plug-Flow detention time= 162.9 min calculated for 15.796 af (71% of inflow)
 Center-of-Mass det. time= 68.8 min (949.9 - 881.1)

Volume	Invert	Avail.Storage	Storage Description
#1	930.00'	19.380 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
930.00	0.130	0.000	0.000
932.00	1.810	1.940	1.940
934.00	4.960	6.770	8.710
936.00	5.710	10.670	19.380

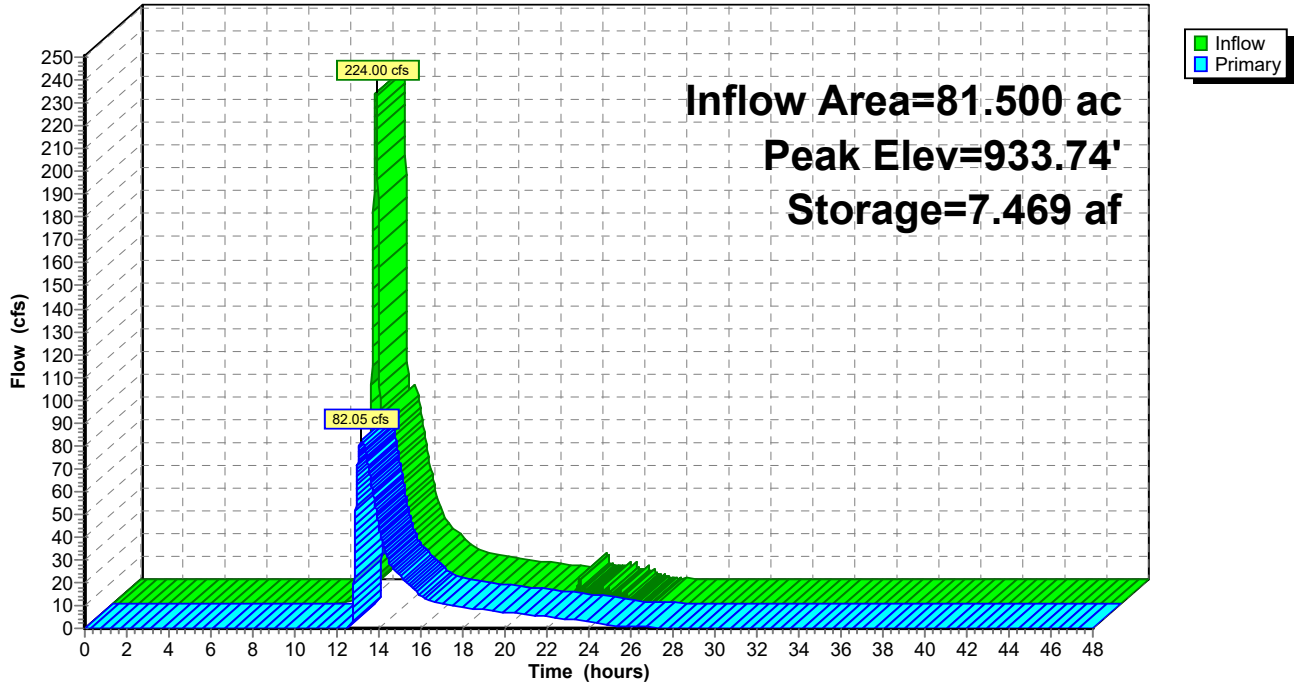
Device	Routing	Invert	Outlet Devices
#1	Primary	933.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 Width (feet) 200.00 350.00

Primary OutFlow Max=82.04 cfs @ 13.19 hrs HW=933.74' (Free Discharge)

↑1=Custom Weir/Orifice (Weir Controls 82.04 cfs @ 1.57 fps)

Pond 5P: (new Pond)

Hydrograph



Summary for Pond 7P: (new Pond)

Inflow Area = 81.500 ac, 0.00% Impervious, Inflow Depth = 3.27" for 100-yr event
 Inflow = 223.53 cfs @ 12.53 hrs, Volume= 22.224 af
 Outflow = 82.05 cfs @ 13.19 hrs, Volume= 15.796 af, Atten= 63%, Lag= 39.6 min
 Primary = 82.05 cfs @ 13.19 hrs, Volume= 15.796 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 933.74' @ 13.19 hrs Surf.Area= 4.549 ac Storage= 7.469 af

Plug-Flow detention time= 163.0 min calculated for 15.796 af (71% of inflow)
 Center-of-Mass det. time= 68.9 min (949.9 - 881.0)

Volume	Invert	Avail.Storage	Storage Description
#1	930.00'	19.380 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
930.00	0.130	0.000	0.000
932.00	1.810	1.940	1.940
934.00	4.960	6.770	8.710
936.00	5.710	10.670	19.380

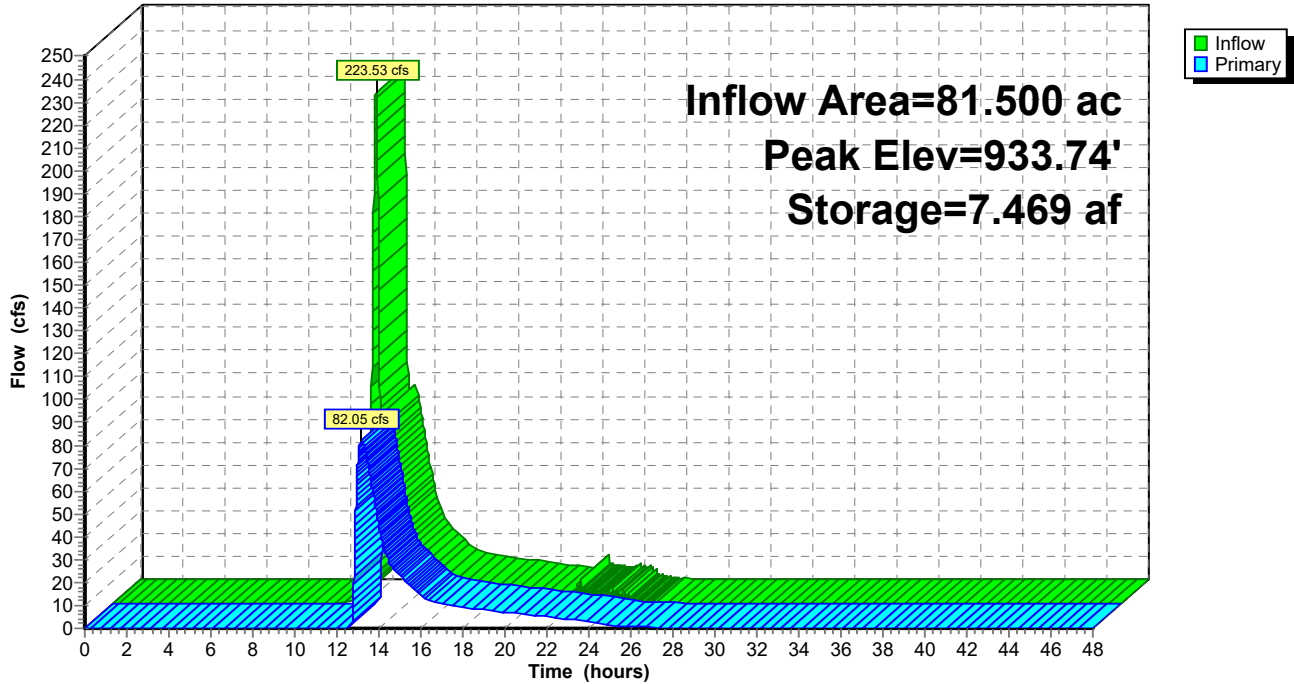
Device	Routing	Invert	Outlet Devices
#1	Primary	933.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 Width (feet) 200.00 350.00

Primary OutFlow Max=82.04 cfs @ 13.19 hrs HW=933.74' (Free Discharge)

↑1=Custom Weir/Orifice (Weir Controls 82.04 cfs @ 1.57 fps)

Pond 7P: (new Pond)

Hydrograph



Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/1/2005 1:05	929.399	-0.836	929.399
5/1/2005 1:10	929.399	0.658	929.399
5/1/2005 1:15	929.399	1.801	929.398
5/1/2005 1:20	929.398	1.780	929.398
5/1/2005 1:25	929.398	1.324	929.398
5/1/2005 1:30	929.398	0.792	929.398
5/1/2005 2:00	929.400	-0.205	929.400
5/1/2005 2:30	929.401	1.088	929.401
5/1/2005 3:00	929.403	1.527	929.403
5/1/2005 3:30	929.406	2.439	929.405
5/1/2005 4:00	929.411	3.798	929.408
5/1/2005 4:30	929.416	5.065	929.411
5/1/2005 5:00	929.423	6.653	929.415
5/1/2005 6:00	929.442	10.096	929.424
5/1/2005 7:04	929.471	14.181	929.436
5/1/2005 8:00	929.502	17.738	929.447
5/1/2005 9:00	929.543	21.597	929.461
5/1/2005 10:04	929.608	26.483	929.484
5/1/2005 10:10	929.614	26.946	929.486
5/1/2005 11:00	929.697	31.904	929.512
5/1/2005 12:00	929.950	44.011	929.601
5/1/2005 13:00	931.056	78.682	929.992
5/1/2005 14:04	931.522	88.662	930.118
5/1/2005 15:00	931.707	92.438	930.183
5/1/2005 16:00	931.830	94.543	930.235
5/1/2005 17:04	931.912	95.638	930.279
5/1/2005 18:00	931.956	96.016	930.310
5/1/2005 19:00	931.988	96.064	930.338
5/1/2005 20:04	932.007	95.814	930.365
5/1/2005 21:00	932.014	95.413	930.384
5/1/2005 22:00	932.013	94.804	930.402
5/1/2005 23:04	932.003	93.961	930.419
5/1/2005 23:54	931.990	93.200	930.431
5/2/2005 0:00	931.988	93.119	930.432
5/2/2005 1:04	931.964	91.984	930.444
5/2/2005 2:00	931.938	90.904	930.453
5/2/2005 3:00	931.905	89.623	930.461
5/2/2005 4:04	931.866	88.117	930.469
5/2/2005 5:00	931.831	86.767	930.476
5/2/2005 6:00	931.791	85.239	930.483
5/2/2005 8:00	931.710	82.080	930.495

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
929.415	-1.134	929.415	0.016	0.016
929.416	-0.136	929.415	0.017	0.016
929.416	0.806	929.415	0.017	0.017
929.415	1.103	929.415	0.017	0.017
929.415	0.849	929.415	0.017	0.017
929.415	0.413	929.415	0.017	0.017
929.417	0.756	929.417	0.017	0.017
929.418	0.570	929.418	0.017	0.017
929.421	1.715	929.420	0.018	0.017
929.423	2.546	929.422	0.017	0.017
929.428	3.598	929.425	0.017	0.017
929.433	5.033	929.429	0.017	0.018
929.440	6.538	929.432	0.017	0.017
929.459	9.933	929.441	0.017	0.017
929.488	13.928	929.453	0.017	0.017
929.519	17.410	929.464	0.017	0.017
929.560	21.190	929.478	0.017	0.017
929.625	26.175	929.501	0.017	0.017
929.631	26.652	929.503	0.017	0.017
929.712	31.995	929.529	0.015	0.017
929.962	44.388	929.618	0.012	0.017
931.062	76.495	930.008	0.006	0.016
931.527	87.878	930.134	0.005	0.016
931.712	91.509	930.199	0.005	0.016
931.835	93.480	930.251	0.005	0.016
931.917	94.458	930.295	0.005	0.016
931.962	94.751	930.326	0.006	0.016
931.994	94.718	930.354	0.006	0.016
932.014	94.381	930.381	0.007	0.016
932.022	94.036	930.400	0.008	0.016
932.021	93.490	930.418	0.008	0.016
932.012	92.715	930.435	0.009	0.016
931.999	92.004	930.446	0.009	0.015
931.997	91.929	930.448	0.009	0.016
931.974	90.856	930.460	0.010	0.016
931.948	89.829	930.468	0.010	0.015
931.916	88.603	930.477	0.011	0.016
931.878	87.157	930.485	0.012	0.016
931.844	85.858	930.491	0.013	0.015
931.804	84.386	930.498	0.013	0.015
931.724	81.339	930.510	0.014	0.015

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
929.714	42.66	929.379	0.315	-0.020
929.697	41.526	929.38	0.298	-0.019
929.68	40.393	929.38	0.281	-0.018
929.663	39.247	929.379	0.265	-0.019
929.646	38.032	929.379	0.248	-0.019
929.629	36.775	929.379	0.231	-0.019
929.53	28.5	929.381	0.130	-0.019
929.443	18.46	929.382	0.042	-0.019
929.381	-4.93	929.385	-0.022	-0.018
929.386	-2.382	929.387	-0.020	-0.018
929.39	0.149	929.39	-0.021	-0.018
929.394	2.289	929.393	-0.022	-0.018
929.399	3.327	929.397	-0.024	-0.018
929.413	6.145	929.406	-0.029	-0.018
929.436	9.9	929.418	-0.035	-0.018
929.458	12.656	929.429	-0.044	-0.018
929.485	15.197	929.443	-0.058	-0.018
929.532	18.94	929.466	-0.076	-0.018
929.537	19.357	929.468	-0.077	-0.018
929.601	24.177	929.494	-0.096	-0.018
929.838	37.885	929.584	-0.112	-0.017
930.973	74.301	929.975	-0.083	-0.017
931.403	84.825	930.102	-0.119	-0.016
931.552	87.437	930.167	-0.155	-0.016
931.634	88.229	930.22	-0.196	-0.015
931.67	87.855	930.264	-0.242	-0.015
931.676	86.955	930.296	-0.280	-0.014
931.665	85.563	930.325	-0.323	-0.013
931.638	83.686	930.352	-0.369	-0.013
931.604	81.841	930.371	-0.410	-0.013
931.558	79.624	930.39	-0.455	-0.012
931.498	76.939	930.408	-0.505	-0.011
931.445	74.641	930.419	-0.545	-0.012
931.44	74.401	930.42	-0.548	-0.012
931.363	71.06	930.433	-0.601	-0.011
931.318	69.092	930.439	-0.620	-0.014
931.237	65.442	930.448	-0.668	-0.013
931.144	61.076	930.457	-0.722	-0.012
931.063	57.048	930.464	-0.768	-0.012
930.974	52.31	930.47	-0.817	-0.013
930.805	41.808	930.483	-0.905	-0.012

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/2/2005 9:00	931.668	80.459	930.501
5/2/2005 10:04	931.623	78.667	930.506
5/2/2005 11:00	931.585	77.125	930.511
5/2/2005 12:00	931.543	75.417	930.516
5/2/2005 13:00	931.501	73.679	930.520
5/2/2005 14:04	931.455	71.760	930.524
5/2/2005 15:00	931.416	70.104	930.528
5/2/2005 16:00	931.374	68.261	930.531
5/2/2005 17:04	931.328	66.221	930.535
5/2/2005 18:00	931.289	64.456	930.538
5/2/2005 19:00	931.248	62.487	930.541
5/2/2005 20:04	931.203	60.304	930.544
5/2/2005 21:00	931.165	58.412	930.547
5/2/2005 22:00	931.124	56.305	930.549
5/2/2005 23:04	931.080	53.967	930.552
5/3/2005 0:00	931.044	51.943	930.555
5/3/2005 1:00	931.005	49.688	930.557
5/3/2005 2:05	930.963	47.186	930.560
5/3/2005 3:00	930.929	45.023	930.561
5/3/2005 4:00	930.893	42.612	930.564
5/3/2005 5:05	930.855	39.955	930.565
5/3/2005 6:00	930.824	37.811	930.565
5/3/2005 7:00	930.792	35.519	930.563
5/3/2005 8:05	930.758	32.951	930.561
5/3/2005 9:00	930.731	30.764	930.560
5/3/2005 10:00	930.703	28.032	930.562
5/3/2005 11:05	930.676	24.801	930.565
5/3/2005 12:00	930.655	22.026	930.568
5/3/2005 13:00	930.634	18.958	930.570
5/3/2005 15:00	930.602	12.620	930.574
5/3/2005 16:00	930.591	9.318	930.576
5/3/2005 17:05	930.583	5.558	930.577
5/3/2005 18:00	930.579	1.939	930.578
5/3/2005 19:00	930.579	-1.226	930.580
5/3/2005 21:00	930.576	2.224	930.576
5/3/2005 23:05	930.572	1.885	930.571
5/4/2005 0:00	930.571	-1.987	930.572
5/4/2005 1:00	930.572	-2.113	930.573
5/4/2005 3:00	930.576	-1.534	930.576
5/4/2005 4:00	930.577	-1.376	930.578

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
931.684	79.773	930.516	0.016	0.015
931.639	78.041	930.522	0.016	0.016
931.602	76.551	930.526	0.017	0.015
931.560	74.897	930.531	0.017	0.015
931.519	73.214	930.535	0.018	0.015
931.474	71.355	930.539	0.019	0.015
931.436	69.749	930.543	0.020	0.015
931.394	67.963	930.546	0.020	0.015
931.349	65.985	930.550	0.021	0.015
931.311	64.273	930.553	0.022	0.015
931.270	62.364	930.556	0.022	0.015
931.225	60.246	930.559	0.022	0.015
931.188	58.412	930.562	0.023	0.015
931.148	56.368	930.565	0.024	0.016
931.105	54.101	930.567	0.025	0.015
931.069	52.138	930.570	0.025	0.015
931.030	49.952	930.572	0.025	0.015
930.989	47.526	930.575	0.026	0.015
930.955	45.428	930.576	0.026	0.015
930.919	43.091	930.578	0.026	0.014
930.882	40.608	930.579	0.027	0.014
930.851	38.613	930.577	0.027	0.012
930.818	36.333	930.576	0.026	0.013
930.784	33.788	930.575	0.026	0.014
930.757	31.403	930.576	0.026	0.016
930.729	28.665	930.578	0.026	0.016
930.701	25.609	930.581	0.025	0.016
930.680	22.977	930.583	0.025	0.015
930.659	20.041	930.585	0.025	0.015
930.625	13.992	930.589	0.023	0.015
930.612	10.868	930.591	0.021	0.015
930.602	7.376	930.592	0.019	0.015
930.597	4.260	930.594	0.018	0.016
930.594	2.366	930.593	0.015	0.013
930.589	2.359	930.588	0.013	0.012
930.585	0.910	930.585	0.013	0.014
930.586	-0.525	930.586	0.015	0.014
930.588	-1.897	930.589	0.016	0.016
930.591	-1.480	930.592	0.015	0.016
930.593	-1.234	930.593	0.016	0.015

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.728	36.013	930.489	-0.940	-0.012
930.652	29.254	930.495	-0.971	-0.011
930.597	23.068	930.5	-0.988	-0.011
930.549	15.591	930.504	-0.994	-0.012
930.516	6.516	930.508	-0.985	-0.012
930.508	-5.13	930.512	-0.947	-0.012
930.508	-6.387	930.516	-0.908	-0.012
930.511	-6.422	930.519	-0.863	-0.012
930.516	-5.711	930.522	-0.812	-0.013
930.521	-4.832	930.525	-0.768	-0.013
930.525	-3.791	930.528	-0.723	-0.013
930.529	-2.787	930.531	-0.674	-0.013
930.532	-2.211	930.533	-0.633	-0.014
930.535	-1.803	930.536	-0.589	-0.013
930.538	-1.542	930.538	-0.542	-0.014
930.54	-1.35	930.54	-0.504	-0.015
930.542	-1.169	930.542	-0.463	-0.015
930.545	-1.041	930.545	-0.418	-0.015
930.547	-0.953	930.547	-0.382	-0.014
930.548	-0.851	930.549	-0.345	-0.015
930.55	-0.758	930.55	-0.305	-0.015
930.552	-0.468	930.552	-0.272	-0.013
930.551	1.674	930.551	-0.241	-0.012
930.549	2.07	930.549	-0.209	-0.012
930.548	2.015	930.547	-0.183	-0.013
930.546	1.165	930.546	-0.157	-0.016
930.548	-1.373	930.548	-0.128	-0.017
930.55	-1.841	930.551	-0.105	-0.017
930.553	-1.724	930.553	-0.081	-0.017
930.557	-1.22	930.557	-0.045	-0.017
930.559	-0.93	930.559	-0.032	-0.017
930.56	-0.691	930.561	-0.023	-0.016
930.562	-0.37	930.562	-0.017	-0.016
930.563	-0.241	930.563	-0.016	-0.017
930.564	1.237	930.563	-0.012	-0.013
930.559	2.49	930.558	-0.013	-0.013
930.557	2.023	930.556	-0.014	-0.016
930.556	-1.936	930.556	-0.016	-0.017
930.559	-1.573	930.559	-0.017	-0.017
930.561	-1.302	930.561	-0.016	-0.017

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/4/2005 5:05	930.579	-1.185	930.579
5/4/2005 6:00	930.580	-1.029	930.580
5/4/2005 7:00	930.581	-0.828	930.581
5/4/2005 8:05	930.582	-0.612	930.582
5/4/2005 9:00	930.581	1.213	930.581
5/4/2005 10:00	930.579	2.867	930.577
5/4/2005 18:00	930.576	-0.764	930.576
5/4/2005 19:00	930.577	-0.522	930.577
5/4/2005 20:05	930.578	-0.335	930.578
5/4/2005 21:00	930.578	-0.316	930.578
5/4/2005 22:00	930.577	0.994	930.577
5/5/2005 0:00	930.571	2.955	930.570
5/5/2005 1:04	930.568	2.644	930.567
5/5/2005 2:00	930.566	1.874	930.565
5/5/2005 3:00	930.566	0.796	930.566
5/5/2005 5:00	930.568	-1.252	930.569
5/5/2005 6:00	930.569	-0.941	930.570
5/5/2005 7:04	930.570	-0.692	930.570
5/5/2005 8:00	930.571	-0.217	930.571
5/5/2005 9:00	930.571	0.006	930.571
5/5/2005 10:04	930.571	2.109	930.570
5/5/2005 11:00	930.569	2.257	930.568
5/5/2005 12:00	930.566	2.720	930.565
5/5/2005 13:04	930.563	2.842	930.562
5/5/2005 14:00	930.560	2.686	930.559
5/5/2005 15:00	930.558	1.505	930.558
5/5/2005 16:04	930.558	-1.575	930.559
5/5/2005 17:00	930.560	-0.917	930.560
5/5/2005 18:00	930.561	-0.915	930.561
5/5/2005 19:04	930.562	-0.800	930.562
5/5/2005 20:00	930.562	-0.813	930.562
5/5/2005 21:00	930.562	-0.594	930.562
5/5/2005 22:04	930.563	-0.317	930.563
5/5/2005 23:00	930.562	2.859	930.561
5/6/2005 0:00	930.560	2.951	930.558
5/6/2005 1:04	930.557	2.963	930.555
5/6/2005 2:00	930.554	2.862	930.552
5/6/2005 3:00	930.551	2.557	930.549
5/6/2005 4:04	930.549	-1.090	930.549
5/6/2005 5:00	930.549	-1.649	930.549

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.594	-1.014	930.594	0.015	0.015
930.595	-0.841	930.595	0.015	0.015
930.596	-0.708	930.596	0.015	0.015
930.595	2.410	930.595	0.013	0.013
930.594	2.732	930.592	0.013	0.011
930.591	2.572	930.590	0.012	0.013
930.591	-0.734	930.591	0.015	0.015
930.592	-0.681	930.592	0.015	0.015
930.592	-0.561	930.593	0.014	0.015
930.591	1.542	930.591	0.013	0.013
930.589	3.012	930.588	0.012	0.011
930.583	2.684	930.582	0.012	0.012
930.581	1.994	930.580	0.013	0.013
930.580	0.343	930.580	0.014	0.015
930.581	-1.734	930.582	0.015	0.016
930.584	-0.775	930.584	0.016	0.015
930.584	-0.459	930.585	0.015	0.015
930.585	-0.244	930.585	0.015	0.015
930.586	-0.292	930.586	0.015	0.015
930.586	-0.332	930.586	0.015	0.015
930.584	2.269	930.583	0.013	0.013
930.581	2.776	930.580	0.012	0.012
930.578	3.015	930.576	0.012	0.011
930.575	2.735	930.574	0.012	0.012
930.573	1.993	930.572	0.013	0.013
930.572	-0.444	930.573	0.014	0.015
930.574	-0.970	930.574	0.016	0.015
930.575	-1.052	930.575	0.015	0.015
930.576	-0.952	930.576	0.015	0.015
930.576	-0.801	930.577	0.014	0.015
930.577	-0.349	930.577	0.015	0.015
930.577	0.200	930.577	0.015	0.015
930.576	2.702	930.575	0.013	0.012
930.574	2.992	930.573	0.012	0.012
930.571	2.937	930.570	0.011	0.012
930.568	2.889	930.566	0.011	0.011
930.565	2.585	930.564	0.011	0.012
930.563	-0.658	930.563	0.012	0.014
930.563	-1.721	930.564	0.014	0.015
930.565	-0.525	930.565	0.016	0.016

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.562	-1.037	930.563	-0.017	-0.016
930.564	-0.896	930.564	-0.016	-0.016
930.565	-0.714	930.565	-0.016	-0.016
930.566	-0.529	930.566	-0.016	-0.016
930.566	-0.209	930.566	-0.015	-0.015
930.566	1.927	930.565	-0.013	-0.012
930.56	-1.191	930.56	-0.016	-0.016
930.561	-0.872	930.561	-0.016	-0.016
930.561	-0.647	930.562	-0.017	-0.016
930.562	-0.587	930.562	-0.016	-0.016
930.563	-0.544	930.563	-0.014	-0.014
930.559	2.786	930.558	-0.012	-0.012
930.556	2.534	930.555	-0.012	-0.012
930.553	1.983	930.552	-0.013	-0.013
930.551	1.087	930.55	-0.015	-0.016
930.551	-2.107	930.552	-0.017	-0.017
930.552	-1.654	930.553	-0.017	-0.017
930.554	-1.242	930.554	-0.016	-0.016
930.555	-0.916	930.555	-0.016	-0.016
930.555	-0.757	930.555	-0.016	-0.016
930.556	-0.599	930.556	-0.015	-0.014
930.556	-0.645	930.556	-0.013	-0.012
930.555	0.765	930.554	-0.011	-0.011
930.551	2.445	930.55	-0.012	-0.012
930.549	2.495	930.547	-0.011	-0.012
930.545	1.974	930.545	-0.013	-0.013
930.543	0.892	930.543	-0.015	-0.016
930.543	-0.582	930.543	-0.017	-0.017
930.544	-2.009	930.544	-0.017	-0.017
930.545	-1.705	930.545	-0.017	-0.017
930.546	-1.303	930.546	-0.016	-0.016
930.546	-0.928	930.546	-0.016	-0.016
930.547	-0.662	930.547	-0.016	-0.016
930.547	-0.488	930.547	-0.015	-0.014
930.547	-0.408	930.547	-0.013	-0.011
930.545	1.408	930.545	-0.012	-0.010
930.542	2.368	930.541	-0.012	-0.011
930.539	2.404	930.538	-0.012	-0.011
930.536	1.888	930.535	-0.013	-0.014
930.533	0.885	930.533	-0.016	-0.016

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/6/2005 6:00	930.550	-0.451	930.550
5/6/2005 7:04	930.551	-0.199	930.551
5/6/2005 8:00	930.552	-0.425	930.552
5/6/2005 9:00	930.552	-0.561	930.552
5/6/2005 10:04	930.552	-0.540	930.552
5/6/2005 11:00	930.552	-0.528	930.552
5/6/2005 12:00	930.551	2.110	930.551
5/6/2005 13:04	930.548	3.201	930.547
5/6/2005 14:00	930.546	3.130	930.544
5/6/2005 15:00	930.542	2.933	930.541
5/6/2005 16:04	930.539	2.417	930.538
5/6/2005 17:00	930.538	-0.725	930.538
5/6/2005 18:00	930.538	-1.668	930.538
5/6/2005 19:04	930.539	-0.796	930.539
5/6/2005 20:00	930.540	0.070	930.540
5/6/2005 21:00	930.540	0.170	930.540
5/6/2005 22:04	930.540	0.271	930.540
5/6/2005 23:00	930.540	-0.225	930.540
5/7/2005 0:00	930.540	-0.370	930.540
5/7/2005 0:05	930.540	-0.184	930.540
5/7/2005 0:10	930.540	0.090	930.540
5/7/2005 1:04	930.539	1.435	930.538
5/7/2005 2:00	930.536	3.167	930.534
5/7/2005 3:00	930.533	3.261	930.531
5/7/2005 4:04	930.529	3.039	930.528
5/7/2005 5:00	930.526	2.458	930.525
5/7/2005 6:00	930.525	0.454	930.525
5/7/2005 7:04	930.526	-1.319	930.526
5/7/2005 8:00	930.526	-0.910	930.526
5/7/2005 9:00	930.527	-0.039	930.527
5/7/2005 11:00	930.527	0.560	930.527
5/7/2005 12:00	930.527	0.428	930.527
5/7/2005 13:04	930.527	0.478	930.527
5/7/2005 14:00	930.525	1.896	930.524
5/7/2005 15:00	930.522	2.888	930.521
5/7/2005 16:04	930.518	3.059	930.517
5/7/2005 17:00	930.516	2.884	930.514
5/7/2005 18:00	930.513	2.195	930.512
5/7/2005 19:04	930.512	1.472	930.512
5/7/2005 20:00	930.513	-1.307	930.513

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.565	-0.332	930.565	0.015	0.015
930.566	-0.236	930.566	0.015	0.015
930.566	-0.540	930.566	0.014	0.014
930.567	-0.650	930.567	0.015	0.015
930.567	-0.541	930.567	0.015	0.015
930.565	1.660	930.565	0.013	0.013
930.563	3.213	930.561	0.012	0.010
930.559	3.267	930.557	0.011	0.010
930.556	3.014	930.555	0.010	0.011
930.553	2.453	930.552	0.011	0.011
930.552	1.047	930.552	0.013	0.014
930.553	-1.589	930.553	0.015	0.015
930.553	-0.866	930.554	0.015	0.016
930.554	-0.403	930.554	0.015	0.015
930.555	0.252	930.555	0.015	0.015
930.555	0.287	930.555	0.015	0.015
930.555	0.358	930.555	0.015	0.015
930.555	-0.144	930.555	0.015	0.015
930.553	1.830	930.552	0.013	0.012
930.553	2.125	930.552	0.013	0.012
930.553	2.418	930.551	0.013	0.011
930.550	2.964	930.548	0.011	0.010
930.547	3.270	930.545	0.011	0.011
930.543	3.077	930.542	0.010	0.011
930.540	2.384	930.539	0.011	0.011
930.539	1.253	930.539	0.013	0.014
930.540	-1.036	930.540	0.015	0.015
930.541	-0.894	930.541	0.015	0.015
930.541	-0.759	930.541	0.015	0.015
930.541	-0.069	930.542	0.014	0.015
930.542	0.673	930.541	0.015	0.014
930.541	2.672	930.540	0.014	0.013
930.538	3.016	930.537	0.011	0.010
930.535	2.991	930.534	0.010	0.010
930.532	3.114	930.530	0.010	0.009
930.528	2.865	930.527	0.010	0.010
930.526	2.257	930.525	0.010	0.011
930.525	0.017	930.525	0.012	0.013
930.526	-0.050	930.526	0.014	0.014
930.527	-0.550	930.527	0.014	0.014

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.533	-0.698	930.533	-0.017	-0.017
930.534	-1.791	930.535	-0.017	-0.016
930.535	-1.653	930.536	-0.017	-0.016
930.536	-1.311	930.536	-0.016	-0.016
930.536	-1.028	930.536	-0.016	-0.016
930.537	-0.636	930.537	-0.015	-0.015
930.537	-0.392	930.537	-0.014	-0.014
930.537	0.113	930.536	-0.011	-0.011
930.535	1.473	930.534	-0.011	-0.010
930.531	2.259	930.53	-0.011	-0.011
930.528	2.229	930.527	-0.011	-0.011
930.525	1.785	930.524	-0.013	-0.014
930.522	0.253	930.522	-0.016	-0.016
930.522	-1.273	930.523	-0.017	-0.016
930.523	-1.754	930.524	-0.017	-0.016
930.524	-1.563	930.525	-0.016	-0.015
930.525	-1.268	930.525	-0.015	-0.015
930.525	-0.962	930.525	-0.015	-0.015
930.525	-0.628	930.526	-0.015	-0.014
930.525	-0.714	930.526	-0.015	-0.014
930.525	-0.795	930.526	-0.015	-0.014
930.525	-0.364	930.526	-0.014	-0.012
930.525	0.143	930.525	-0.011	-0.009
930.523	1.76	930.522	-0.010	-0.009
930.519	2.039	930.519	-0.010	-0.009
930.516	2.075	930.516	-0.010	-0.009
930.513	1.624	930.513	-0.012	-0.012
930.511	0.457	930.511	-0.015	-0.015
930.511	-0.957	930.511	-0.015	-0.015
930.512	-1.852	930.513	-0.015	-0.014
930.514	-1.316	930.514	-0.013	-0.013
930.514	-1.015	930.514	-0.013	-0.013
930.514	-0.754	930.515	-0.013	-0.012
930.515	-0.402	930.515	-0.010	-0.009
930.514	2.305	930.513	-0.008	-0.008
930.512	2.437	930.511	-0.006	-0.006
930.509	1.966	930.508	-0.007	-0.006
930.505	1.86	930.505	-0.008	-0.007
930.502	1.335	930.502	-0.010	-0.010
930.5	0.353	930.5	-0.013	-0.013

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/7/2005 21:00	930.513	-1.061	930.514
5/7/2005 22:04	930.514	-0.872	930.514
5/7/2005 23:00	930.514	-0.007	930.514
5/8/2005 0:00	930.514	0.430	930.515
5/8/2005 1:04	930.515	0.570	930.515
5/8/2005 2:00	930.514	2.399	930.513
5/8/2005 3:00	930.512	2.584	930.511
5/8/2005 4:04	930.509	2.734	930.507
5/8/2005 5:00	930.506	2.848	930.504
5/8/2005 6:00	930.503	2.658	930.501
5/8/2005 7:04	930.500	1.811	930.499
5/8/2005 8:00	930.500	1.506	930.499
5/8/2005 9:00	930.501	-0.994	930.501
5/8/2005 10:04	930.502	-0.765	930.502
5/8/2005 11:00	930.502	-0.759	930.502
5/8/2005 12:00	930.502	-0.545	930.502
5/8/2005 13:04	930.502	-0.265	930.503
5/8/2005 14:00	930.502	0.512	930.503
5/8/2005 15:00	930.501	1.495	930.501
5/8/2005 16:04	930.498	2.940	930.497
5/8/2005 17:00	930.496	2.909	930.494
5/8/2005 18:00	930.492	2.688	930.491
5/8/2005 19:04	930.489	2.228	930.488
5/8/2005 20:00	930.487	1.490	930.487
5/8/2005 21:00	930.487	-0.051	930.487
5/8/2005 22:04	930.488	-0.392	930.488
5/8/2005 23:00	930.489	-0.332	930.489
5/9/2005 0:00	930.489	-0.402	930.489
5/9/2005 1:00	930.490	-0.440	930.490
5/9/2005 2:04	930.490	-0.413	930.490
5/9/2005 3:00	930.489	0.337	930.489
5/9/2005 4:00	930.487	2.142	930.487
5/9/2005 5:04	930.484	2.617	930.483
5/9/2005 6:00	930.481	2.867	930.480
5/9/2005 7:00	930.478	2.731	930.477
5/9/2005 8:04	930.475	2.239	930.474
5/9/2005 9:00	930.474	-0.879	930.474
5/9/2005 10:00	930.474	-1.535	930.474
5/9/2005 11:04	930.475	-0.268	930.475
5/9/2005 12:00	930.475	-0.271	930.475

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.527	-0.712	930.527	0.014	0.013
930.527	-0.634	930.527	0.013	0.013
930.527	-0.161	930.527	0.013	0.013
930.527	0.387	930.527	0.013	0.012
930.525	1.861	930.525	0.010	0.010
930.523	3.243	930.521	0.009	0.008
930.520	3.117	930.518	0.008	0.007
930.516	2.935	930.514	0.007	0.007
930.513	2.499	930.512	0.007	0.008
930.511	0.247	930.511	0.008	0.010
930.511	-1.659	930.511	0.011	0.012
930.512	-0.113	930.512	0.012	0.013
930.513	-0.060	930.513	0.012	0.012
930.513	-0.085	930.513	0.011	0.011
930.513	-0.474	930.513	0.011	0.011
930.513	-0.533	930.513	0.011	0.011
930.513	0.743	930.512	0.011	0.009
930.511	2.107	930.510	0.009	0.007
930.508	2.781	930.507	0.007	0.006
930.504	2.976	930.503	0.006	0.006
930.502	2.843	930.500	0.006	0.006
930.499	2.301	930.498	0.007	0.007
930.498	-0.424	930.497	0.009	0.009
930.498	-1.645	930.498	0.011	0.011
930.499	-0.685	930.499	0.012	0.012
930.499	-0.280	930.499	0.011	0.011
930.500	0.187	930.500	0.011	0.011
930.500	0.352	930.500	0.011	0.011
930.500	0.347	930.500	0.010	0.010
930.498	1.496	930.498	0.008	0.008
930.496	2.929	930.495	0.007	0.006
930.493	2.820	930.492	0.006	0.005
930.490	2.733	930.488	0.006	0.005
930.487	2.454	930.486	0.006	0.006
930.484	1.921	930.484	0.006	0.007
930.484	1.319	930.483	0.009	0.009
930.484	-0.955	930.485	0.010	0.011
930.485	-0.679	930.485	0.011	0.011
930.485	-0.305	930.485	0.010	0.010
930.485	0.229	930.485	0.010	0.010

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.5	-1.06	930.501	-0.013	-0.013
930.502	-1.589	930.502	-0.012	-0.012
930.503	-1.533	930.503	-0.011	-0.011
930.503	-1.269	930.503	-0.011	-0.012
930.504	-1.048	930.504	-0.011	-0.011
930.504	-0.779	930.504	-0.010	-0.009
930.504	-0.441	930.504	-0.008	-0.007
930.503	1.883	930.502	-0.006	-0.005
930.501	2.559	930.499	-0.005	-0.005
930.497	1.992	930.497	-0.006	-0.004
930.494	1.669	930.493	-0.006	-0.006
930.491	1.19	930.491	-0.009	-0.008
930.489	0.172	930.489	-0.012	-0.012
930.49	-1.634	930.49	-0.012	-0.012
930.491	-1.495	930.491	-0.011	-0.011
930.491	-1.314	930.492	-0.011	-0.010
930.492	-1.059	930.492	-0.010	-0.011
930.492	-0.962	930.492	-0.010	-0.011
930.492	-0.871	930.493	-0.009	-0.008
930.493	-0.67	930.493	-0.005	-0.004
930.491	0.397	930.491	-0.005	-0.003
930.488	2.227	930.487	-0.004	-0.004
930.485	2.175	930.484	-0.004	-0.004
930.482	1.793	930.481	-0.005	-0.006
930.479	1.015	930.479	-0.008	-0.008
930.477	-2.167	930.478	-0.011	-0.010
930.477	-1.935	930.478	-0.012	-0.011
930.479	-1.453	930.479	-0.010	-0.010
930.479	-1.116	930.479	-0.011	-0.011
930.48	-0.794	930.48	-0.010	-0.010
930.48	-0.753	930.48	-0.009	-0.009
930.48	-0.622	930.48	-0.007	-0.007
930.479	2.442	930.478	-0.005	-0.005
930.477	2.062	930.476	-0.004	-0.004
930.474	1.852	930.473	-0.004	-0.004
930.47	1.8	930.469	-0.005	-0.005
930.467	1.64	930.467	-0.007	-0.007
930.465	1.064	930.464	-0.009	-0.010
930.464	-1.547	930.464	-0.011	-0.011
930.464	-1.981	930.464	-0.011	-0.011

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/9/2005 13:00	930.475	-0.221	930.475
5/9/2005 14:04	930.476	-0.119	930.475
5/9/2005 15:00	930.475	-0.178	930.475
5/9/2005 16:00	930.474	2.473	930.473
5/9/2005 17:04	930.472	2.988	930.470
5/9/2005 18:00	930.469	2.732	930.468
5/9/2005 19:00	930.466	2.689	930.464
5/9/2005 20:04	930.462	2.489	930.461
5/9/2005 21:00	930.460	2.123	930.459
5/9/2005 22:00	930.459	-0.746	930.459
5/9/2005 23:04	930.459	-1.281	930.459
5/10/2005 0:00	930.459	-0.068	930.460
5/10/2005 1:00	930.460	0.263	930.460
5/10/2005 2:04	930.460	0.380	930.460
5/10/2005 3:00	930.460	0.083	930.460
5/10/2005 4:00	930.460	-0.152	930.460
5/10/2005 5:04	930.458	1.172	930.458
5/10/2005 6:00	930.456	2.932	930.454
5/10/2005 7:00	930.453	2.920	930.451
5/10/2005 8:04	930.449	2.780	930.448
5/10/2005 9:00	930.446	2.480	930.445
5/10/2005 10:00	930.444	1.943	930.443
5/10/2005 11:04	930.443	1.447	930.443
5/10/2005 12:00	930.443	-1.082	930.444
5/10/2005 13:00	930.444	-0.757	930.444
5/10/2005 14:04	930.444	-0.122	930.444
5/10/2005 15:00	930.444	0.547	930.444
5/10/2005 16:00	930.444	0.652	930.444
5/10/2005 17:04	930.444	0.698	930.444
5/10/2005 18:00	930.442	1.455	930.442
5/10/2005 19:00	930.439	2.721	930.438
5/10/2005 20:04	930.435	2.897	930.434
5/10/2005 21:00	930.432	2.804	930.431
5/10/2005 22:00	930.429	2.482	930.428
5/10/2005 23:04	930.427	1.822	930.426
5/11/2005 0:00	930.426	1.508	930.426
5/11/2005 1:00	930.427	-0.929	930.427
5/11/2005 2:04	930.427	-0.808	930.427
5/11/2005 3:00	930.427	-0.275	930.427
5/11/2005 4:00	930.427	0.384	930.427

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.485	0.441	930.485	0.010	0.010
930.485	0.503	930.485	0.009	0.010
930.484	1.639	930.483	0.009	0.008
930.481	2.688	930.479	0.007	0.006
930.477	2.875	930.476	0.005	0.006
930.474	2.791	930.473	0.005	0.005
930.471	2.421	930.470	0.005	0.006
930.469	1.247	930.469	0.007	0.008
930.469	0.096	930.469	0.009	0.010
930.470	-0.476	930.470	0.011	0.011
930.470	-0.551	930.470	0.011	0.011
930.471	-0.708	930.471	0.012	0.011
930.471	-0.138	930.471	0.011	0.011
930.470	0.181	930.470	0.010	0.010
930.470	2.673	930.469	0.010	0.009
930.468	2.685	930.466	0.008	0.006
930.464	2.695	930.463	0.006	0.005
930.461	2.743	930.460	0.005	0.006
930.458	2.681	930.457	0.005	0.006
930.455	2.272	930.454	0.006	0.006
930.453	-0.119	930.454	0.007	0.009
930.453	-1.211	930.453	0.009	0.010
930.454	0.363	930.454	0.011	0.011
930.454	-0.058	930.454	0.011	0.010
930.455	-0.462	930.455	0.011	0.011
930.455	-0.396	930.455	0.011	0.011
930.454	-0.239	930.454	0.010	0.010
930.453	2.016	930.453	0.009	0.009
930.451	2.976	930.449	0.007	0.005
930.448	2.825	930.446	0.006	0.004
930.444	2.769	930.443	0.005	0.005
930.441	2.574	930.440	0.006	0.006
930.438	2.170	930.438	0.006	0.007
930.437	-1.056	930.437	0.008	0.009
930.437	-1.372	930.437	0.010	0.011
930.437	0.197	930.437	0.011	0.011
930.438	0.587	930.438	0.011	0.011
930.438	0.609	930.438	0.011	0.011
930.438	-0.093	930.438	0.011	0.011
930.438	-0.294	930.438	0.011	0.011

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.465	-1.355	930.465	-0.010	-0.010
930.465	-1.039	930.465	-0.011	-0.010
930.466	-0.868	930.466	-0.009	-0.009
930.466	-0.782	930.466	-0.008	-0.007
930.466	-0.621	930.466	-0.006	-0.004
930.464	1.67	930.464	-0.005	-0.004
930.462	2.473	930.46	-0.004	-0.004
930.458	2.044	930.457	-0.004	-0.004
930.455	1.66	930.454	-0.005	-0.005
930.452	1.341	930.452	-0.007	-0.007
930.449	0.606	930.449	-0.010	-0.010
930.449	-1.247	930.449	-0.010	-0.011
930.449	-1.884	930.449	-0.011	-0.011
930.45	-1.275	930.45	-0.010	-0.010
930.45	-0.885	930.45	-0.010	-0.010
930.45	-0.772	930.45	-0.010	-0.010
930.45	-0.601	930.45	-0.008	-0.008
930.45	-0.585	930.45	-0.006	-0.004
930.448	0.383	930.448	-0.005	-0.003
930.445	2.111	930.444	-0.004	-0.004
930.442	2.077	930.441	-0.004	-0.004
930.439	1.758	930.438	-0.005	-0.005
930.435	1.277	930.435	-0.008	-0.008
930.433	0.476	930.433	-0.010	-0.011
930.433	-0.683	930.433	-0.011	-0.011
930.433	-1.725	930.434	-0.011	-0.010
930.434	-1.275	930.434	-0.010	-0.010
930.434	-0.817	930.434	-0.010	-0.010
930.434	-0.549	930.434	-0.010	-0.010
930.434	-0.484	930.434	-0.008	-0.008
930.434	-0.411	930.434	-0.005	-0.004
930.432	0.725	930.431	-0.003	-0.003
930.428	2.009	930.428	-0.004	-0.003
930.425	2.012	930.424	-0.004	-0.004
930.422	1.719	930.421	-0.005	-0.005
930.419	1.272	930.418	-0.007	-0.008
930.416	0.396	930.416	-0.011	-0.011
930.416	-0.08	930.416	-0.011	-0.011
930.416	-1.802	930.417	-0.011	-0.010
930.416	-1.31	930.417	-0.011	-0.010

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/11/2005 5:04	930.427	0.563	930.427
5/11/2005 6:00	930.427	0.773	930.427
5/11/2005 7:00	930.425	1.804	930.424
5/11/2005 8:04	930.421	2.600	930.420
5/11/2005 9:00	930.418	2.853	930.417
5/11/2005 10:00	930.415	2.787	930.414
5/11/2005 11:04	930.412	2.445	930.411
5/11/2005 12:00	930.409	1.872	930.409
5/11/2005 13:00	930.409	1.551	930.408
5/11/2005 14:04	930.409	-0.560	930.409
5/11/2005 15:00	930.409	-0.969	930.409
5/11/2005 16:00	930.409	-0.358	930.410
5/11/2005 17:04	930.409	0.067	930.410
5/11/2005 18:00	930.409	0.700	930.409
5/11/2005 19:00	930.409	0.810	930.409
5/11/2005 20:04	930.407	2.034	930.406
5/11/2005 21:00	930.404	2.631	930.403
5/11/2005 22:00	930.401	2.821	930.399
5/11/2005 23:04	930.397	2.755	930.396
5/12/2005 0:00	930.394	2.469	930.393
5/12/2005 1:00	930.392	1.930	930.391
5/12/2005 2:04	930.391	1.509	930.390
5/12/2005 3:00	930.391	-1.007	930.391
5/12/2005 4:00	930.391	-0.778	930.391
5/12/2005 5:04	930.391	-0.258	930.391
5/12/2005 6:00	930.391	0.547	930.391
5/12/2005 7:00	930.391	0.723	930.391
5/12/2005 8:04	930.391	0.787	930.390
5/12/2005 9:00	930.389	1.175	930.388
5/12/2005 10:00	930.386	2.741	930.385
5/12/2005 11:04	930.382	2.813	930.381
5/12/2005 12:00	930.379	2.744	930.378
5/12/2005 13:00	930.376	2.469	930.375
5/12/2005 14:04	930.373	1.952	930.372
5/12/2005 15:00	930.372	-1.174	930.372
5/12/2005 16:00	930.372	-1.281	930.372
5/12/2005 17:04	930.372	-0.244	930.372
5/12/2005 18:00	930.372	0.655	930.372
5/12/2005 19:00	930.372	0.632	930.372
5/12/2005 20:04	930.372	0.631	930.372

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.436	1.227	930.436	0.009	0.009
930.433	2.922	930.432	0.006	0.005
930.430	2.903	930.429	0.005	0.005
930.427	2.821	930.425	0.006	0.005
930.424	2.568	930.422	0.006	0.005
930.421	2.064	930.420	0.006	0.006
930.419	-0.399	930.419	0.007	0.008
930.419	-1.391	930.420	0.010	0.011
930.420	0.036	930.420	0.011	0.012
930.420	0.449	930.420	0.011	0.011
930.420	0.612	930.420	0.011	0.011
930.420	0.310	930.420	0.011	0.010
930.420	0.272	930.420	0.011	0.010
930.418	1.234	930.418	0.009	0.009
930.415	2.850	930.414	0.006	0.005
930.412	2.876	930.411	0.005	0.005
930.409	2.799	930.408	0.005	0.005
930.406	2.558	930.405	0.005	0.006
930.403	2.028	930.402	0.006	0.006
930.401	-0.959	930.401	0.007	0.008
930.401	-1.354	930.402	0.009	0.011
930.402	-0.248	930.402	0.011	0.012
930.402	0.650	930.402	0.011	0.011
930.402	0.527	930.402	0.011	0.011
930.402	0.431	930.402	0.011	0.011
930.402	0.016	930.402	0.011	0.011
930.400	1.365	930.400	0.009	0.009
930.397	2.803	930.396	0.006	0.006
930.394	2.809	930.393	0.005	0.005
930.391	2.741	930.390	0.005	0.005
930.388	2.512	930.386	0.006	0.005
930.385	2.096	930.384	0.006	0.006
930.383	-0.294	930.383	0.007	0.008
930.383	-1.296	930.383	0.010	0.011
930.383	0.527	930.383	0.011	0.011
930.383	0.651	930.383	0.011	0.011
930.383	0.437	930.383	0.011	0.011
930.383	-0.223	930.383	0.011	0.011
930.383	-0.145	930.383	0.011	0.011
930.381	1.940	930.381	0.009	0.009

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.417	-0.962	930.417	-0.010	-0.010
930.417	-0.516	930.417	-0.010	-0.010
930.417	-0.329	930.417	-0.008	-0.007
930.416	-0.129	930.416	-0.005	-0.004
930.414	0.262	930.414	-0.004	-0.003
930.411	1.951	930.411	-0.004	-0.004
930.407	1.913	930.407	-0.005	-0.004
930.404	1.721	930.404	-0.005	-0.005
930.401	1.265	930.401	-0.008	-0.007
930.399	0.513	930.399	-0.010	-0.010
930.398	-0.863	930.398	-0.011	-0.011
930.398	-1.838	930.399	-0.011	-0.011
930.399	-1.31	930.399	-0.010	-0.011
930.399	-0.816	930.399	-0.010	-0.010
930.399	-0.581	930.399	-0.010	-0.010
930.399	-0.322	930.399	-0.008	-0.007
930.399	-0.347	930.399	-0.005	-0.004
930.397	0.072	930.397	-0.004	-0.002
930.393	1.945	930.393	-0.004	-0.003
930.39	1.95	930.39	-0.004	-0.003
930.387	1.714	930.386	-0.005	-0.005
930.383	1.273	930.383	-0.008	-0.007
930.381	0.597	930.381	-0.010	-0.010
930.38	-1.76	930.38	-0.011	-0.011
930.38	-1.829	930.381	-0.011	-0.010
930.38	-0.996	930.381	-0.011	-0.010
930.381	-0.601	930.381	-0.010	-0.010
930.381	-0.508	930.381	-0.010	-0.009
930.38	-0.601	930.38	-0.009	-0.008
930.38	-0.556	930.38	-0.006	-0.005
930.378	0.651	930.378	-0.004	-0.003
930.376	2.301	930.375	-0.003	-0.003
930.372	1.832	930.372	-0.004	-0.003
930.369	1.628	930.368	-0.004	-0.004
930.366	1.36	930.365	-0.006	-0.007
930.363	0.808	930.363	-0.009	-0.009
930.361	-1.331	930.362	-0.011	-0.010
930.361	-1.354	930.361	-0.011	-0.011
930.361	-1.019	930.361	-0.011	-0.011
930.362	-0.816	930.362	-0.010	-0.010

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/12/2005 21:00	930.372	0.074	930.371
5/12/2005 22:00	930.370	1.978	930.370
5/12/2005 23:04	930.367	2.845	930.366
5/13/2005 0:00	930.364	2.653	930.363
5/13/2005 1:00	930.361	2.624	930.360
5/13/2005 2:04	930.357	2.489	930.356
5/13/2005 3:00	930.355	2.158	930.354
5/13/2005 4:00	930.352	1.677	930.352
5/13/2005 5:04	930.352	-0.034	930.352
5/13/2005 6:00	930.352	0.520	930.352
5/13/2005 7:00	930.353	-0.116	930.353
5/13/2005 8:04	930.352	-0.278	930.352
5/13/2005 9:00	930.352	-0.413	930.352
5/13/2005 10:00	930.352	0.179	930.352
5/13/2005 11:04	930.351	1.671	930.350
5/13/2005 12:00	930.349	2.082	930.348
5/13/2005 13:00	930.346	2.494	930.345
5/13/2005 14:04	930.342	2.652	930.341
5/13/2005 15:00	930.339	2.665	930.338
5/13/2005 16:00	930.336	2.386	930.335
5/13/2005 17:04	930.333	1.865	930.333
5/13/2005 18:00	930.332	-0.730	930.332
5/13/2005 19:00	930.332	-1.157	930.332
5/13/2005 20:04	930.332	-0.606	930.332
5/13/2005 21:00	930.332	0.440	930.332
5/13/2005 22:00	930.332	0.669	930.332
5/13/2005 23:04	930.332	0.726	930.332
5/14/2005 0:00	930.331	0.430	930.331
5/14/2005 1:00	930.330	2.155	930.329
5/14/2005 2:04	930.327	2.754	930.326
5/14/2005 3:00	930.324	2.508	930.323
5/14/2005 4:00	930.321	2.515	930.320
5/14/2005 5:04	930.317	2.404	930.316
5/14/2005 6:00	930.315	2.192	930.314
5/14/2005 7:00	930.312	1.790	930.312
5/14/2005 8:04	930.311	1.523	930.311
5/14/2005 9:00	930.312	-0.206	930.312
5/14/2005 10:00	930.312	-0.534	930.312
5/14/2005 11:04	930.311	-0.440	930.311
5/14/2005 12:00	930.311	0.088	930.311

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.379	2.787	930.378	0.007	0.007
930.376	2.646	930.375	0.006	0.005
930.372	2.667	930.371	0.005	0.005
930.369	2.587	930.368	0.005	0.005
930.366	2.252	930.365	0.005	0.005
930.364	1.659	930.363	0.007	0.007
930.363	0.969	930.363	0.008	0.009
930.364	0.331	930.364	0.012	0.012
930.364	-0.100	930.364	0.012	0.012
930.364	-0.558	930.364	0.012	0.012
930.364	-0.252	930.364	0.011	0.011
930.363	0.156	930.363	0.011	0.011
930.363	0.984	930.362	0.011	0.010
930.361	2.117	930.360	0.009	0.008
930.357	2.509	930.356	0.006	0.006
930.354	2.710	930.353	0.005	0.005
930.351	2.687	930.349	0.005	0.004
930.347	2.390	930.346	0.005	0.005
930.345	1.946	930.344	0.006	0.006
930.344	-0.429	930.344	0.008	0.009
930.344	-1.036	930.344	0.011	0.011
930.344	-0.396	930.344	0.012	0.012
930.344	0.388	930.344	0.012	0.012
930.344	0.601	930.344	0.012	0.012
930.344	0.679	930.343	0.012	0.011
930.343	0.449	930.343	0.011	0.011
930.341	1.289	930.341	0.009	0.009
930.339	2.755	930.338	0.008	0.007
930.336	2.604	930.335	0.006	0.006
930.332	2.572	930.331	0.005	0.005
930.329	2.449	930.328	0.005	0.005
930.326	2.148	930.325	0.005	0.005
930.323	1.590	930.323	0.006	0.007
930.323	1.241	930.323	0.008	0.009
930.324	0.367	930.323	0.012	0.011
930.323	0.061	930.323	0.012	0.012
930.323	-0.465	930.323	0.011	0.011
930.323	-0.109	930.323	0.011	0.011
930.322	0.181	930.323	0.011	0.012
930.322	0.634	930.322	0.011	0.011

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.362	-0.971	930.362	-0.010	-0.009
930.361	-0.859	930.361	-0.009	-0.009
930.361	-0.679	930.361	-0.006	-0.005
930.36	1.547	930.36	-0.004	-0.003
930.358	1.943	930.357	-0.003	-0.003
930.354	1.634	930.354	-0.003	-0.002
930.351	1.699	930.35	-0.004	-0.004
930.348	1.609	930.347	-0.004	-0.005
930.344	1.164	930.344	-0.008	-0.008
930.342	0.656	930.342	-0.010	-0.010
930.341	-0.537	930.341	-0.012	-0.012
930.342	-1.53	930.342	-0.010	-0.010
930.342	-1.149	930.342	-0.010	-0.010
930.342	-0.737	930.342	-0.010	-0.010
930.342	-0.518	930.342	-0.009	-0.008
930.341	-0.296	930.341	-0.008	-0.007
930.341	-0.158	930.341	-0.005	-0.004
930.339	0.136	930.339	-0.003	-0.002
930.336	2.151	930.335	-0.003	-0.003
930.333	1.784	930.332	-0.003	-0.003
930.329	1.562	930.329	-0.004	-0.004
930.326	1.253	930.326	-0.006	-0.006
930.323	0.788	930.323	-0.009	-0.009
930.321	-0.214	930.321	-0.011	-0.011
930.321	-0.617	930.321	-0.011	-0.011
930.321	-0.908	930.322	-0.011	-0.010
930.322	-0.748	930.322	-0.010	-0.010
930.321	-0.935	930.322	-0.010	-0.009
930.321	-0.787	930.321	-0.009	-0.008
930.321	-0.633	930.321	-0.006	-0.005
930.32	-0.152	930.32	-0.004	-0.003
930.318	0.783	930.318	-0.003	-0.002
930.314	1.595	930.314	-0.003	-0.002
930.311	1.765	930.311	-0.004	-0.003
930.308	1.639	930.308	-0.004	-0.004
930.305	1.261	930.304	-0.006	-0.007
930.302	0.612	930.302	-0.010	-0.010
930.301	-1.847	930.301	-0.011	-0.011
930.3	-1.787	930.301	-0.011	-0.010
930.301	-0.729	930.301	-0.010	-0.010

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/14/2005 13:00	930.311	0.466	930.311
5/14/2005 14:04	930.310	0.649	930.310
5/14/2005 15:00	930.309	1.190	930.308
5/14/2005 16:00	930.306	2.682	930.305
5/14/2005 16:59	930.303	2.580	930.302
5/14/2005 18:00	930.299	2.460	930.298
5/14/2005 19:00	930.296	2.303	930.295
5/14/2005 20:04	930.293	1.928	930.292
5/14/2005 21:00	930.291	1.592	930.290
5/14/2005 22:00	930.290	1.243	930.290
5/14/2005 23:04	930.290	0.738	930.290
5/15/2005 0:00	930.290	-0.023	930.290
5/15/2005 1:00	930.290	-0.304	930.290
5/15/2005 2:04	930.290	-0.142	930.290
5/15/2005 3:00	930.290	0.254	930.290
5/15/2005 4:00	930.289	0.550	930.289
5/15/2005 5:04	930.287	1.195	930.287
5/15/2005 6:00	930.284	2.604	930.283
5/15/2005 7:00	930.281	2.563	930.280
5/15/2005 9:00	930.275	2.248	930.274
5/15/2005 10:00	930.272	1.939	930.271
5/15/2005 11:04	930.269	1.463	930.269
5/15/2005 12:00	930.269	1.437	930.268
5/15/2005 13:00	930.269	0.612	930.269
5/15/2005 14:04	930.269	0.338	930.269
5/15/2005 15:00	930.268	-0.102	930.268
5/15/2005 16:00	930.268	0.112	930.268
5/15/2005 17:04	930.268	0.304	930.268
5/15/2005 18:00	930.267	0.562	930.267
5/15/2005 19:00	930.265	1.444	930.265
5/15/2005 19:59	930.263	2.656	930.262
5/15/2005 21:00	930.260	2.432	930.259
5/15/2005 22:00	930.256	2.290	930.255
5/15/2005 23:04	930.253	2.210	930.252
5/16/2005 0:00	930.250	2.018	930.250
5/16/2005 1:00	930.248	1.694	930.247
5/16/2005 2:04	930.247	1.599	930.246
5/16/2005 3:00	930.247	-0.396	930.247
5/16/2005 4:00	930.246	-0.249	930.246
5/16/2005 5:04	930.246	0.134	930.246

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.320	1.472	930.320	0.009	0.009
930.317	2.477	930.316	0.007	0.006
930.314	2.653	930.313	0.005	0.005
930.310	2.589	930.309	0.004	0.004
930.307	2.358	930.306	0.004	0.004
930.304	1.925	930.304	0.005	0.006
930.302	0.771	930.303	0.006	0.008
930.302	-0.978	930.302	0.009	0.010
930.302	0.649	930.302	0.011	0.012
930.302	0.614	930.302	0.012	0.012
930.302	0.490	930.302	0.012	0.012
930.302	-0.071	930.302	0.012	0.012
930.301	0.098	930.301	0.011	0.011
930.301	1.334	930.300	0.011	0.010
930.299	1.905	930.298	0.009	0.008
930.295	2.369	930.294	0.006	0.005
930.292	2.524	930.291	0.005	0.004
930.289	2.559	930.288	0.005	0.005
930.286	2.336	930.285	0.005	0.005
930.281	0.151	930.281	0.006	0.007
930.280	-0.875	930.281	0.008	0.010
930.281	0.233	930.281	0.012	0.012
930.281	0.580	930.281	0.012	0.013
930.281	0.420	930.281	0.012	0.012
930.280	0.391	930.280	0.011	0.011
930.280	0.227	930.280	0.012	0.012
930.279	0.423	930.279	0.011	0.011
930.277	2.006	930.276	0.009	0.008
930.274	2.325	930.273	0.007	0.006
930.271	2.512	930.270	0.006	0.005
930.268	2.508	930.266	0.005	0.004
930.264	2.301	930.263	0.004	0.004
930.262	1.878	930.261	0.006	0.006
930.259	0.666	930.259	0.006	0.007
930.259	0.113	930.259	0.009	0.009
930.259	0.595	930.259	0.011	0.012
930.259	0.418	930.259	0.012	0.013
930.259	0.187	930.259	0.012	0.012
930.258	0.189	930.258	0.012	0.012
930.258	0.326	930.258	0.012	0.012

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.301	-0.569	930.301	-0.010	-0.010
930.301	-0.53	930.301	-0.009	-0.009
930.3	-0.624	930.3	-0.009	-0.008
930.3	-0.584	930.3	-0.006	-0.005
930.299	0.159	930.299	-0.004	-0.003
930.297	1.547	930.296	-0.002	-0.002
930.293	1.457	930.293	-0.003	-0.002
930.29	1.554	930.289	-0.003	-0.003
930.287	1.624	930.286	-0.004	-0.004
930.284	1.291	930.283	-0.006	-0.007
930.281	0.783	930.281	-0.009	-0.009
930.28	-1.862	930.28	-0.010	-0.010
930.279	-1.762	930.28	-0.011	-0.010
930.28	-0.745	930.28	-0.010	-0.010
930.28	-0.585	930.28	-0.010	-0.010
930.279	-0.569	930.279	-0.010	-0.010
930.279	-0.423	930.279	-0.008	-0.008
930.279	-0.489	930.279	-0.005	-0.004
930.278	-0.252	930.278	-0.003	-0.002
930.272	1.421	930.272	-0.003	-0.002
930.269	1.616	930.268	-0.003	-0.003
930.265	1.568	930.265	-0.004	-0.004
930.262	1.285	930.262	-0.007	-0.006
930.26	0.698	930.26	-0.009	-0.009
930.258	-1.6	930.258	-0.011	-0.011
930.257	-1.616	930.258	-0.011	-0.010
930.258	-0.679	930.258	-0.010	-0.010
930.258	-0.682	930.258	-0.010	-0.010
930.258	-0.664	930.258	-0.009	-0.009
930.257	-0.523	930.257	-0.008	-0.008
930.257	-0.412	930.257	-0.006	-0.005
930.256	-0.239	930.256	-0.004	-0.003
930.254	-0.186	930.254	-0.002	-0.001
930.25	1.552	930.25	-0.003	-0.002
930.248	1.66	930.247	-0.002	-0.003
930.244	1.465	930.244	-0.004	-0.003
930.241	1.18	930.241	-0.006	-0.005
930.238	0.705	930.238	-0.009	-0.009
930.236	0.292	930.236	-0.010	-0.010
930.235	0.537	930.235	-0.011	-0.011

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/16/2005 6:00	930.246	0.415	930.246
5/16/2005 7:00	930.246	0.433	930.246
5/16/2005 8:04	930.245	0.501	930.245
5/16/2005 9:00	930.244	2.390	930.243
5/16/2005 10:00	930.242	2.309	930.241
5/16/2005 11:04	930.238	2.169	930.237
5/16/2005 12:00	930.235	2.263	930.234
5/16/2005 13:00	930.232	2.360	930.231
5/16/2005 14:04	930.229	2.181	930.228
5/16/2005 15:00	930.226	1.854	930.226
5/16/2005 16:00	930.224	0.638	930.224
5/16/2005 17:04	930.224	-0.968	930.224
5/16/2005 18:00	930.224	0.329	930.224
5/16/2005 19:00	930.224	0.263	930.224
5/16/2005 20:04	930.224	0.005	930.224
5/16/2005 21:00	930.223	0.122	930.223
5/16/2005 22:00	930.223	0.394	930.223
5/16/2005 23:04	930.222	0.555	930.222
5/17/2005 0:00	930.220	1.081	930.220
5/17/2005 1:04	930.217	2.412	930.216
5/17/2005 2:00	930.214	2.347	930.213
5/17/2005 3:00	930.211	2.187	930.210
5/17/2005 4:04	930.208	2.116	930.207
5/17/2005 5:00	930.205	1.922	930.204
5/17/2005 6:00	930.202	1.642	930.202
5/17/2005 7:04	930.201	0.387	930.201
5/17/2005 8:00	930.201	-0.585	930.201
5/17/2005 9:00	930.201	0.095	930.201
5/17/2005 10:04	930.201	0.456	930.201
5/17/2005 11:00	930.200	0.536	930.200
5/17/2005 11:04	930.200	0.615	930.200
5/17/2005 12:00	930.200	0.273	930.200
5/17/2005 13:04	930.199	0.313	930.199
5/17/2005 14:00	930.199	0.377	930.199
5/17/2005 15:00	930.197	1.236	930.196
5/17/2005 16:04	930.193	2.118	930.193
5/17/2005 17:00	930.191	2.319	930.190
5/17/2005 18:00	930.187	2.242	930.187
5/17/2005 19:04	930.184	2.096	930.183
5/17/2005 20:00	930.181	1.814	930.181

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.257	0.554	930.257	0.011	0.011
930.255	1.099	930.255	0.009	0.009
930.252	2.379	930.251	0.007	0.006
930.249	2.471	930.248	0.005	0.005
930.246	2.357	930.245	0.004	0.004
930.243	2.210	930.242	0.005	0.005
930.240	1.921	930.239	0.005	0.005
930.237	1.583	930.237	0.005	0.006
930.236	1.505	930.236	0.007	0.008
930.237	0.000	930.237	0.011	0.011
930.236	-0.239	930.236	0.012	0.012
930.236	0.110	930.236	0.012	0.012
930.236	0.482	930.236	0.012	0.012
930.235	0.566	930.235	0.011	0.011
930.235	0.548	930.235	0.011	0.011
930.234	2.400	930.233	0.011	0.010
930.231	2.402	930.230	0.008	0.007
930.228	2.180	930.227	0.006	0.005
930.225	2.208	930.224	0.005	0.004
930.221	2.255	930.220	0.004	0.004
930.219	2.165	930.218	0.005	0.005
930.216	1.837	930.215	0.005	0.005
930.214	-0.372	930.214	0.006	0.007
930.213	-0.652	930.214	0.008	0.010
930.214	0.357	930.214	0.012	0.012
930.213	0.363	930.213	0.012	0.012
930.213	-0.067	930.213	0.012	0.012
930.213	0.002	930.213	0.012	0.012
930.212	0.293	930.212	0.011	0.011
930.212	0.619	930.212	0.012	0.012
930.211	0.548	930.211	0.011	0.011
930.210	1.160	930.210	0.010	0.010
930.207	2.400	930.206	0.008	0.007
930.204	2.302	930.203	0.005	0.004
930.201	2.151	930.200	0.004	0.004
930.197	2.094	930.197	0.004	0.004
930.195	1.934	930.194	0.004	0.004
930.192	1.667	930.192	0.005	0.005
930.191	-0.437	930.191	0.007	0.008
930.190	-0.787	930.190	0.009	0.009

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.236	-1.032	930.236	-0.010	-0.010
930.235	-0.88	930.236	-0.011	-0.010
930.235	-0.635	930.235	-0.010	-0.010
930.235	-0.402	930.235	-0.009	-0.008
930.235	-0.25	930.235	-0.007	-0.006
930.234	-0.115	930.234	-0.004	-0.003
930.233	2.082	930.232	-0.002	-0.002
930.23	2.022	930.229	-0.002	-0.002
930.226	1.33	930.226	-0.003	-0.002
930.223	1.215	930.223	-0.003	-0.003
930.22	1.328	930.22	-0.004	-0.004
930.217	1.085	930.217	-0.007	-0.007
930.215	0.838	930.215	-0.009	-0.009
930.213	-1.427	930.214	-0.011	-0.010
930.213	-1.525	930.213	-0.011	-0.011
930.213	-0.619	930.213	-0.010	-0.010
930.213	-0.666	930.213	-0.010	-0.010
930.212	-0.641	930.212	-0.010	-0.010
930.212	-0.625	930.212	-0.008	-0.008
930.211	-0.462	930.212	-0.006	-0.004
930.211	-0.106	930.211	-0.003	-0.002
930.209	0.135	930.209	-0.002	-0.001
930.206	1.676	930.205	-0.002	-0.002
930.203	1.55	930.202	-0.002	-0.002
930.2	1.261	930.199	-0.002	-0.003
930.196	1.104	930.196	-0.005	-0.005
930.194	0.824	930.193	-0.007	-0.008
930.191	0.572	930.191	-0.010	-0.010
930.19	-0.817	930.19	-0.011	-0.011
930.19	-1.346	930.19	-0.010	-0.010
930.19	-1.297	930.19	-0.010	-0.010
930.19	-0.452	930.19	-0.010	-0.010
930.189	-0.313	930.19	-0.010	-0.009
930.189	-0.476	930.189	-0.010	-0.010
930.189	-0.553	930.189	-0.008	-0.007
930.188	-0.486	930.188	-0.005	-0.005
930.188	-0.448	930.188	-0.003	-0.002
930.185	-0.247	930.185	-0.002	-0.002
930.182	1.382	930.182	-0.002	-0.001
930.179	1.548	930.179	-0.002	-0.002

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/17/2005 21:00	930.179	1.445	930.179
5/17/2005 22:04	930.178	1.310	930.178
5/17/2005 23:00	930.178	-0.432	930.178
5/18/2005 0:00	930.177	-0.022	930.178
5/18/2005 1:04	930.177	0.334	930.177
5/18/2005 2:00	930.177	0.667	930.177
5/18/2005 3:00	930.177	0.552	930.177
5/18/2005 4:04	930.176	0.463	930.176
5/18/2005 5:00	930.175	0.366	930.175
5/18/2005 6:00	930.173	1.244	930.173
5/18/2005 7:04	930.170	2.014	930.169
5/18/2005 8:00	930.167	2.247	930.166
5/18/2005 9:00	930.164	2.187	930.163
5/18/2005 10:04	930.161	2.076	930.160
5/18/2005 11:00	930.158	1.789	930.158
5/18/2005 12:00	930.156	1.444	930.155
5/18/2005 13:04	930.155	0.935	930.154
5/18/2005 14:00	930.154	-0.537	930.154
5/18/2005 15:00	930.154	0.054	930.154
5/18/2005 16:04	930.154	0.392	930.154
5/18/2005 17:00	930.153	0.696	930.153
5/18/2005 18:00	930.153	0.526	930.153
5/18/2005 19:04	930.152	0.468	930.152
5/18/2005 20:00	930.151	0.403	930.151
5/18/2005 21:00	930.149	0.873	930.149
5/18/2005 22:04	930.146	2.058	930.146
5/18/2005 23:00	930.143	2.193	930.143
5/19/2005 0:00	930.141	2.085	930.140
5/19/2005 1:04	930.137	2.001	930.137
5/19/2005 2:00	930.135	1.744	930.134
5/19/2005 3:00	930.132	1.461	930.132
5/19/2005 4:04	930.131	-0.748	930.131
5/19/2005 5:00	930.130	-0.758	930.130
5/19/2005 6:00	930.130	0.343	930.130
5/19/2005 7:04	930.130	0.660	930.130
5/19/2005 8:00	930.129	0.587	930.129
5/19/2005 9:00	930.129	0.190	930.129
5/19/2005 10:04	930.128	0.237	930.128
5/19/2005 11:00	930.127	0.394	930.128
5/19/2005 12:00	930.126	1.505	930.126

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.190	0.258	930.190	0.011	0.011
930.190	0.625	930.190	0.012	0.012
930.190	0.426	930.190	0.012	0.012
930.189	0.058	930.189	0.012	0.011
930.189	0.184	930.189	0.012	0.012
930.188	0.426	930.188	0.011	0.011
930.186	1.040	930.186	0.009	0.009
930.183	2.201	930.182	0.007	0.006
930.180	2.298	930.179	0.005	0.004
930.177	2.152	930.176	0.004	0.003
930.174	2.066	930.173	0.004	0.004
930.171	1.833	930.171	0.004	0.005
930.169	1.542	930.168	0.005	0.005
930.167	-0.258	930.167	0.006	0.007
930.167	-0.735	930.167	0.009	0.009
930.167	0.292	930.167	0.011	0.012
930.166	0.615	930.166	0.011	0.012
930.166	0.618	930.166	0.012	0.012
930.166	0.219	930.166	0.012	0.012
930.165	0.296	930.165	0.011	0.011
930.164	0.431	930.164	0.011	0.011
930.162	0.937	930.162	0.009	0.009
930.159	2.192	930.158	0.007	0.006
930.156	2.236	930.156	0.005	0.005
930.153	2.079	930.153	0.004	0.004
930.150	2.006	930.149	0.004	0.003
930.147	1.795	930.147	0.004	0.004
930.145	1.547	930.144	0.004	0.004
930.143	-0.888	930.143	0.006	0.006
930.143	-0.779	930.143	0.008	0.009
930.143	0.478	930.143	0.011	0.011
930.142	0.718	930.142	0.011	0.011
930.142	0.490	930.142	0.012	0.012
930.142	0.043	930.142	0.012	0.012
930.141	0.184	930.141	0.011	0.011
930.140	0.416	930.140	0.011	0.011
930.138	1.486	930.138	0.009	0.009
930.136	2.347	930.135	0.008	0.007
930.133	2.060	930.132	0.006	0.004
930.130	1.904	930.129	0.004	0.003

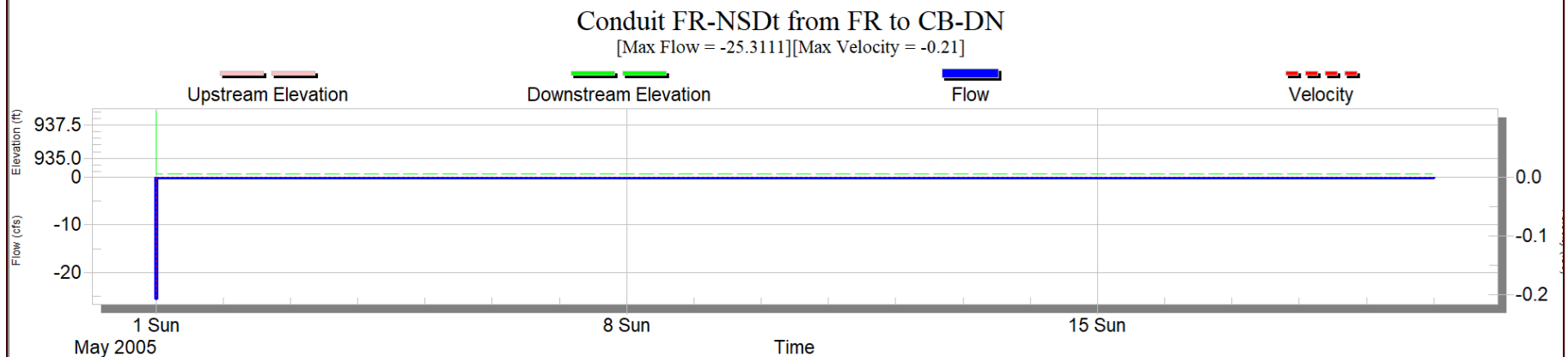
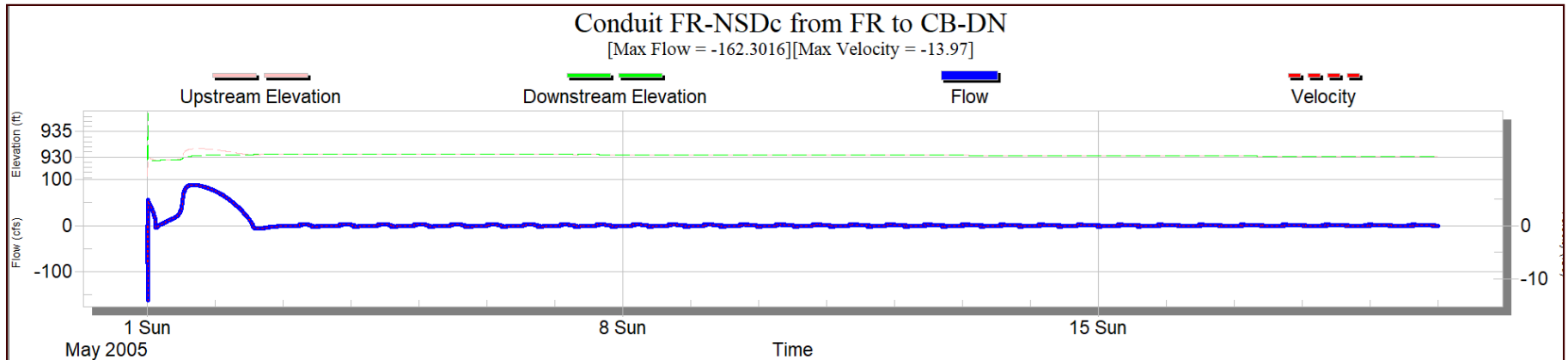
Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.176	1.341	930.176	-0.003	-0.003
930.173	1.143	930.173	-0.005	-0.005
930.17	0.764	930.17	-0.008	-0.008
930.168	0.405	930.168	-0.009	-0.010
930.167	-0.706	930.167	-0.010	-0.010
930.166	-1.31	930.167	-0.011	-0.010
930.166	-0.454	930.166	-0.011	-0.011
930.166	-0.205	930.166	-0.010	-0.010
930.166	-0.318	930.166	-0.009	-0.009
930.165	-0.436	930.165	-0.008	-0.008
930.165	-0.365	930.165	-0.005	-0.004
930.164	-0.47	930.164	-0.003	-0.002
930.162	-0.388	930.162	-0.002	-0.001
930.158	1.402	930.158	-0.003	-0.002
930.156	1.519	930.155	-0.002	-0.003
930.153	1.286	930.152	-0.003	-0.003
930.149	1.123	930.149	-0.006	-0.005
930.147	0.752	930.146	-0.007	-0.008
930.144	0.44	930.144	-0.010	-0.010
930.143	-1.271	930.143	-0.011	-0.011
930.142	-1.36	930.143	-0.011	-0.010
930.142	-0.27	930.142	-0.011	-0.011
930.142	-0.181	930.142	-0.010	-0.010
930.142	-0.395	930.142	-0.009	-0.009
930.141	-0.533	930.141	-0.008	-0.008
930.141	-0.478	930.141	-0.005	-0.005
930.14	-0.504	930.14	-0.003	-0.003
930.138	0.641	930.138	-0.003	-0.002
930.135	1.74	930.135	-0.002	-0.002
930.132	1.394	930.132	-0.003	-0.002
930.129	1.056	930.129	-0.003	-0.003
930.126	0.987	930.126	-0.005	-0.005
930.123	0.835	930.123	-0.007	-0.007
930.121	0.645	930.121	-0.009	-0.009
930.119	-1.209	930.119	-0.011	-0.011
930.118	-1.178	930.119	-0.011	-0.010
930.119	-0.274	930.119	-0.010	-0.010
930.118	-0.43	930.118	-0.010	-0.010
930.118	-0.698	930.118	-0.009	-0.010
930.118	-0.665	930.118	-0.008	-0.008

Culvert Change Analysis North Shore Drive Culvert 1

Existing			
Existing 48" CMP			
	Stage Upstream	Conduit Flow	Stage Downstream
5/19/2005 13:04	930.123	2.333	930.122
5/19/2005 14:00	930.120	2.023	930.120
5/19/2005 15:00	930.117	1.871	930.117
5/19/2005 16:04	930.114	1.876	930.113
5/19/2005 17:00	930.111	1.796	930.111
5/19/2005 18:00	930.109	1.608	930.108
5/19/2005 19:04	930.106	0.932	930.106
5/19/2005 20:00	930.106	0.501	930.106
5/19/2005 21:00	930.106	0.759	930.106
5/19/2005 22:04	930.106	0.574	930.106
5/19/2005 23:00	930.105	-0.057	930.105
5/19/2005 23:55	930.105	0.226	930.105
Max	932.015	96.081	930.582

Proposed				
46" Diameter				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.127	1.894	930.126	0.004	0.004
930.124	1.811	930.123	0.004	0.003
930.121	1.621	930.121	0.004	0.004
930.119	0.575	930.119	0.005	0.006
930.119	0.305	930.119	0.008	0.008
930.119	0.722	930.119	0.010	0.011
930.119	0.542	930.118	0.013	0.012
930.118	-0.157	930.118	0.012	0.012
930.118	-0.002	930.118	0.012	0.012
930.117	0.248	930.117	0.011	0.011
930.116	0.609	930.116	0.011	0.011
930.116	1.722	930.115	0.011	0.010
			0.011	0.011
Max	94.774	930.596	0.007	0.014

Proposed				
46" Diameter with 6" plate				
Stage Upstream	Conduit Flow	Stage Downstream	Upstream Δ Proposed - Existing	Downstream Δ Proposed - Existing
930.117	-0.577	930.117	-0.006	-0.005
930.116	-0.14	930.116	-0.004	-0.004
930.115	2.104	930.114	-0.002	-0.003
930.112	1.958	930.112	-0.002	-0.001
930.109	0.927	930.109	-0.002	-0.002
930.106	0.984	930.106	-0.003	-0.002
930.103	1.16	930.103	-0.003	-0.003
930.1	1.164	930.1	-0.006	-0.006
930.097	0.955	930.097	-0.009	-0.009
930.095	0.632	930.095	-0.011	-0.011
930.094	0.804	930.094	-0.011	-0.011
930.094	-0.908	930.094	-0.011	-0.011
			-0.066	-0.009
Max	88.237	930.566	-0.338	-0.016



Appendix D

Plan Set

Building a Better World for All of Us[®]

Sustainable buildings, sound infrastructure, safe transportation systems, clean water, renewable energy and a balanced environment. Building a Better World for All of Us communicates a company-wide commitment to act in the best interests of our clients and the world around us.

We're confident in our ability to balance these requirements.

JOIN OUR SOCIAL COMMUNITIES

