



Feasibility Report

Pioneer Trail Wetland Restoration Project

Prepared for
Riley Purgatory Bluff Creek Watershed District

March 2020

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Certifications

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Scott Sobiech PE #: 41338

3/4/2020

Date

Executive Summary

This study was completed to evaluate the feasibility of restoring the wetland on three parcels owned by Riley Purgatory Bluff Creek Watershed District (RPBCWD) located northwest of the intersection of Pioneer Trail and CSAH 101 in Chanhassen, Minnesota.

The project objectives included restoring the wetland, restoring hydrology to as close to predevelopment conditions as possible while not negatively impacting neighboring properties or downstream conditions, and enhance flood detention to reduce discharges to Bluff Creek which is impaired for turbidity which is directly related to flows. The proposed outlets could not cause the water surface elevations in the wetland or downstream locations to exceed the existing 10-year or 100-year, 24-hour design rainfall event elevations. In addition to these two design events, 70-years of actual rainfall data was also simulated to see how closely the proposed hydrology could approximate predevelopment conditions. The downstream flow rates were also evaluated to ensure that the proposed designs did not pose an increased risk of erosion. The water quality impacts were evaluated with P8 models of the existing and proposed conditions.

Two restoration conceptual plans (Conceptual Plan A and Conceptual Plan B) were developed to illustrate what the wetland restoration might look like. The main difference between these concepts is the amount of excavation and grading below the proposed water surface. Conceptual Plan A restores the site to as close as predevelopment conditions as possible while minimizing alterations in the wetland area. Conceptual Plan B is similar to Concept Plan A but would have additional excavation of the site to increase the open water areas and provide vegetative enhancement with diverse native wetland communities. The main difference between these concepts is the amount of excavation and grading below the proposed water surface. These concepts are shown in Figure 3-5 and Figure 3-6 and are discussed in sections 3.3 and 3.4. Both concepts will return most of the site to wetland conditions, restoring approximately 6.5 acres of what is currently covered in cattails, turf and reed canary grass.

Two outlet configurations were identified that could meet the project objectives. Outlet Option1 is the simpler design consisting of a simple overflow structure and outlet pipe. This design improved the wetland hydrology and downstream water quality while basically matching the existing conditions design rainfall event elevations and outflow

rates. Outlet Option 2 was more complex but provided increased runoff detention within the wetland and some reduction in downstream flows relative to existing conditions in addition to improving the wetland's hydrology and downstream water quality.

Based on the results of the engineering assessment, potential site impacts, and phosphorous removed, Conceptual Plan A with Outlet Option 2, is recommended as the most feasible wetland restoration plan. Conceptual Plan A with Outlet Option 2 wetland restoration is a feasible project included in RPBCWD's 10-year plan and is consistent with the project specific goals including helping improve and protect the water quality of waters located downstream.

The engineer opinion of probable cost for the design, permitting, and construction of Conceptual Plan A with Outlet Option 2 is \$630,000 with a potential range of \$504,000 to \$819,000 based on the current level of design. As plans and specifications for the recommended conceptual design are prepared, the District should continue to collaborate with city of Chanhassen staff about plan details. If the Board elects to pursue the project, it is recommended that coordination with the city of Chanhassen start in the near term to transfer the remaining parcel to district ownership in advance of the project implementation.

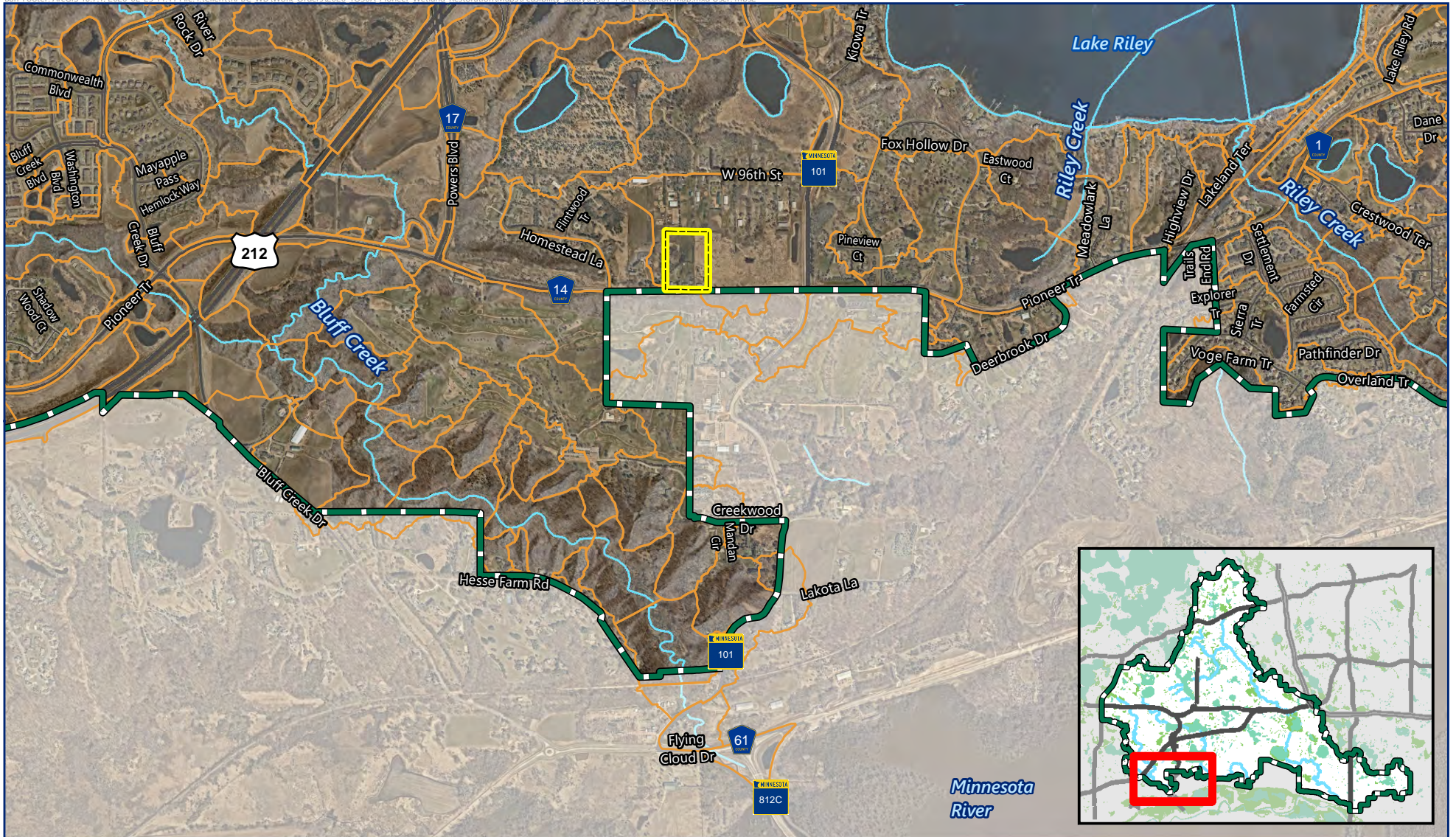
1.0 Wetland Restoration Plan Context and Goals

1.1 Background

This report summarizes the proposed actions within the northwest quadrant of the intersection of Pioneer Trail and CSAH 101 in Chanhassen to restore the portion of the wetland on the parcels owned by Riley Purgatory Bluff Creek Watershed District (RPBCWD) as outlined in the district's 10-year plan. The three parcels were previously purchased in fee title to remove the flood prone structures from the floodplain using a flood damage reduction grant from the Minnesota Department of Natural Resources (MNDNR). Two parcels were purchased by RPBCWD and the third by the city of Chanhassen. The City intends to transfer the property to RPBCWD for restoration purposes. The RPBCWD received a Clean Water Fund (CWF) grant for the purpose of wetland restoration within these three parcels. This feasibility study evaluates two proposed outlet options and two conceptual plans for restoration and includes concept level designs and opinions of probable cost ranges for each option.





1.2 Project Location

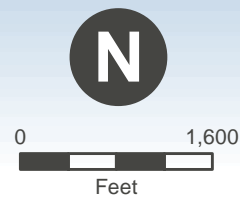
The project site is approximately seven acres within the Bluff Creek subwatershed of the RPBCWD in the City of Chanhassen (Section 26, Township 116N, and Range 23W) Carver County in the Minnesota River – Shakopee Major Watershed #33, within Bank Service Area 9. The project site is located approximately ½ mile east of Bluff Creek. Bluff Creek discharges to the Minnesota River. A site location map is provided in Figure 1-1. A 2019 aerial photo of the site showing the property and planned project boundaries are shown in Figure 1-2.



Pioneer Trail Wetland Restoration Feasibility Design Memo

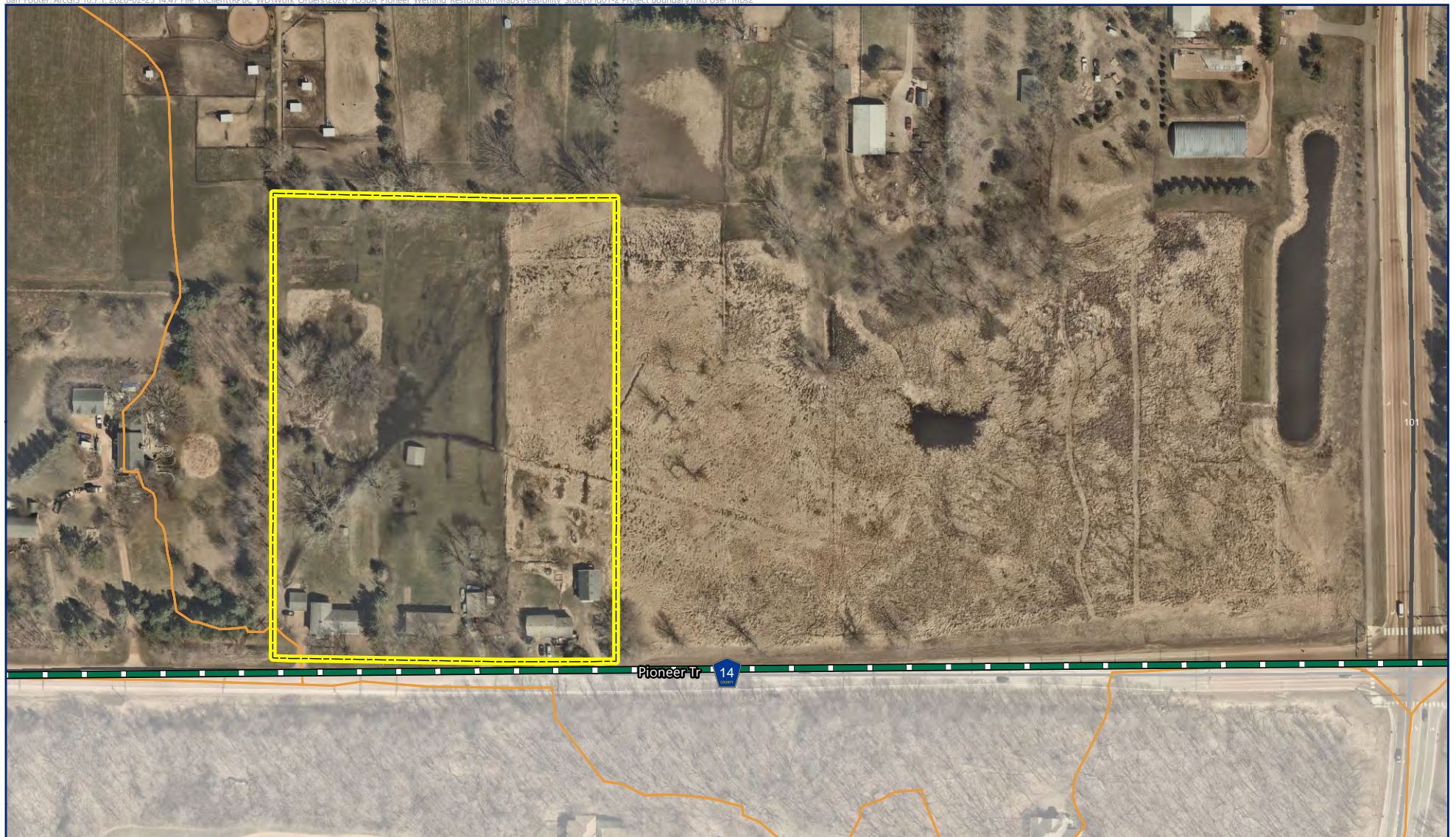


-  Project Boundary
-  Creek Alignment
-  Lake
-  Watershed District Boundary






SITE LOCATION MAP

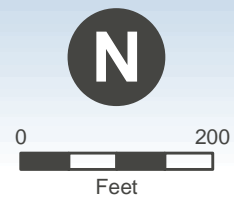
FIGURE 1-1



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Subwatershed Boundary
-  Watershed District Boundary



PROJECT BOUNDARY

FIGURE 1-2

1.3 Project Goals

Wetland restoration is the primary purpose of the project with a goal to restore the site to pre-settlement hydrology and develop diverse native plant communities. Additional project objectives include replacing the outlet to regulate hydrology, increasing runoff detention within the wetland, reducing outflow turbidity and flow rates, decreasing the total suspended solids and the total phosphorus load to Bluff Creek, improving the site's aesthetics, providing educational opportunities and potentially constructing a recreational boardwalk/trail connection with Pioneer Trail. Initially it was hoped that the project could also increase the net flood storage capacity and reduce flooding on the neighboring properties but attaining these goals would require lowering the proposed water surface elevation below the downstream ditch elevation and would be in opposition of the primary goal of restoring the site to as close to pre-development conditions as possible. The project goals are consistent with the RPBCWD general purpose to protect public health and welfare and to provide for the provident use of natural resources through planning, flood control, and conservation projects. The project will not result in changes to the 100-year and 10-year flood elevations.

2.0 Existing Conditions

2.1 Site History and Characteristics



2.1.1 Historical Land Use

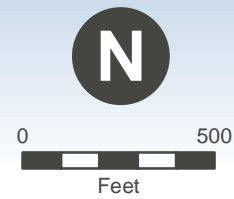
Prior to European settlement, the site was located within the Big Woods Subsection (222Mb) of the Eastern Broadleaf Forest Province as mapped by the Minnesota Department of Natural Resources (MNDNR, 2020a). The Big Woods ecoregion was dominated by oak woodland and maple-basswood forests. Wetlands and wet prairie areas were historically intermixed within this region. As settlement occurred, much of the landscape was initially converted to farmland. Aerial imagery of the site from 1937 shows that the site was all farmland (Figure 2-1). The site was in crop rotation into the 1950s. Homes surrounding the site were built in the 1960s and the land has been primarily used for pasture since then. Figure 2-2 shows current conditions. Additional years of aerial imagery from 1937 through 2019 are provided in Appendix A.



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary





Imagery Source: Carver County, 1937

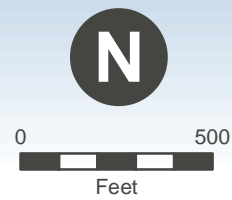
FIGURE 2-1



Pioneer Trail Wetland Restoration Feasibility Design Memo

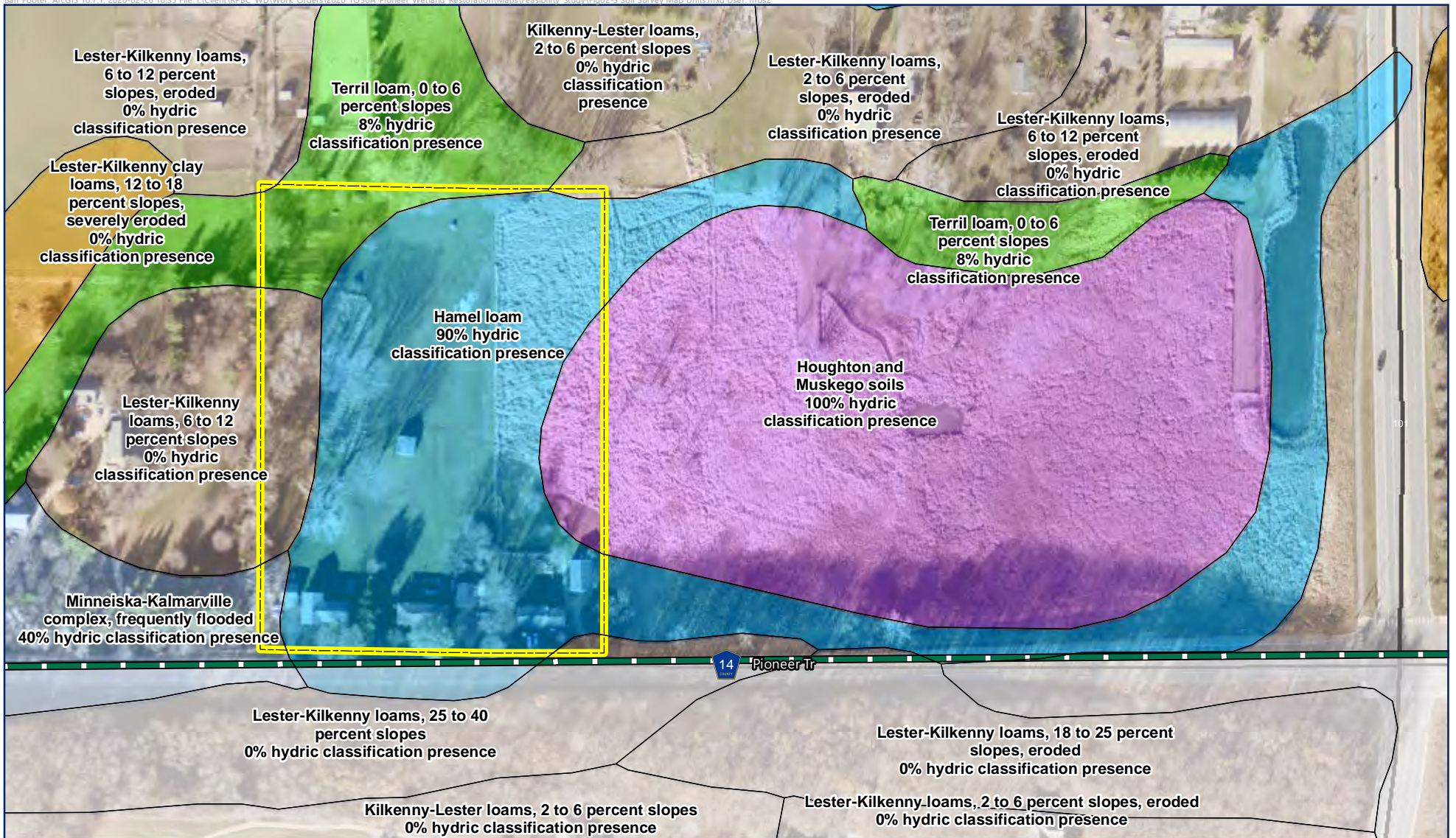


-  Project Boundary
-  Watershed District Boundary



2.1.2 Soils

Approximately 5.8 acres of the 7.3-acre project area are mapped with hydric soil including Hamel loam, which is a predominantly hydric soil (90 percent hydric classification rating) and all hydric Houghton and Muskego soils (100 percent hydric classification rating). The Houghton and Muskego soils extend throughout the wetland area located east of the project site as shown in Figure 2-3. The southwest corner of the site is mapped with partially hydric Minneiska-Kalmarville complex, frequently flooded soil (40 percent hydric classification rating). Adjacent upland soils mapped within the project site include non-hydric Lester-Kilkenny loams, 6 to 12 percent slopes (0 percent hydric classification rating) and predominantly non-hydric Terril loam, 0 to 6 percent slopes (8 percent hydric classification rating).

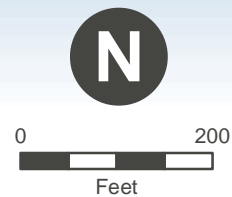


Pioneer Trail Wetland Restoration Feasibility Design Memo



- Soil Map Unit Name (SSURGO)
- Hamel loam
 - Houghton and Muskego soils
 - Kilkenny-Lester loams
 - Lester-Kilkenny clay loams
 - Minneiska-Kalmarville complex
 - Terril loam

- Project Boundary
- Watershed District Boundary



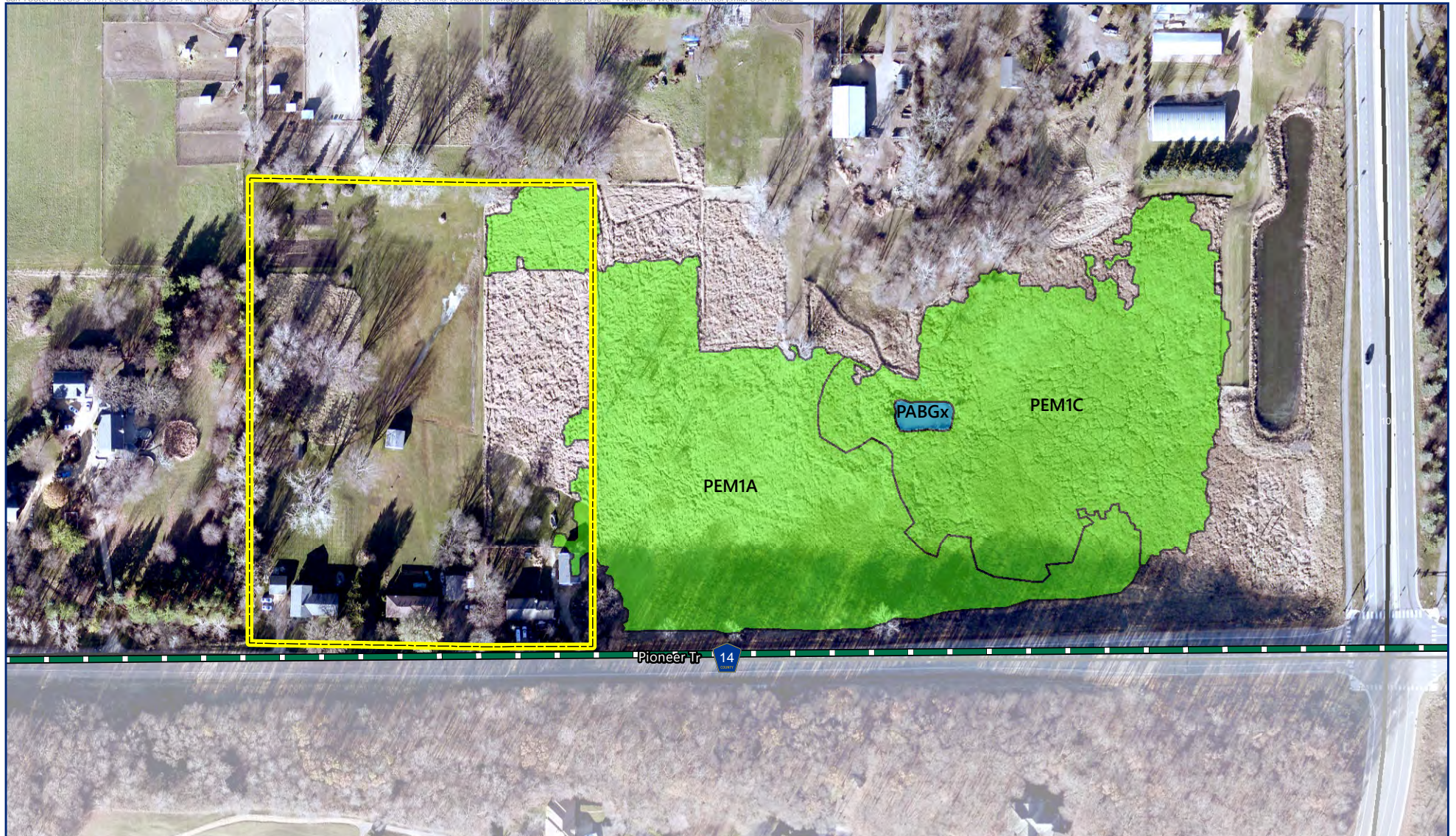
SOIL MAP UNIT NAMES

FIGURE 2-3

2.1.3 Site Vegetation Communities




Current site vegetation will be documented during a field investigation in the spring of 2020. The Minnesota Land Cover Classification System (MLCCS, MNDNR, 2018) identifies the majority of the site as short grasses with sparse tree cover on hydric soils. The southern portion of the site is identified as short grasses and mixed trees with 11-25 percent impervious cover and the northeast corner of the site is identified as seasonally flooded altered/non-native dominated emergent vegetation, according to the MLCCS. The seasonally flooded emergent vegetation extends to the east beyond the project site with a semi-permanently flooded cattail marsh east of that.

The MNDNR updated National Wetland Inventory (NWI) identifies the northeastern corner and the eastern edge of the project area as a Type 1 palustrine emergent (PEM1A) seasonally flooded basin. The wetland primarily located east of the project area is a cattail marsh also identified in the NWI as a Type 3 palustrine emergent shallow marsh (PEM1C) as shown in Figure 2-4. A wetland delineation will be conducted in the spring of 2020 to document existing wetland and vegetative communities within the project area.



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary
- National Wetland Inventory (MNDNR Update)
-  Freshwater Emergent Wetland
-  Freshwater Pond

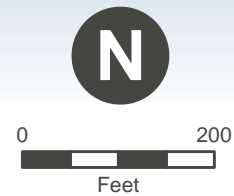


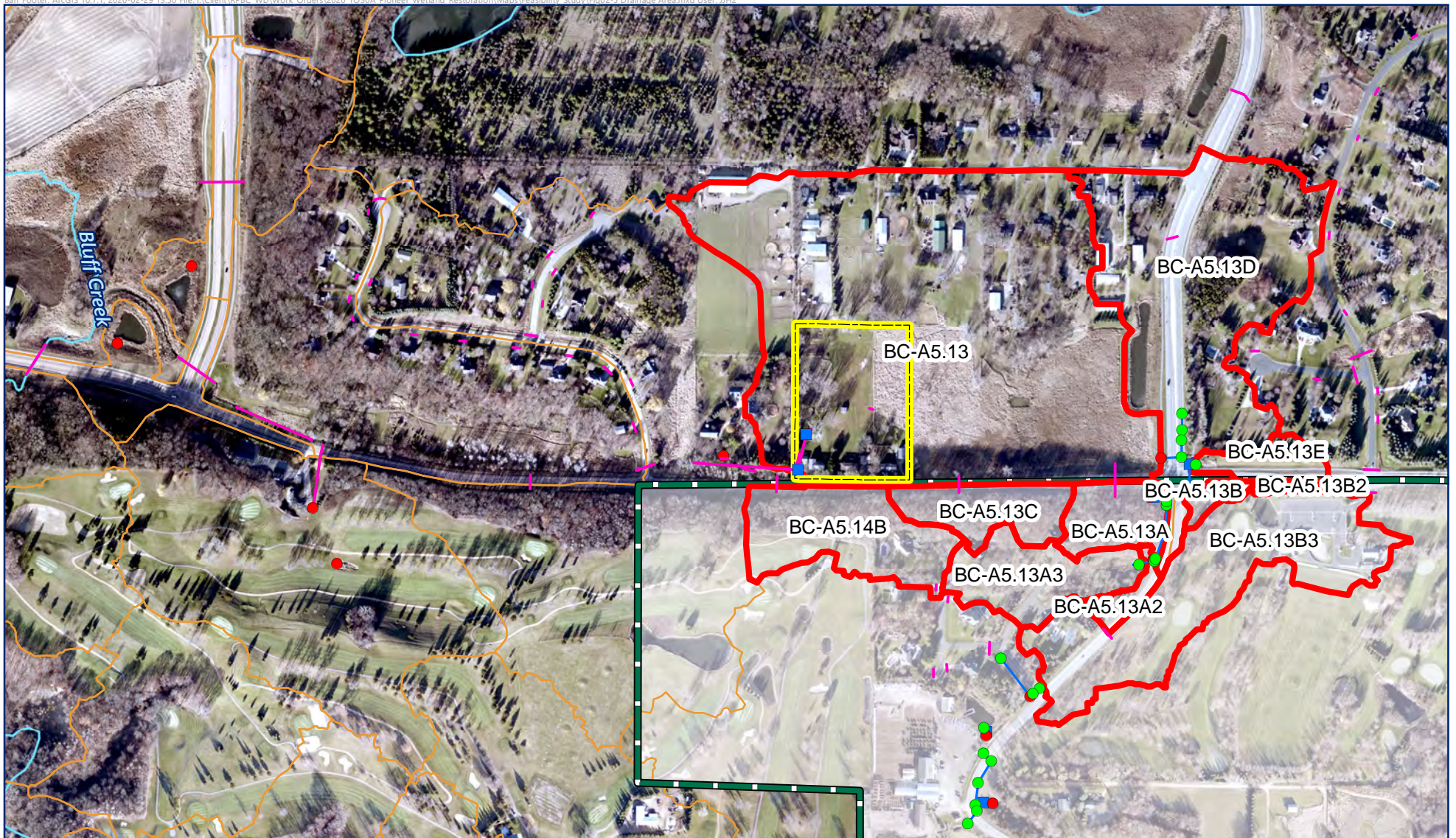
FIGURE 2-4

2.1.4 Hydrology and Drainage Features

The wetland drainage area is shown on Figure 2-5. It has a tributary drainage area of approximately 98 acres that includes portions of Highway 101, Pioneer Trail and the Halla Greens Executive Golf Course. A portion of the outflows from the 6.6 acre subwatershed BC-A5.14B on the south side of Pioneer Trail also contributes runoff into the wetland until the water elevations in the wetland exceed those in the north Pioneer Trail ditch.











Site hydrology has been modified by draintile, culverts, ditches, and berms. These existing drainage features are shown in Figure 2-6. A berm cuts through the eastern portion of the site from north to south with a culvert of unknown size. An area at the northwestern portion of the project area appears to have been previously excavated. Ditches on the site connect the wetland to the east with the excavated area in the northwestern portion, and the outlets at the southwestern portion of the site. There is conflicting information as to the sizes and locations of the outlet pipes and structures. There are two known outlet pipes and one known outfall pipe to the ditch along the north side of Pioneer Trail. The pipe outfall elevation (876.68) is the highest point in the outlet pipe network and is the controlling elevation during periods of high flows. Draintile is also present at the outlet but its exact location and the location of the outfall location unknown. Based on the best available information it appears that a 4-inch diameter draintile line runs out from the lowest outlet structure and daylights several hundred feet west of the site along the north side of Pioneer Trail, this needs to be filed verified if the project moves to implementation.

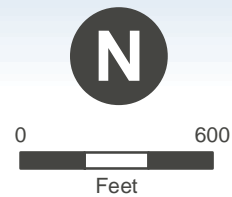
Flow conditions in the ditch downstream of the wetland were found to be more complicated than initially expected. Due to the inverse slope on the wetland outlet pipe water in the downstream ditch can backflow into the wetland until the water elevation in the wetland exceeds the elevation in the ditch. The backflows are primarily due to runoff from the south side of Pioneer Trail that enters the downstream ditch via a culvert west of the wetland outlet (see Figure 2-6). The driveway culverts along the ditch to the west of the site also caused tailwater impacts and limited the wetland outflows.



Pioneer Trail Wetland Restoration Feasibility Design Memo

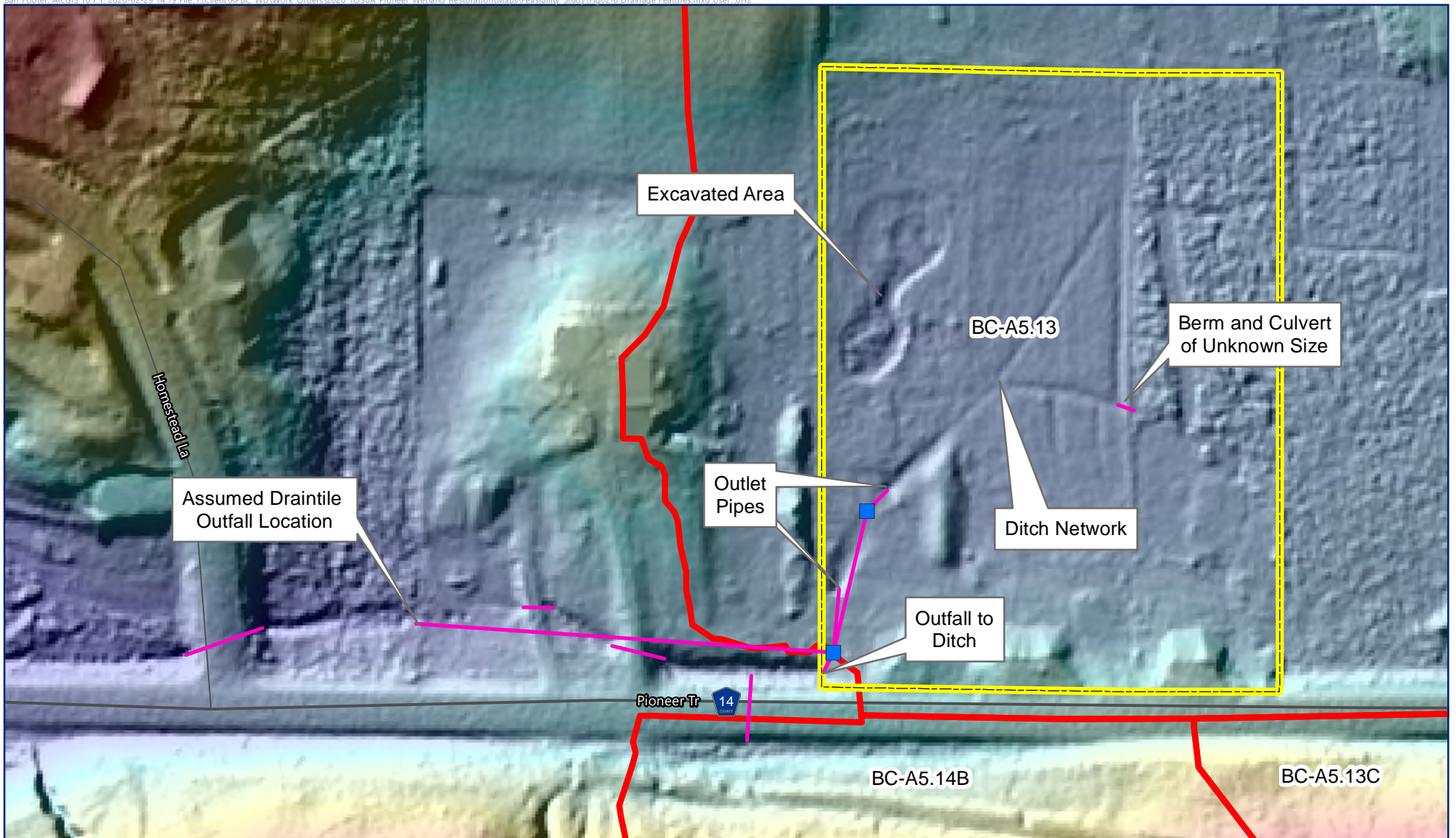


-  Culvert Alignment
-  Gravity Main Alignment
-  Stormwater Inlet
-  Stormwater Outlet
-  Manhole
-  Creek Alignment
-  Watershed District Boundary
-  Wetland Drainage Area
-  Subwatershed Boundary
-  Project Boundary







**WETLAND DRAINAGE AREA
AND CONNECTION TO
BLUFF CREEK**

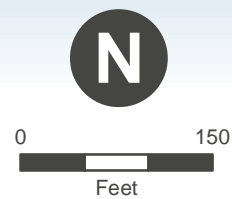
FIGURE 2-5



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Culvert/Drain tile Alignment
-  Manholes
-  Wetland Drainage Area
-  Project Boundary



**EXISTING PROJECT SITE
DRAINAGE FEATURES
AND OUTLET STRUCTURES**

FIGURE 2-6

2.1.5 Downstream Hydrology and Special Features

The segment of Bluff Creek from Pioneer Trail to Flying Cloud Drive is mapped by the MNDNR with adjacent native plant communities of mesic hardwood forest systems including elm/basswood/black ash/hackberry forest (MHs49a), sugar maple/basswood/bitternut hickory forest (MHs39a), and red oak/sugar maple/basswood/bitternut hickory forest (MHs38c) and dry hill southern upland prairies (UPs13d). These native plant communities are ranked as either imperiled or vulnerable to extirpation and the area has been identified by the Minnesota County Biological Survey (MCBS) as a site with high biodiversity significance.

The segment of Bluff Creek downstream south of Flying Cloud Drive includes Rice Lake, which has been identified as a wild rice location and includes a northern bulrush marsh (MRn93a) native plant community. This community is also ranked as vulnerable to extirpation. The marsh is adjacent to a wet meadow/carr system sedge meadow (WMn82b). This area has also been identified by the MCBS as a site with high biodiversity significance.

From Rice Lake, Bluff Creek discharges into the Minnesota River, which has the potential to support endangered mussel species.

The Bluff Creek Total Maximum Daily Load (TMDL): Biological Stressor Identification report (TMDL Report) identified multiple biological stressors on Bluff Creek, including Total Suspended Sediment (TSS) loads. High TSS loads to the creek can come from both watershed and near-channel sources. The TMDL Report identified near-channel sources as the primary sources of sediment

2.1.6 Site Features, Issues of Concern, and Wetland Restoration Potential

No known site features or significant issues of concern have been identified that would prevent the wetland restoration project from moving forward. The site was reviewed for the following:

- Residential homes at the southern portion of the site have been removed. A septic system and wells have been abandoned and tanks have been pulled. Fill material is still present from the septic system mound and residential homes.
- The Minnesota State Historic Preservation Office database does not contain any archaeological or historic records within the project area.

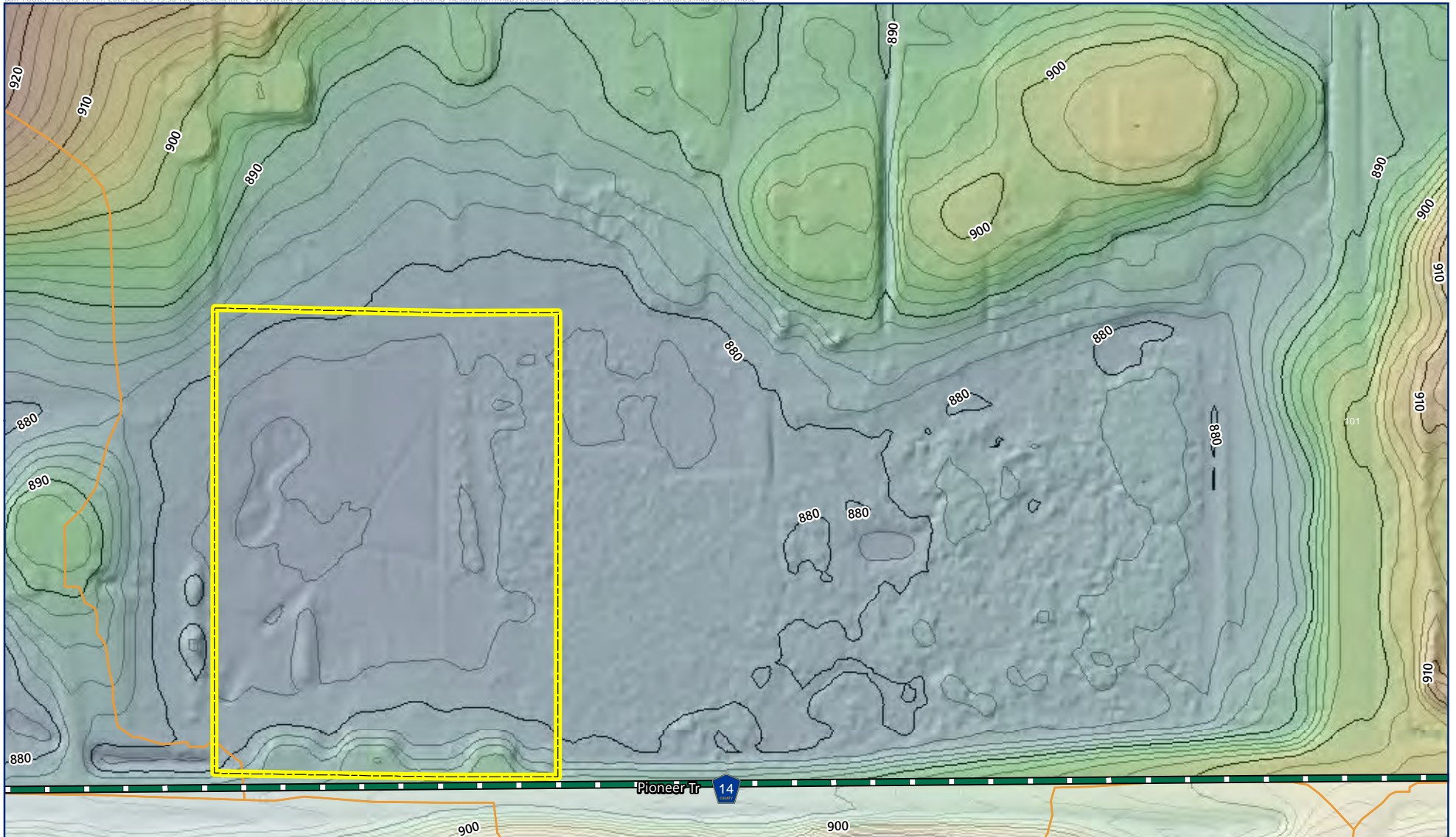
-
- No permanent conservation easements are present within the project site.
 - A drainage easement is present outside of the project site approximately 800 feet east of the project area associated with a storm pond that was constructed between 2013 and 2014.
 - The project area has not been enrolled in any state or federal conservation programs.
 - An underground gas line may be present at the southern edge of the property.
 - No known crude oil, petroleum pipelines, utilities, or other easements or restrictions are located on or within the vicinity of the site.
 - The site has not been known to be used as a storage or disposal area for hazardous substances, pollutants, or contaminants, or a dumpsite. A Phase I site assessment may be needed if it hasn't already been completed.

If this project is approved by the Board of Managers, further investigation will be conducted to confirm the above information. Additional information regarding the natural resources surrounding the area includes:

- Calcareous fens have been identified within two miles from the project site, though in a different watershed. The proposed project is not anticipated to affect nearby calcareous fens.
- The site is within the high potential zone where the federally endangered rusty patched bumble bee is presumed to be present. Given the likely disturbed nature of the site and anticipated lack of pollinator habitat for this species, it is unlikely that the site in its current condition would provide sufficient habitat to support this species. Further evaluation and consultation with the U.S. Fish and Wildlife Service is anticipated to evaluate the potential for the project to affect this species. The proposed project will involve re-establishment of native vegetation, which should include prairie and wet prairie species that may provide valuable pollinator habitat for this species in the future.
- The site and adjacent wetland are likely dominated with non-native invasive vegetation. There are no regulatory requirements associated with the project to meet designated performance standards for native vegetation. However, the project goal to develop diverse native plant communities will be a challenge.

Based on an initial desktop review, the site has potential for wetland restoration and could provide valuable downstream water quality protection. The project area has been identified in the University of Minnesota Natural Resources Research Institute's Restorable Wetland Inventory (UMN NRRI, 2013).

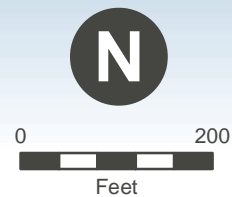
The area of potential restored wetland will be identified more specifically after the wetland delineation is conducted. In addition, soil borings will be conducted to determine the approximate depth of hydric soil and designated spot elevations will be surveyed to verify the accuracy of Light Detection and Ranging (LiDAR) digital elevation model (DEM) and make corrections as needed. Existing surface topography using LiDAR contours and DEM is shown in Figure 2-7. LiDAR contours show the lowest elevation within the site below 876 feet above mean sea level in the location of the previously excavated area (Figure 2-7) and the LiDAR DEM grid has elevations below 874 feet in the same area. The majority of the area mapped with hydric soils is below or within the 878-ft contour. The septic mound system and area where the homes were located at the southern portion of the site range from 878 ft to 888 ft. Areas east of the site that appear to be wetter than the project site have LiDAR contours higher in elevation, indicating potential inaccuracies possibly due to vegetation height in the cattail marsh.



Pioneer Trail Wetland Restoration Feasibility Design Memo



- Project Boundary
- Subwatershed Boundary
- Watershed District Boundary
- Surface Topography (DNR, 2011)
- 10-Foot Contour
- 2-Foot Contour



SURFACE TOPOGRAPHY

FIGURE 2-7

3.0 Evaluated Restoration Options

Barr used the RPBCWD's Bluff Creek PCSWMM model to model existing and estimated predevelopment conditions as well as evaluate the impacts of the proposed outlets on the wetland and areas downstream of the wetland outlet. In addition to the standard design rainfall events, a continuous simulation of 70 years of observed rainfall was completed using the 1950-2019 Minneapolis-St. Paul Airport climate data set to generate a times series of water levels and flows for predevelopment, existing and proposed conditions. The continuous simulation results were then used to develop an elevation-duration curve for each of the modeled scenarios and flow-duration curves in the ditch downstream of the wetland outlet for existing and proposed conditions. This methodology accounts for how the wetlands responds to past patterns of recorded rainfall that occurred over a wide range of climatic conditions.

The existing conditions PCSWMM model was updated with survey information, provided by the city of Chanhassen, at the outlet of the wetland and plan sheet information from the ongoing CSAH 101 reconstruction projects. The larger model was then clipped down to just include the watershed areas upstream of the wetland and downstream of the wetland to its confluence with Bluff Creek. The existing conditions model results were used to set the 100-year and 10-year, 24-hour design storm event elevations, which could not be exceeded under the proposed conditions. The existing conditions outflows in the ditch downstream of the wetland were also compared to the proposed conditions results to evaluate the proposed outlets impact on flow rates to Bluff Creek.

Pre-development conditions were simulated by assuming zero impervious area in the watershed and no draitile or culvert outlets from the wetland. The predevelopment wetland outflow elevation is not known with certainty but was assumed to be a surface overflow at approximately the same elevation as the highest point in the existing pipe outlet network (876.68). The predevelopment model results were used as a guide when designing the proposed outlets.

Proposed conditions assumed all the existing outlet structures, including the draitile, were removed or bulkheaded. The highest known point in the ditch downstream of the wetland (876.23 feet) became the controlling elevation for outflow from the wetland and retains more water on the site, similar to predevelopment conditions. The existing backflow from the ditch also had to accounted for in the proposed outlets. If it was

blocked from entering the wetland the peak water elevations and flow rates along the ditch would be greater than the existing conditions elevations and flows. The proposed conditions storage curve for the wetland was also modified to account for the fill removal around the existing structures and septic mound. The net result of the change in control elevation and the fill removal is that there was no significant change in the available flood storage. The two proposed outlets were designed to detain as much water as possible without causing 10-year or 100-year, 24-hour design rainfall event peak-water elevations to rise above those experienced under existing conditions. The details of these two outlet configurations are discussed in sections 3.1 and 3.2.

Two restoration conceptual plans were also developed to illustrate what the wetland restoration might look like. The main difference between these plans is the amount of excavation and grading below the proposed water surface. These conceptual plans are shown in Figure 3-5 and Figure 3-6 and are discussed in sections 3.3 and 3.4. Both plans will return most of the site to wetland conditions, restoring approximately 6.5 acres of what is currently covered in cattails, turf and reed canary grass.

3.1 Proposed Outlet Option 1

Proposed Outlet Option 1 is a simple 48" diameter overflow structure with a 24" RCP outlet pipe. The rim of the control structure is set at an elevation of 976.2 feet and the ultimate control elevation is set 976.23 feet at the downstream end of the outlet pipe. This elevation corresponds to the highest known elevation in ditch downstream of the wetland. The approximate location of these structures and an example drawing of a similar structure are shown in Figure 3-1.

This outlet configuration matches the existing 10-year design rainfall event elevations in the wetland and slightly reduces the peak 100-year, 24-hour water elevation as shown in Table 4-1. It also maintains a higher water level in the wetland than the existing outlet and the water levels are within 0.5 feet of the predevelopment elevations more than 70 percent of the time as shown in Figure 3-3. The design allows the downstream ditch to backflow into the wetland, similar to existing conditions, and does not have much of an impact on the magnitude or frequency of flows in the ditch as shown in Figure 3-4.

Outlet Option1 would also provide some water quality benefit, removing an additional 3.8 pounds of total phosphorus (TP) and 1,060 pounds of total suspended solids annually as shown in Table 4-1.

In summary, Outlet Option1 closely matches the existing conditions outflows and peak water surface elevations while improving the wetland hydrology to more closely match predevelopment conditions. It also reduces the TP and TSS loading to Bluff Creek.

3.2 Proposed Outlet Option 2

Proposed Outlet Option 2 is more complex than Option1 and provides more downstream benefit than Option1. This outlet configuration would require the re-routing of flows from subwatershed BC_A5.14B (see Figure 2-6) on the south side of Pioneer Trail into the wetland in order to manage tailwater and backflow issues in the ditch downstream of the wetland. This flow re-direction is shown in Figure 3-2. The outlet from the wetland would consist of a 24" RCP inlet pipe to a 60" diameter control structure with a rim elevation of 979.0 feet. The control structure has an internal weir and orifice that are sized to allow for more extended detention than Outlet Option1 but still draw the wetland back down to have capacity to contain the next rain event. The approximate location of these structures and an example drawing of a similar structure are shown in Figure 3-2.

This outlet configuration matches the existing 10-year design rainfall event elevations in the wetland and slightly reduces the peak 100-year, 24-hour water elevation as shown in Table 3-1. Similar to Option1, it also maintains a higher water level in the wetland than the existing outlet and the water levels are within 0.5 feet of the predevelopment elevations more than 70 percent of the time as shown in Figure 3-3. Because of the re-routing of the outflows from subwatershed BC-A5.14B into the wetland, Option2 also causes some reduction in the downstream flows as shown in Figure 3-4. It reduces the frequency of flows between 2 and 5 cfs and decreases the magnitude of the most extreme flows by several cubic feet per second.

Outlet Option2 would also provide water quality benefits, removing an additional 5.0 pounds of total phosphorus (TP) and 1,680 pounds of total suspended solids annually as shown in Table 3-2. These reductions are greater than Option1 due to rerouting the flows from south of Pioneer Trail, which do not currently experience significant treatment, into the wetland and the extended detention time within the wetland.

In summary, Outlet Option2 closely matches the existing conditions outflows and peak water surface elevations while improving the wetland hydrology to more closely match

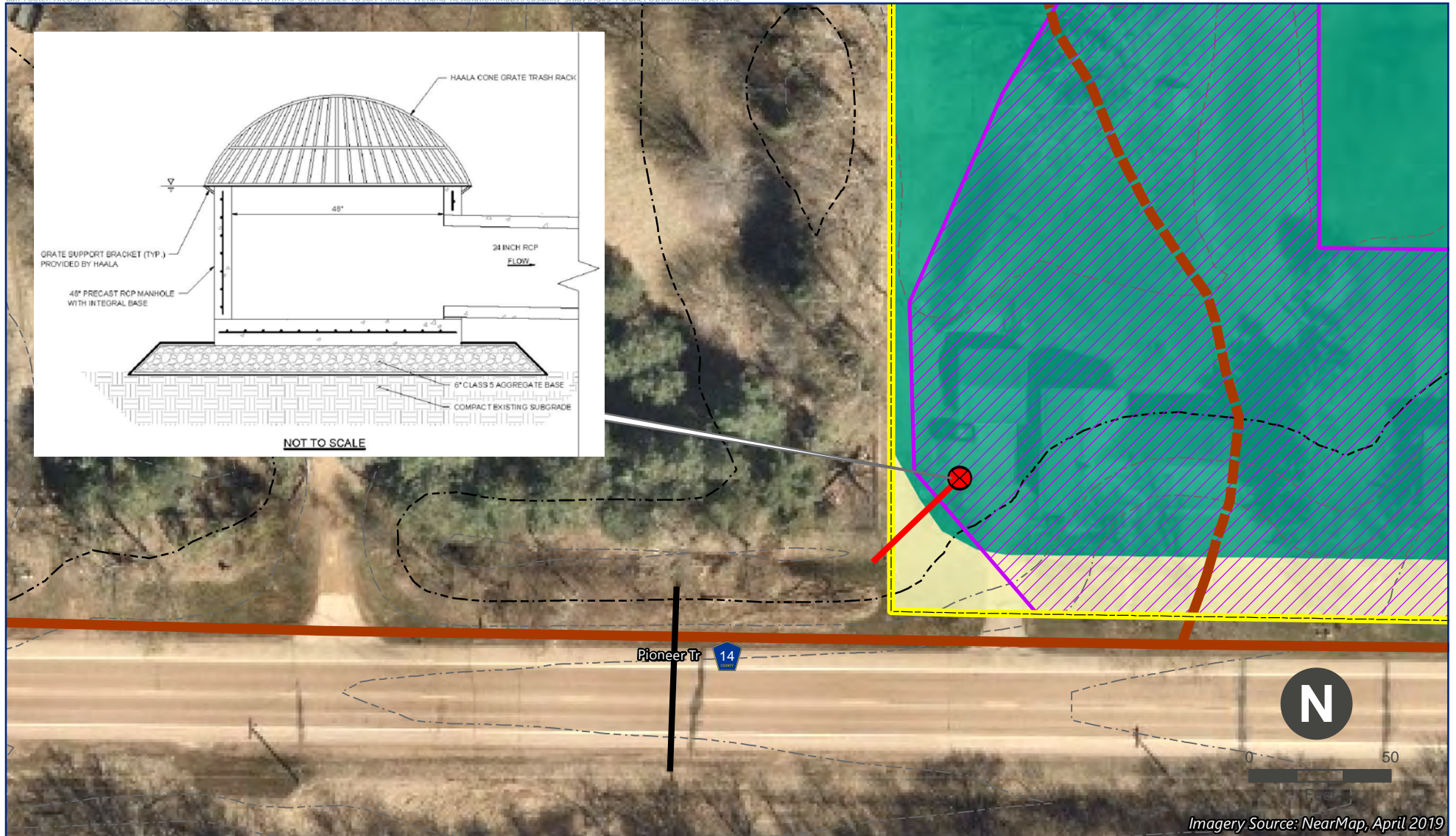
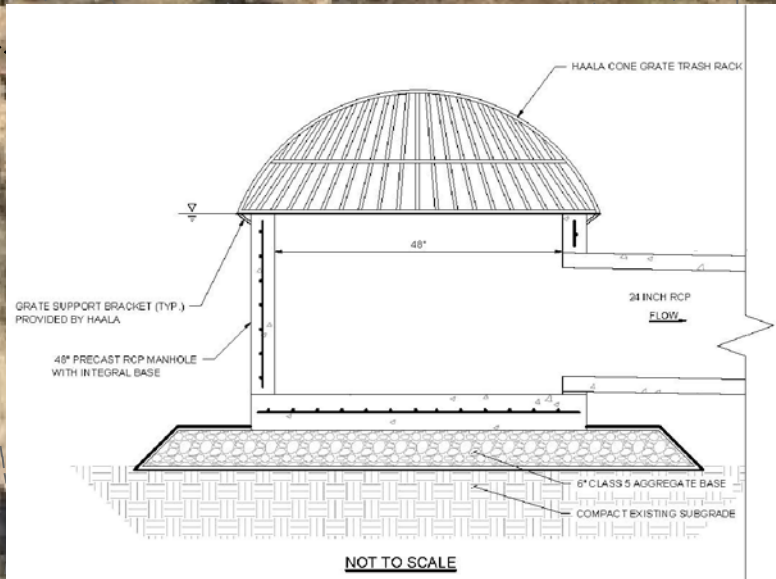
predevelopment conditions. It also reduces the frequency and magnitude of outflows from the wetland and the TP and TSS loading to Bluff Creek.

Table 3-1 Design Event Peak Water Surface Elevations in the Wetland

Modeled Scenario	10-year, 24-hour Design Event Peak Water Surface Elevations (ft, NGVD29)	100-year, 24-hour Design Event Peak Water Surface Elevations (ft, NGVD29)
Existing Conditions	878.20	879.50
Proposed Outlet Option1	878.20	879.47
Proposed Outlet Option2	878.20	879.48

Table 3-2 Total Phosphorus and Total Suspended Solids P8 Results

Pollutant	Average Annual Wetland Outflow Load (lbs/year)			Average Annual Load Reduction (lbs/year)	
	Existing Conditions	Proposed Outlet Option1	Proposed Outlet Option2	Proposed Outlet Option1	Proposed Outlet Option2
Total Phosphorus	26.7	23.0	21.8	3.8	5.0
Total Suspended Solids	2,940	1,880	1,260	1,060	1,680



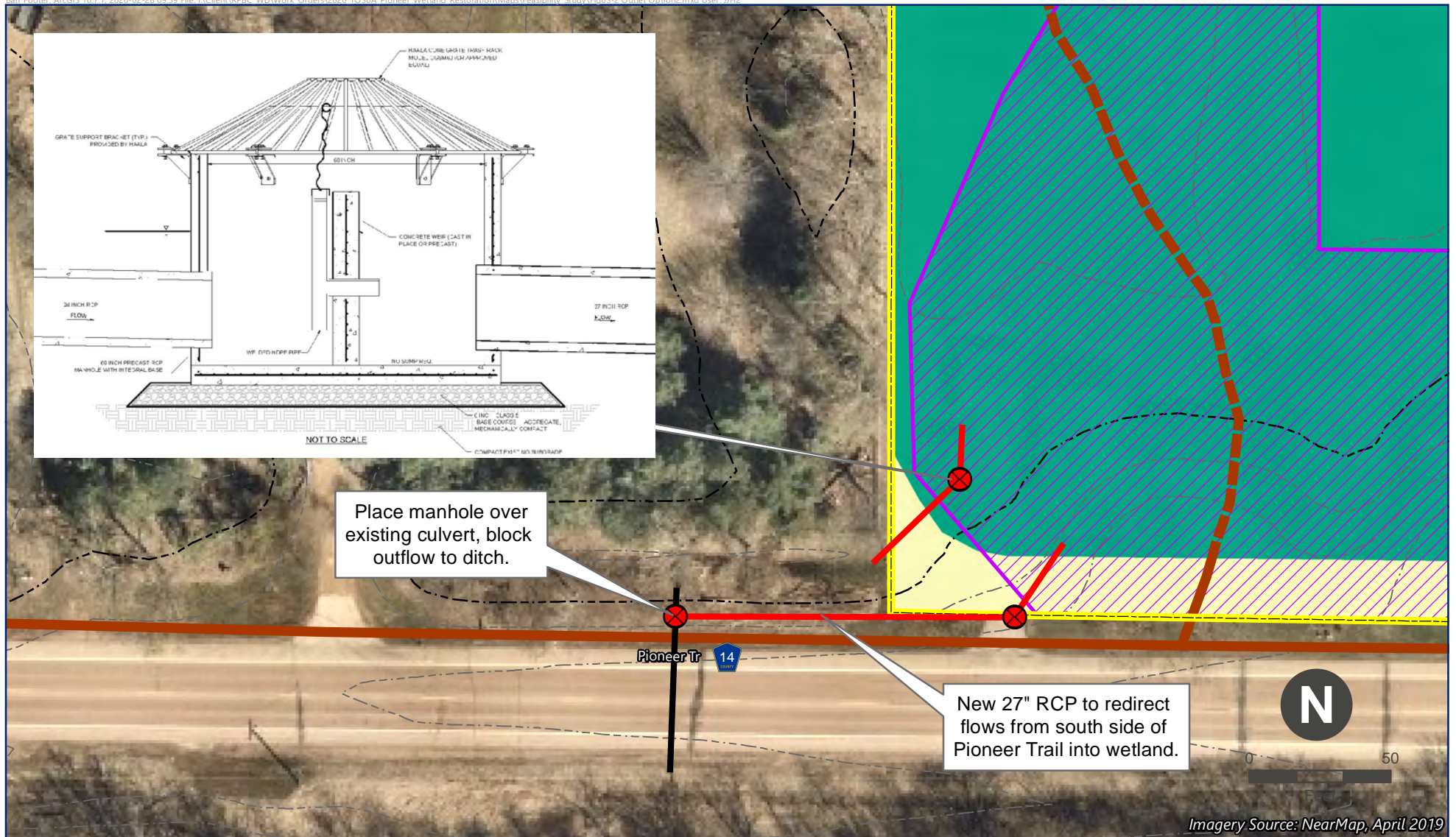
Pioneer Trail Wetland Restoration Feasibility Design Memo



- | | |
|--|--|
| <ul style="list-style-type: none"> Prairie Woodland Wet Meadow, Saturated Soil | <ul style="list-style-type: none"> Proposed Outlet Structure Proposed Outlet Pipes Existing Pipes Path (Dashed for Boardwalk) Remove Fill Project Boundary |
|--|--|

**Proposed Outlet Option 1:
48" Overflow Structure
and 24" Outlet Pipe**

FIGURE 3-1



Pioneer Trail Wetland Restoration Feasibility Design Memo



<p>Concept A Areas</p> <ul style="list-style-type: none"> Prairie Woodland Wet Meadow, Saturated Soil 	<ul style="list-style-type: none"> Proposed Outlet Structure Proposed Outlet Pipes Existing Pipes Path (Dashed for Boardwalk) Remove Fill Project Boundary
---	--

Proposed Outlet Option2:
 60" Overflow Structure with Weir and Orifice,
 24" Inlet Pipe
 and 27" Outlet Pipe

FIGURE 3-2

Figure 3-3. Wetland Elevation-Duration Curves

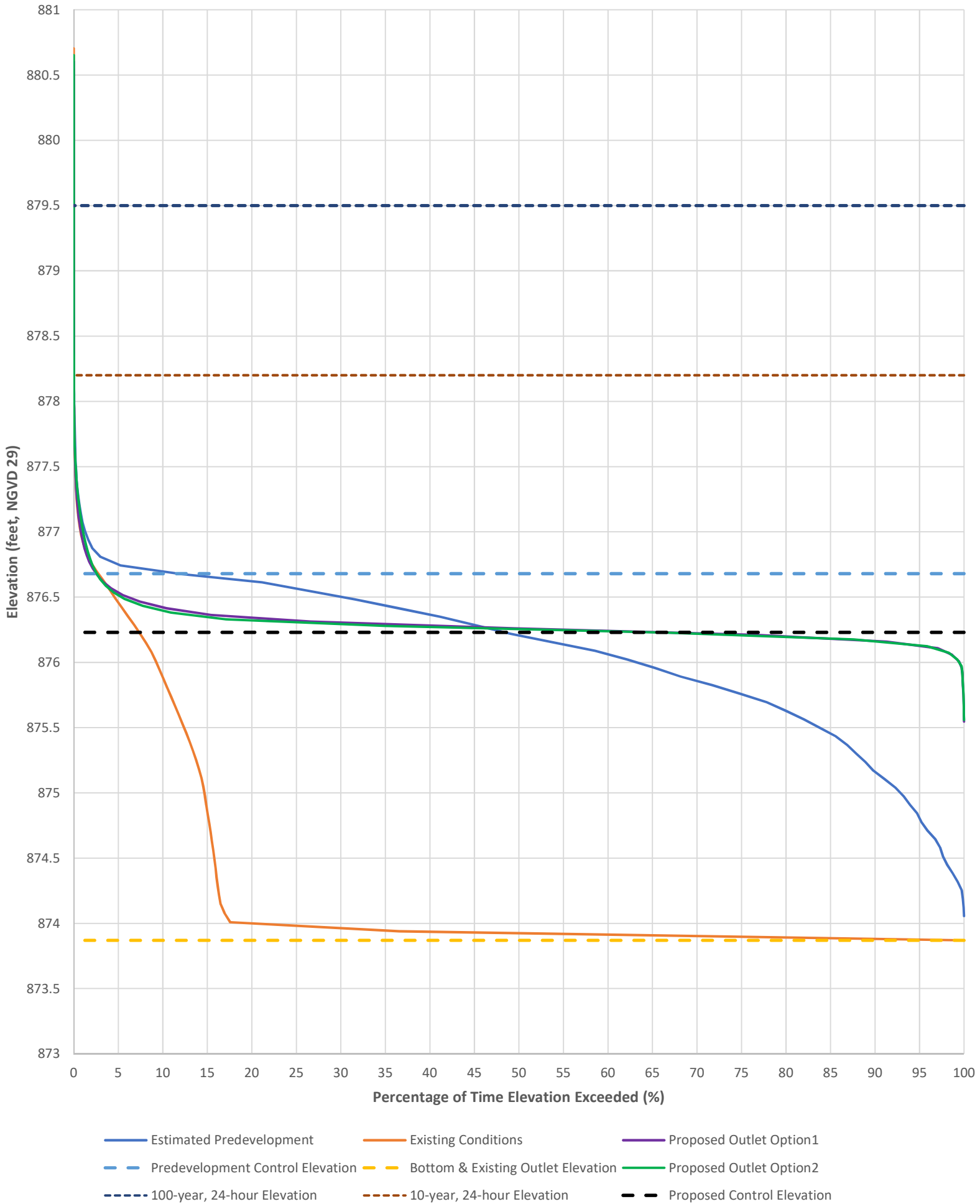
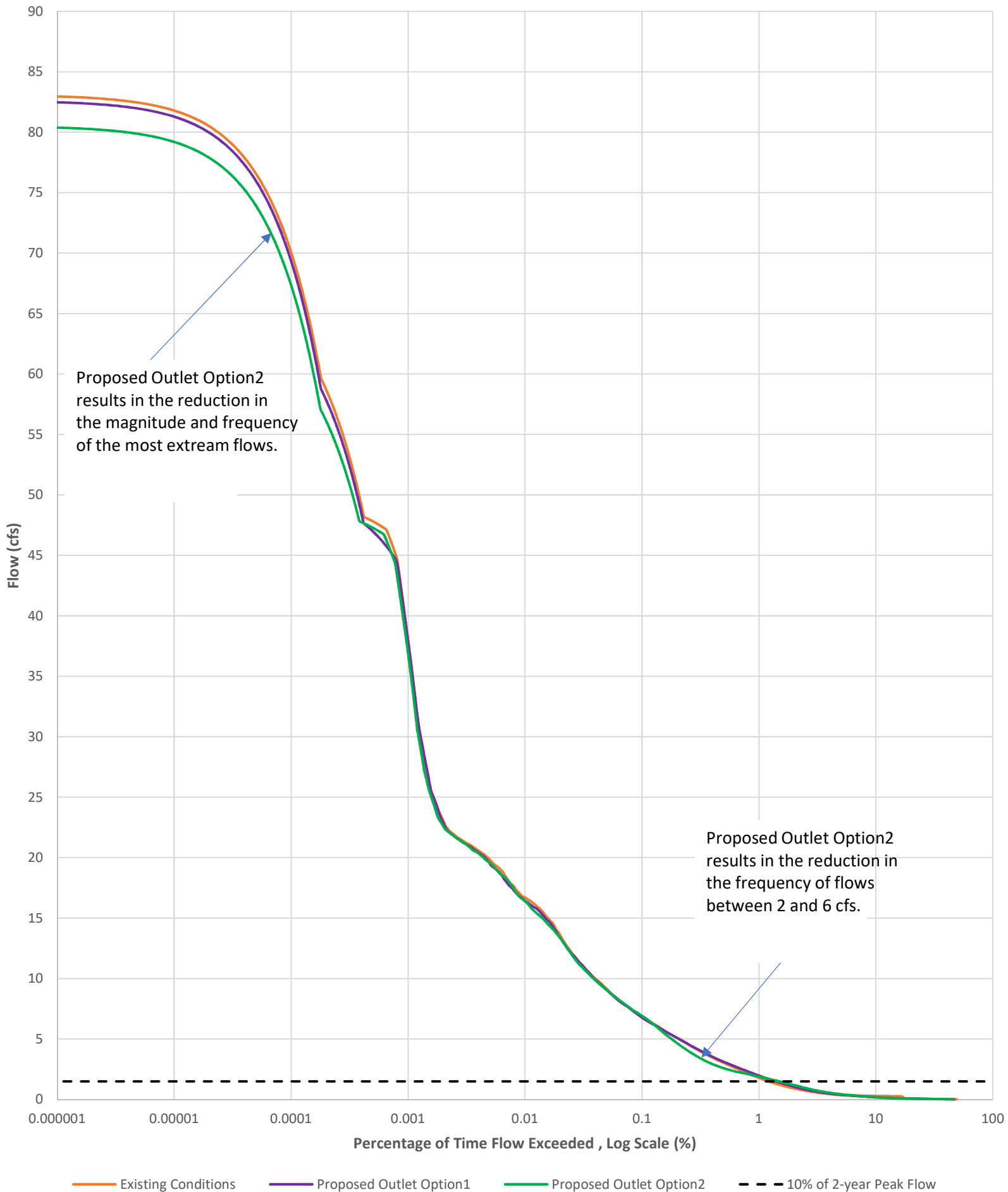


Figure 3-4. Wetland Downstream Ditch Flow-Duration Curves



3.3 Conceptual Plan A

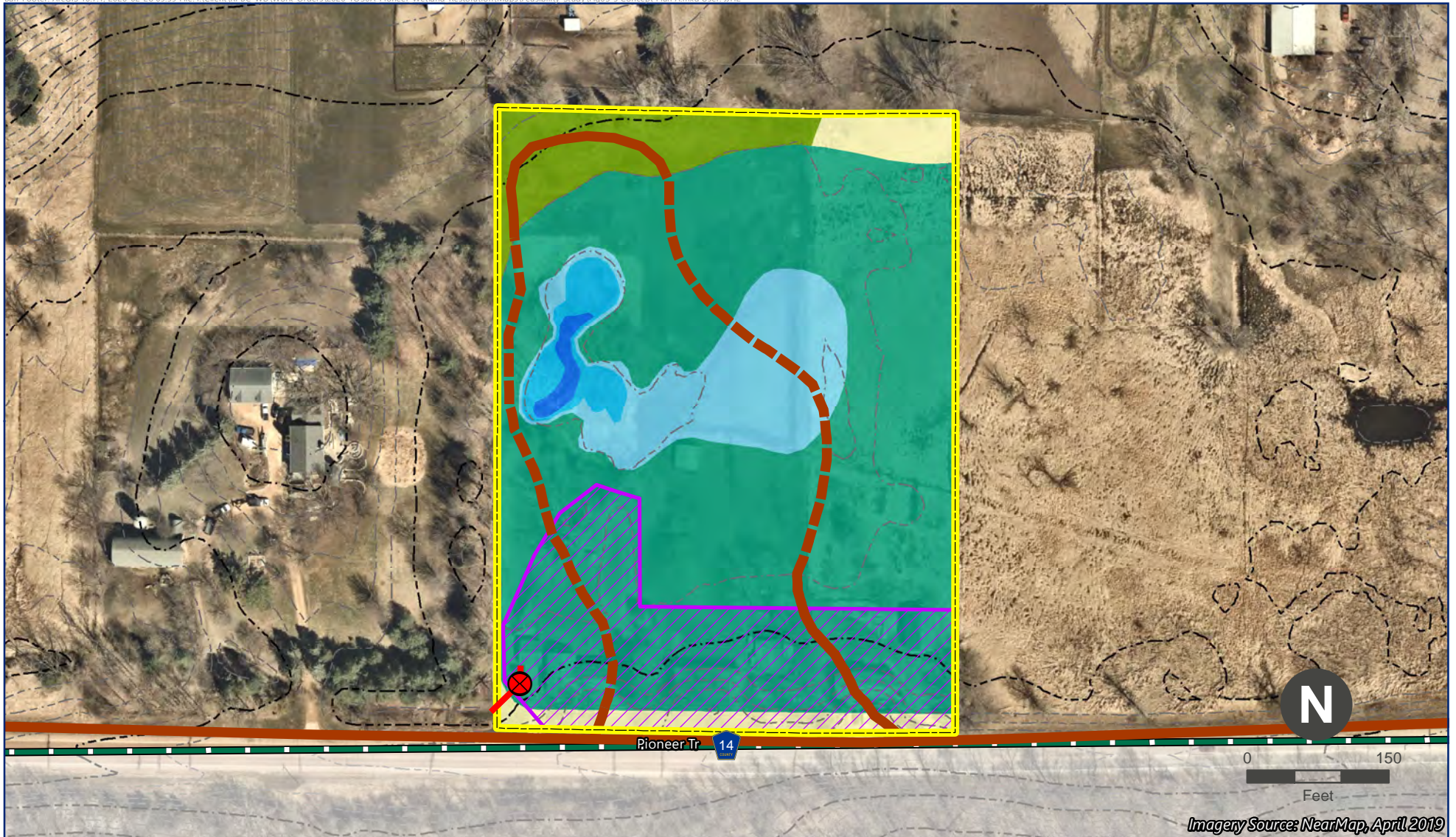
Conceptual Plan A restores the site to as close as predevelopment conditions as possible while minimizing alterations in the wetland area. The conceptual design is shown in Figure 3-5. The plan will look the same for both outlet options discussed in sections 3.1 and 3.2.

The purple, hatched area along the north side of Pioneer Trail delineates the approximate area where fill material will be removed to return the grading to predevelopment elevations and allow wetland vegetation to grow up to Pioneer Trail, similar to what is seen just east of the project site. Further site investigation will be needed to determine the exact extent of the fill material. Removing the fill material will also require the removal of a couple dozen trees around the former residences. Trees in the unfilled areas will not be removed.

This plan will also remove the berm that runs north to south across the eastern portion of the site (Figure 2-6) and fill in the ditch network (Figure 2-6) that crisscrosses the site to restore the hydrology. The existing outlet structures and pipes, including draintile, will be either removed or bulkheaded.

Once the hydrology of the site is restored, native wetland vegetation will be re-established across much of the site, restoring approximately 6.5 acres of what is currently covered in cattails, turf and reed canary grass. Planting activities would include plowing or disking for seed bed preparation. Some areas north of Pioneer Trail and the north side of the site may remain dry enough to support native upland vegetation such as prairie grasses and woods and would provide an upland buffer to the wetland. Most of the site will be covered in a wet meadow saturated soil conditions and sedge meadow with <0.5 feet of standing water. Based on the existing topography, there will be some areas with deeper water, up to 2 feet deep, that could support more water tolerant wetland vegetation or emergent macrophytes.

An optional trail/boardwalk loop concept is also shown on Figure 3-5. This loop would eventually connect to the planned trail along Pioneer Trail and link in with the existing trail along Highway 101. In addition to improving the site's aesthetics, the boardwalk/trail loop would improve access and provide the district with opportunities to educate visitors at the site.



Imagery Source: NearMap, April 2019

Pioneer Trail Wetland Restoration Feasibility Design Memo



Concept A Areas

- Prairie
- Woodland
- Wet Meadow, Saturated Soil
- Open Water Area, Depth >0.5 feet
- Open Water Area, Depth >1.0 foot
- Open Water Area, Depth >2.0 feet

- Proposed Outlet Structure
- Proposed Outlet Pipes
- Path (Dashed for Boardwalk)
- Remove Fill
- Project Boundary
- Watershed District Boundary

**CONCEPT PLAN A:
MINIMAL EXCAVATION
TO REMOVE FILL AND
GRADING TO FILL DITCHES**

FIGURE 3-5

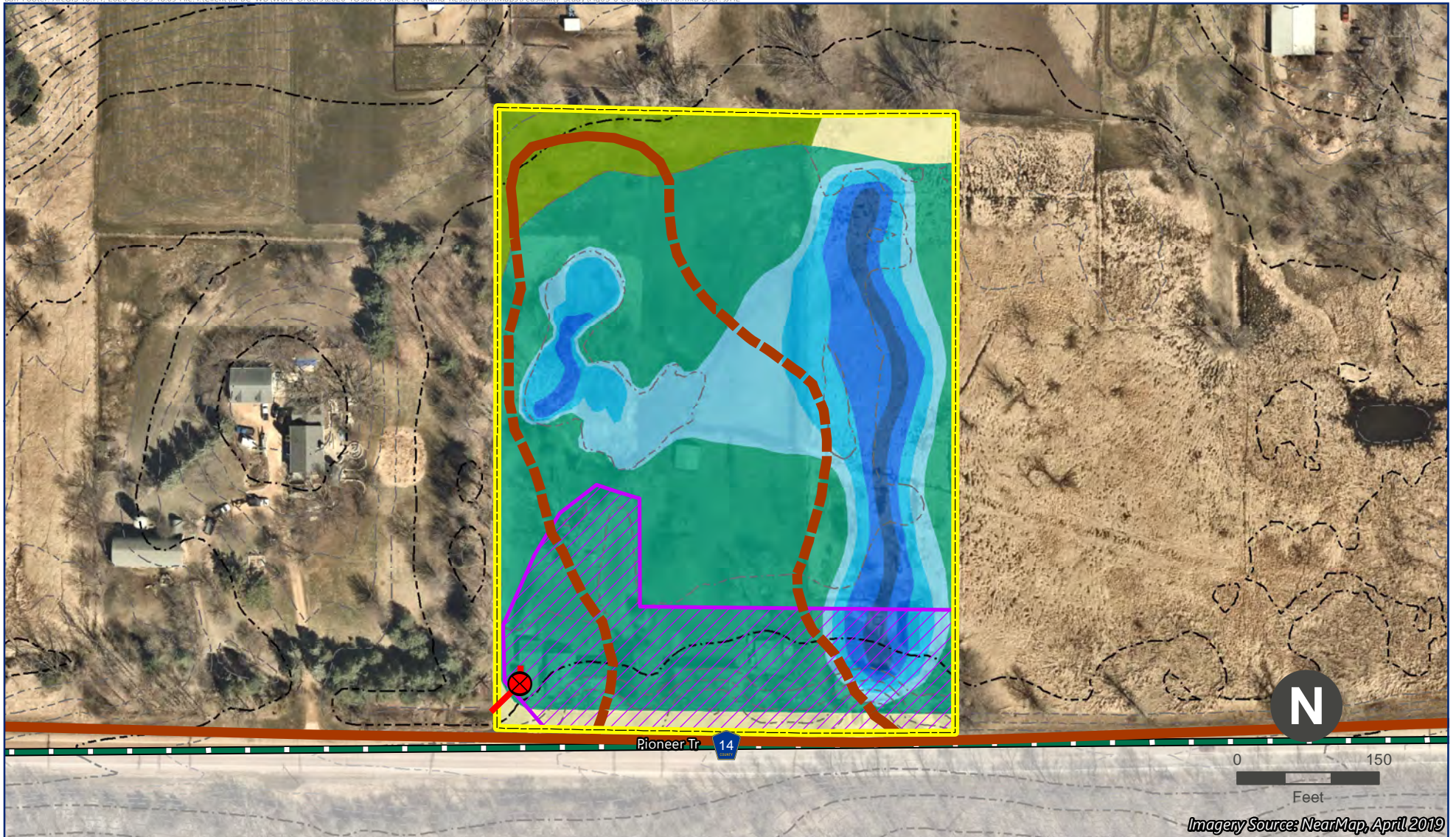
3.4 Conceptual Plan B

The Conceptual Plan B design is shown in Figure 3-6Figure 3-5. The plan will look the same for both outlet options discussed in sections 3.1 and 3.2. Conceptual Plan B is similar to Conceptual Plan A but would have additional excavation of the site to increase the open water areas and provide vegetative enhancement with diverse native wetland communities.

The purple, hatched area along the north side of Pioneer Trail delineates the approximate area where fill material will be removed to return the grading to predevelopment elevations and allow wetland vegetation to grow up to Pioneer Trail, similar to what is seen just east of the project site. Further site investigation will be needed to determine the exact extent of the fill material. Removing the fill material will also require the removal of a couple dozen trees around the former residences. Trees in the unfilled areas will not be removed.

This plan will also remove the berm that runs north to south across the eastern portion of the site (Figure 2-6). The existing outlet structures and pipes, including draitile, will be either removed or bulkheaded. Additional excavation would occur near the center of the site where the existing drainage ditches are located. The surface, hydric soils would be stockpiled and replaced after the excavation was complete. The deeper water areas shown in Figure 3-6 are for illustrative purposes only, the exact extend and depth of the excavation have not been determined.

Once the removals are complete, native wetland vegetation will be re-established across much of the site, restoring approximately 6.5 acres of what is currently covered in cattails, turf and reed canary grass. Planting activities would include plowing or disking for seed bed preparation. Like Conceptual Plan A, small areas north of Pioneer Trail and the north side of the site may remain dry enough to support native upland vegetation such as prairie grasses and woods and would provide an upland buffer to the wetland. Most of the site will still be covered in a wet meadow with saturated soil conditions and shallow marsh areas with (<0.5 feet) of standing water. The excavated areas will provide expanded areas with deeper water that could support more water-tolerant wetland vegetation and emergent macrophytes with as much as 2.5 feet of standing water. The optional recreational trail/boardwalk loop concept shown on Figure 3-6 is the same as Conceptual Plan A's and would provide the same connections and educational opportunities.



Pioneer Trail Wetland Restoration Feasibility Design Memo



Concept B Areas

- Prairie
- Woodland
- Wet Meadow, Saturated Soil
- Open Water Area, Depth >0.5 feet
- Open Water Area, Depth >1.0 foot
- Open Water Area, Depth >2.0 feet
- Open Water Area, Depth ~2.5 feet

- Proposed Outlet Structure
- Proposed Outlet Pipes
- Path (Dashed for Boardwalk)
- Remove Fill
- Project Boundary
- Watershed District Boundary

**CONCEPT PLAN B:
ADDITIONAL EXCAVATION
TO EXPAND
OPEN WATER AREA AND
GRADING TO FILL DITCHES**

FIGURE 3-6

3.5 Engineer's Opinion of Probable Cost

The Engineer's opinion of probable cost is reported as a range of probable costs. The range reflects the level of uncertainty, unknowns, and risk associated with the level of design completed. Based on the current level of design, the cost range for construction, planning engineering and design, permitting, construction management, and contingency is estimated as \$400,000 to \$927,000. The optional recreation footpath and boardwalk could add between \$339,000 to \$550,000 to the overall project cost.

Table 3-3 provides a summary of conceptual plan and outlet option Opinion of Probable Costs. Detailed cost breakdowns are provided in Appendix B.

Table 3-3 Summary of Conceptual Plan and Outlet Option Opinion of Probable Costs

Conceptual Plan and Outlet Option	Opinion of Probable Costs
Conceptual Plan A with Outlet Option1 (Excludes Footpath and Boardwalk)	\$500,000 (\$400,000 - \$650,000)
Conceptual Plan A with Outlet Option2 (Excludes Footpath and Boardwalk)	\$630,000 (\$504,000 - \$819,000)
Conceptual Plan B with Outlet Option1 (Excludes Footpath and Boardwalk)	\$594,000 (\$476,000 - \$773,000)
Conceptual Plan B with Outlet Option2 (Excludes Footpath and Boardwalk)	\$731,000 (\$571,000 - \$927,000)
Optional Footpath and Boardwalk	\$423,000 (\$339,000 - \$550,000)

3.6 Regulatory Review

A preliminary agency meeting was held at the RPBCWD office on February 11, 2020 with the following participants:

- Masha Hoy, Carver County Watershed Management Organization
- Ben Carlson, Minnesota Board of Water and Soil Resources
- Aaron Finke, Carver County Soil and Water Conservation District
- Terry Jeffery, RPBCWD
- Andi Moffatt, WSB for the City of Chanhassen
- Scott Sobiech, Karen Wold (Jay Hawley-on call), Barr Engineering for the RPBCWD
- Marissa Merriman, USACE (remote)

Site information and modeling results were presented during the meeting to discuss the proposed project, provide conceptual options, and request comments to develop feasibility and conceptual design plans for the project. Agency responses were generally supportive of the project and no significant issues or concerns were identified.

Due to funding sources associated with the proposed project, the project cannot receive wetland restoration credits. This simplifies the regulatory process for this project.

Both conceptual plans are anticipated to result in no-loss activity under 8420.0415 of the Minnesota Wetland Conservation Act (WCA) rules or the wildlife habitat exemption under 8420.0420 Subpart 9 and therefore, would not require wetland replacement.

Both conceptual plan options are also anticipated to be authorized by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Federal Clean Water Act through the Nationwide Permit (NWP) 27 for aquatic habitat restoration, enhancement, and establishment activities or the NWP 43 for stormwater management facilities. To avoid USACE wetland mitigation requirements, excavation within delineated wetlands will need to be conducted by scooping and not grading and redistributing soil to the extent possible. Grading and redistributing soil within a wetland is considered discharge of dredged or fill material and is treated as a wetland impact. Removing hydric soil and replacing it after excavation is also considered a wetland impact. For the project to meet NWP conditions, wetland impacts cannot exceed 1/2 acre.

Wetland restoration projects should be designed to restore the site back to pre-settlement vegetation communities. Since this project also has the goals of providing flood water retention and downstream water quality improvements, some excavated portions of the site may result in deeper wetland regimes from what was historically present. If this is the case, the excavation should be limited to that necessary for the purpose of enhancement to provide diverse native vegetation communities.

3.7 Adjacent Property Owners

The proposed outlet configurations are designed to maintain the existing 100-year and 10-year, 24-hour flood elevations and prevent adjacent properties from experiencing more flooding than they do under existing conditions. If the project is approved by the RPBCWD Board of Managers, a public meeting will be held with adjacent property owners to present the proposed project and request comments.

4.0 Conceptual Design Summary

Table 4-1 summarizes the estimated annual total phosphorus removal and Engineer's opinion of probable cost for each of the conceptual designs considered. Table 4-2 provides a summary of the potential project benefits.

Table 4-1 Summary of Conceptual Plan and Outlet Option Combinations

Conceptual Design	Estimated Annual TP Reduction (lbs/yr) ⁽¹⁾	Estimated Annual TSS Reduction (lbs/yr) ⁽¹⁾	Engineer's Opinion of Probable Cost (\$) ⁽³⁾	Anticipated Maintenance Cost over 3-year (\$) ⁽⁴⁾	Annual Cost per Pound TP Removed (\$/lbs TP/yr) ⁽²⁾	Annual Cost per Pound TSS Removed (\$/lbs TP/yr) ⁽²⁾
	A	B	C	D	$G = (C+D) / A / 30$	$G = (C+D) / B / 30$
Conceptual Plan A with Outlet Option 1	3.8	1060	\$500,000 (\$400,000 - \$650,000)	\$56,300 (\$45,100 - \$84,500)	\$4,880 (\$3,900 - \$6,440)	\$17 (\$14 - \$23)
Conceptual Plan A with Outlet Option 2	5	1680	\$630,000 (\$504,000 - \$819,000)	\$56,300 (\$45,100 - \$84,500)	\$4,580 (\$3,660 - \$6,020)	\$14 (\$11 - \$18)
Conceptual Plan B with Outlet Option 1	3.8	1060	\$594,000 (\$476,000 - \$773,000)	\$56,300 (\$45,100 - \$84,500)	\$5,700 (\$4,570 - \$7,520)	\$20 (\$16 - \$27)
Conceptual Plan B with Outlet Option 2	5	1680	\$731,000 (\$571,000 - \$927,000)	\$56,300 (\$45,100 - \$84,500)	\$5,130 (\$4,110 - \$6,740)	\$15 (\$12 - \$20)

Note(s):

- (1) Estimated annual total phosphorus (TP) and total suspended solids (TSS) reductions are the removal in the wetland, the BMP performance was evaluated over a 70-year period (1949-2019).
- (2) Based on a 30-year period. Includes estimated costs for permitting, engineering, and construction; and estimated annual operation and maintenance costs.
- (3) Estimate includes all wetland restoration costs
- (4) Anticipated annual maintenance cost includes spot herbicide treatments and mowing.

Table 4-2 Project Benefit Summary

Benefits	Qualitative Discussion	Metric
Habitat (acres)	Restore drained and degraded wetland dominated by invasive vegetation, to high quality native wetland communities providing wildlife and amphibian habitat. Adjacent prairie may provide pollinator habitat for the federally endangered rusty patched bumble bee	Approximately 6 acres of restored wetland and adjacent upland buffer.
Wetland Management Class	Anticipated to improve from current classification. Primarily wet/sedge meadow, shallow marsh with small area of deep marsh vegetation communities anticipated to increase from low ratings to moderate or high ratings. Additional functional ratings anticipated to increase may include amphibian habitat, wildlife habitat, and recreational/aesthetics ratings.	
Pollutants ¹ (e.g., TP, TSS, etc; lbs)	Reduce TP and TSS load to reduce movement of eroded soil and nutrients to Bluff Creek	Reduce TSS by 1060-1680 lbs/yr; Reduce TP by 3.8-5 lbs/yr
Flood Storage (acre feet)	Increased flood storage by removal of fill placed during home construction but lost storage due to raising outlet elevation to retain more water.	Increases net storage below the 100-year flood elevation by ~0.15 acre-feet.
Abstraction (cubic ft)	Increase detention of runoff in the restored wetland will promote additional evapo-transpiration from the area. Increasing native plants should also improve infiltration.	Metric cannot be measured in the context of this Project.
Community Reach	The optional, recreational trail/boardwalk would allow for public accessibility; public hearing held prior to RPBCWD Board ordering project; will hold neighborhood meetings prior to construction; plans for future interpretive signage	
Flow Reduction (fps, cfs, psf, etc.)	Outlet option 2 reduces the frequency of 2-5 cfs flows to reduce erosion and scour potential while also reducing magnitude of most extreme flows Outlet improvements create water levels within 0.5 feet of the predevelopment elevations more than 70 percent of the time.	

Of the conceptual outlet designs evaluated, Outlet Option 2 is recommended due to downstream benefits of reduced TP, TSS, and flow reductions. Conceptual Plan A with Outlet Option 2 provides downstream benefits with traditional wetland restoration. While Conceptual Plan B with Outlet Option 2 provides the same downstream benefits, the additional excavation in Conceptual Plan B does not mimic pre-settlement conditions but would provide more variety of wetland community types which may be desirable from an aesthetic perspective.

The optimization of the chosen design would need to be coordinated with the city of Chanhasen to ensure that the design meets the city’s wetland management guidelines.

5.0 Schedule of Activities

Table 5-1 summarizes an estimated schedule of anticipated tasks if the RPBCWD Board of Managers authorize final design of a wetland restoration project.

Table 5-1 Potential Schedule of Activities

Implementation Element	
Feasibility (this report)	February-March 2020
Board Order Project	March 2020
Wetland delineation and survey	Submittal in June. Approval and concurrence in August 2020.
Pre-application regulatory meetings	June 2020
Restoration Design	March – August 2020
Application submittal	August 2020, receiving approvals and permits October 2020
Bid Period and Opening	September 2020
Award	October 2020
Construction	October -November 2020
Warranty Period, Easement Recordation	May 2021-2023
Establishment Period	2021-2025

6.0 Agreements

Table 6-1 summarizes anticipated agreements required prior to construction of a wetland restoration project.

Table 6-1 Summary of Anticipated Agreements

Description	Notes	Period	Lead Organization
Property Transfer	The City of Chanhassen currently owns one of the parcels. The agreement will include a plan for transfer of ownership to RPBCWD.	2020	RPBCWD and city of Chanhassen
Potential Agreement with private property owner(s).	A public meeting will be held to discuss the proposed project and request comments. Vegetation management in the wetland adjacent to the project area is recommended to prevent the spread of invasive vegetation into the project site. This would result in the need for agreements with adjacent residential property owner(s) of residential property to construct the wetland restoration project.	2020	RPBCWD

7.0 Recommendation

Based on the results of the engineering assessment, potential site impacts, and phosphorous removed, Conceptual Plan A with Outlet Option 2, is recommended as the most feasible wetland restoration plan. The engineering assessment was based on information collected during a review of available data and preliminary site characterization. Conceptual Plan A with Outlet Option 2 wetland restoration is a feasible project included in RPBCWD's 10-year plan and is consistent with the project specific goals including helping improve and protect the water quality of waters located downstream.

The engineer opinion of probable cost for the design, permitting, and construction of Conceptual Plan A with Outlet Option 2 is \$630,000 with a potential range of \$504,000 to \$819,000 based on the current level of design. As plans and specifications for the recommended conceptual design are prepared, the District should continue to collaborate with city of Chanhasen staff about plan details. If the Board elects to pursue the project, it is recommended that coordination with the city of Chanhasen start in the near term to transfer the remaining parcel to district ownership in advance of the project implementation.

Additionally, it is recommended that the RPBCWD monitor wetland restoration site 5 years after construction and periodically after that as well. This monitoring will be used to document whether project goals are being met.

8.0 References

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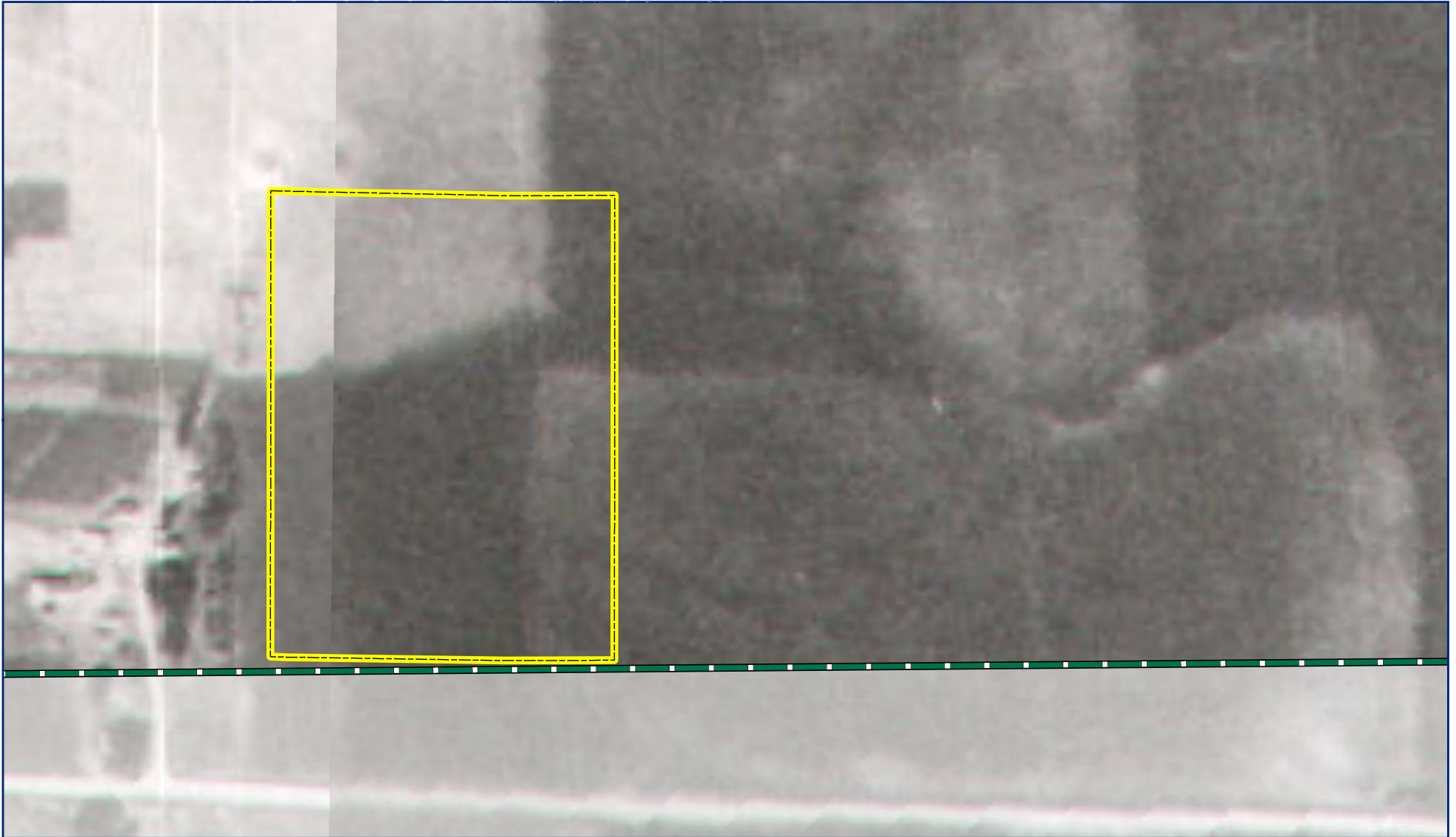
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http://www.dnr.state.mn.us/sitertools/data_software_license.html

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Appendix A

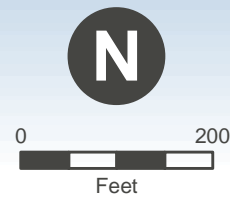
Historical Aerial Imagery



Pioneer Trail Wetland Restoration Feasibility Design Memo

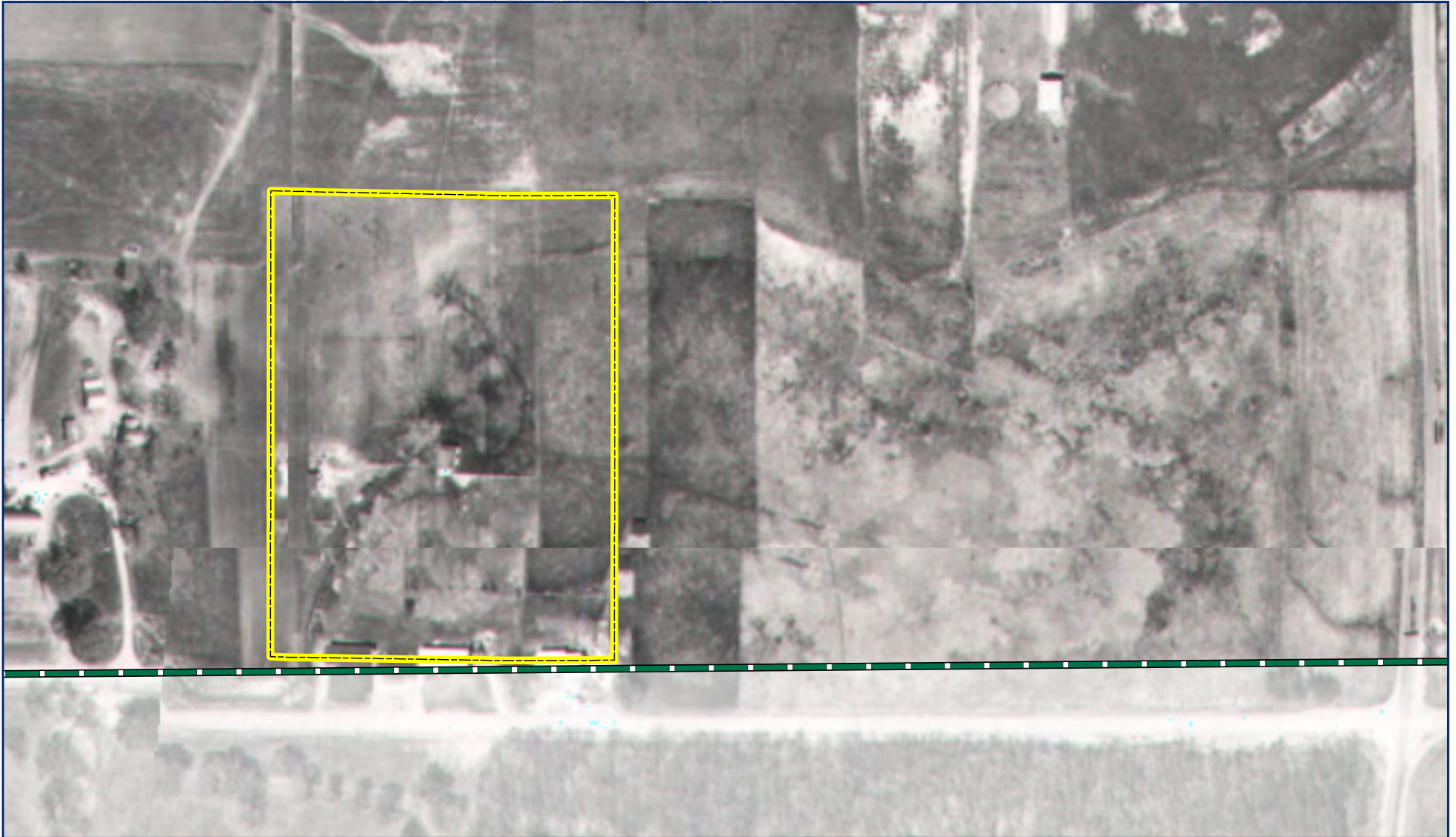


-  Project Boundary
-  Watershed District Boundary





Imagery Source: Carver County, 1937

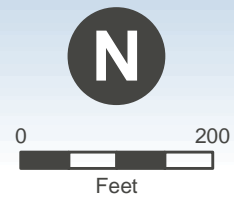
FIGURE A-1



Pioneer Trail Wetland Restoration Feasibility Design Memo

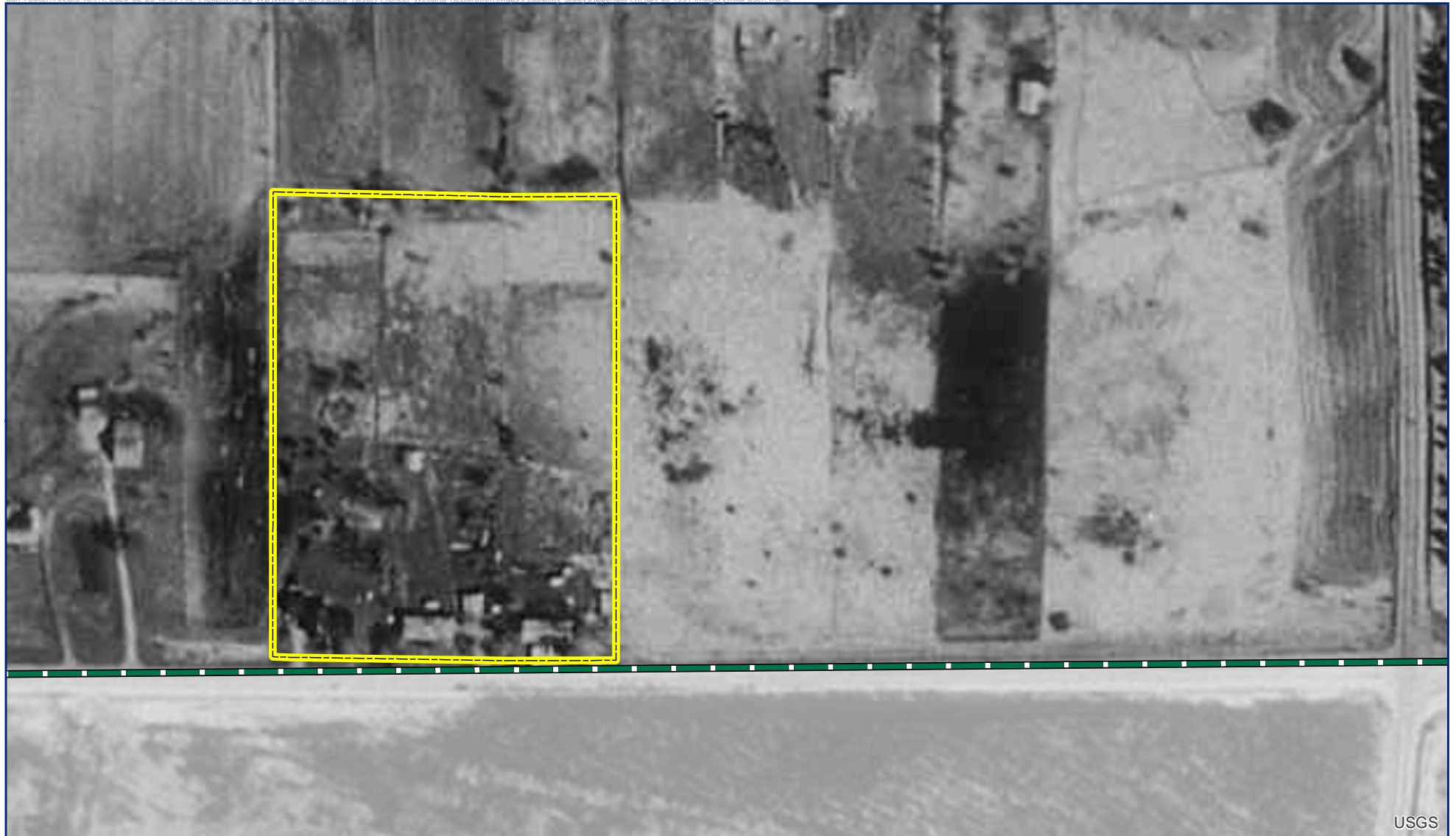


-  Project Boundary
-  Watershed District Boundary





Imagery Source: Carver County, 1969

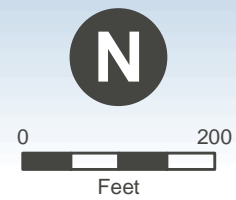
FIGURE A-2



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



1991 IMAGERY



FIGURE A-3

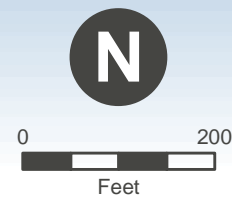
Imagery Source: USGS, 1991



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



Imagery Source: MetCouncil, 1997



1997 IMAGERY

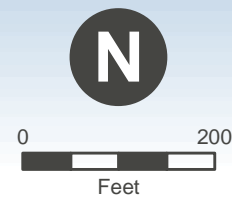
FIGURE A-4



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



2000 IMAGERY



FIGURE A-5

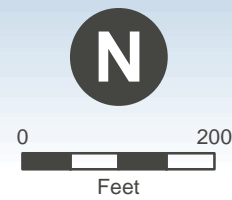
Imagery Source: MetCouncil, 2000



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



2002 IMAGERY

FIGURE A-6



Imagery Source: Aerials Express, 2002

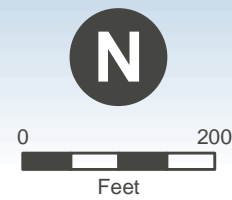


Carver County GIS, Aerometric

Pioneer Trail Wetland Restoration Feasibility Design Memo



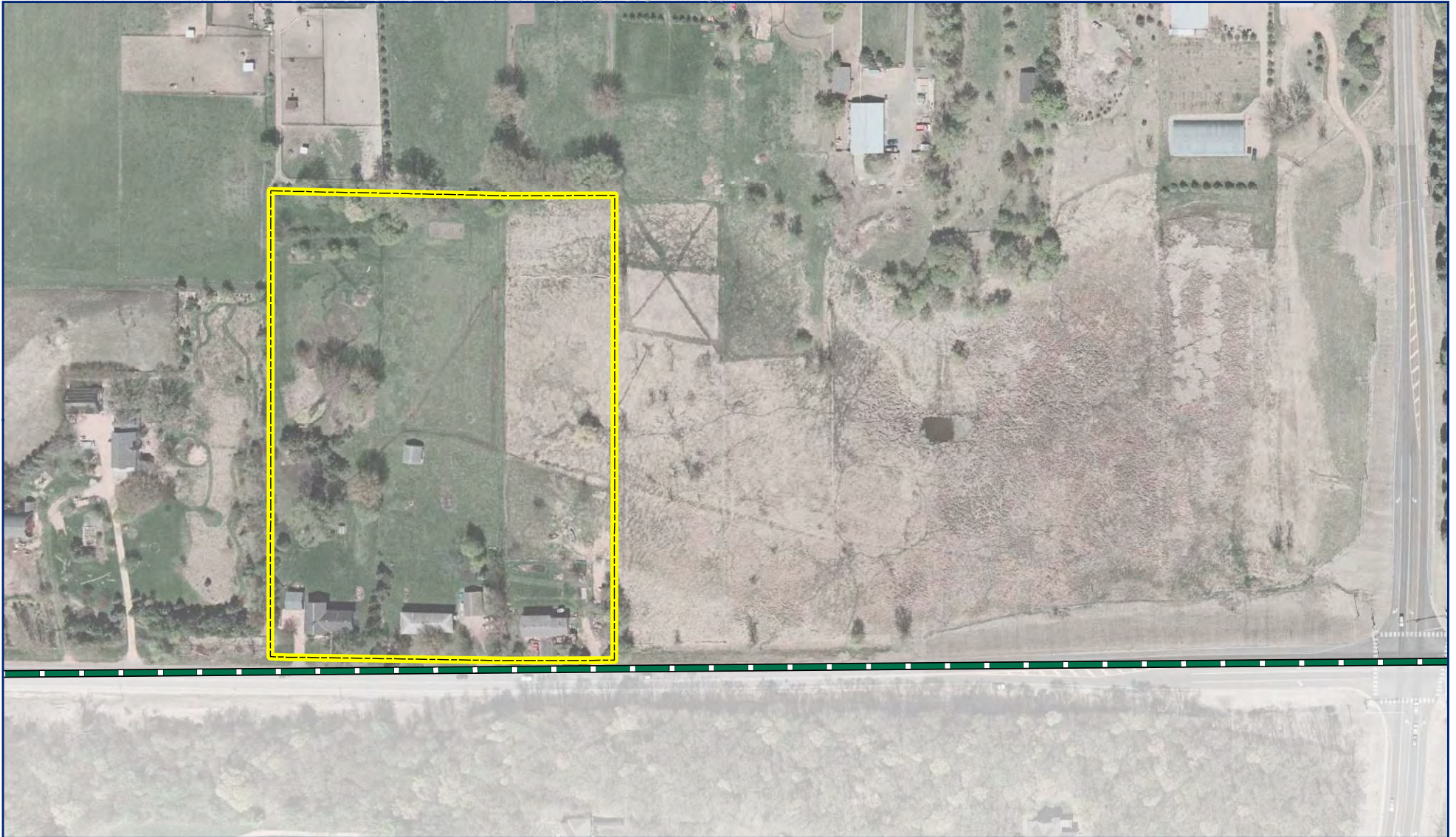
-  Project Boundary
-  Watershed District Boundary



2005 IMAGERY



FIGURE A-7

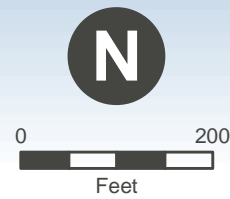
Imagery Source: Carver County, 2005



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary





Imagery Source: USGS, 2006

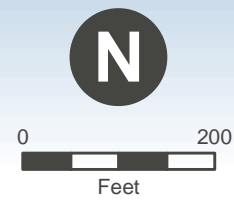
FIGURE A-8



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary





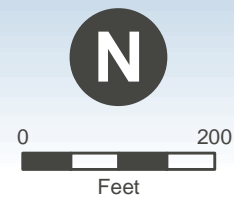


Carver County GIS, Pictometry

Pioneer Trail Wetland Restoration Feasibility Design Memo



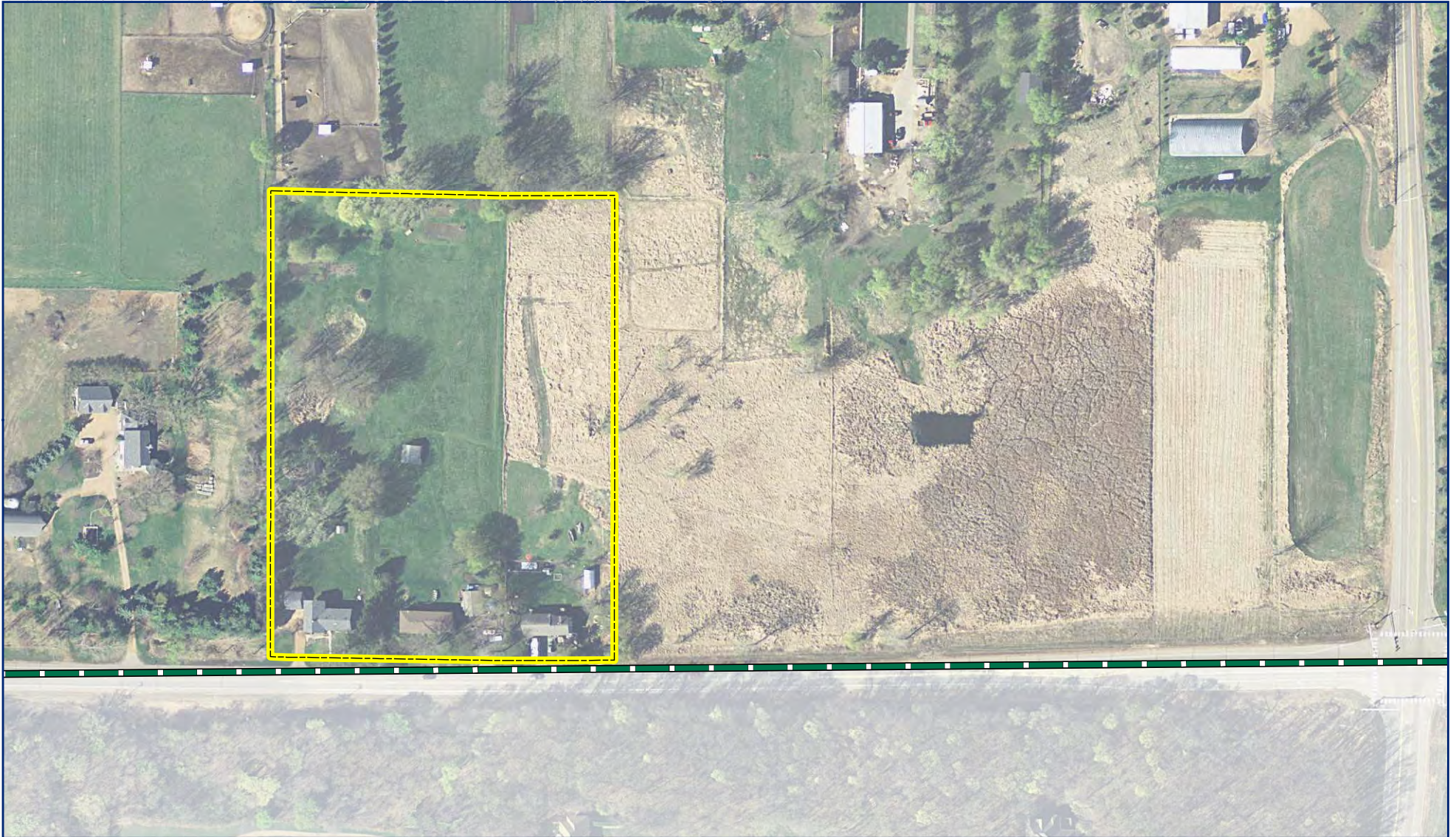
-  Project Boundary
-  Watershed District Boundary



2011 IMAGERY



FIGURE A-10

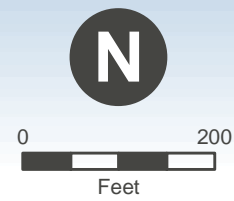
Imagery Source: Carver County, 2011



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



2012 IMAGERY

FIGURE A-11



Imagery Source: USGS, 2012

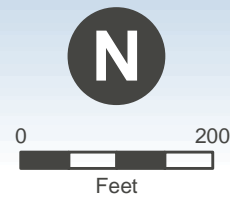


Carver County GIS, Aerometric

Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary





Imagery Source: Carver County, 2013

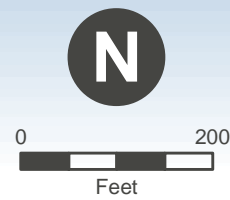


Carver County & Pictometry International

Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



2014 IMAGERY

FIGURE A-13



Imagery Source: Carver County, 2014

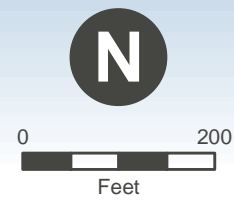


Carver County & Suredex Corporation

Pioneer Trail Wetland Restoration Feasibility Design Memo



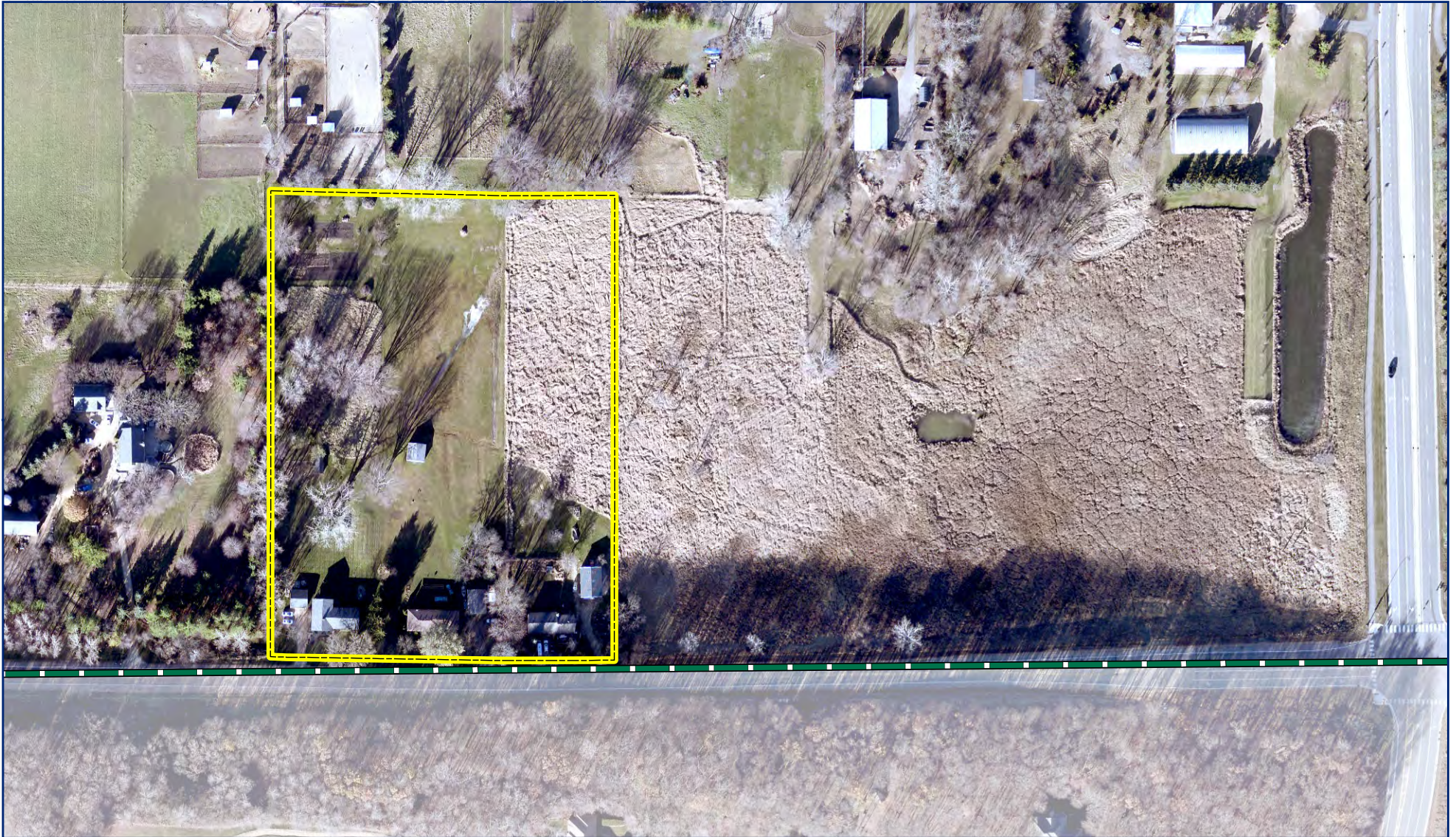
-  Project Boundary
-  Watershed District Boundary



2016 IMAGERY



FIGURE A-14

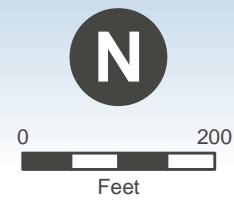
Imagery Source: MetCouncil, 2016



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary





Imagery Source: Carver County, 2017

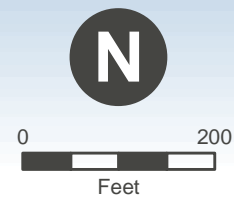
FIGURE A-15



Pioneer Trail Wetland Restoration Feasibility Design Memo



-  Project Boundary
-  Watershed District Boundary



Appendix B

Engineer's Opinion of Probably Cost

1.0 Cost Estimate

Engineer's opinions of probable costs for design, permitting, and construction were developed for each conceptual design. These opinions of costs, project reserves, contingency, documentation and discussion are intended to provide background information for feasibility alternatives assessment, analysis purposes and budget authorization by the RPBCWD. The cost of time escalation is not included in the opinions of probable cost. All costs are presented in 2020 US dollars.

Quantities were estimated with calculations based on available information presented in previous sections. Dimensions, areas, and volumes for construction were estimated using excel, GIS and manufacturer information.

Unit costs are based on recent bid prices, published construction cost index resources, and similar stormwater BMP and wetland restoration projects. Unit process were developed and compared to similar project prices. Costs associated with Base Planning Engineering and Design (PED) are based on percentages of estimated construction cost and are within a range similar to those used in past projects designed by Barr. Costs associated with Construction Management (CM) are based on estimated costs to manage the construction process, based on Barr's experience with similar projects, but may change depending on the services that are provided during construction. The estimates also include Permitting and Regulatory Approvals, which is intended to account for additional planning, coordination, and mitigation costs that are likely to be incurred as the project is permitted with environmental agencies.

The opinions of cost include tasks and items related to engineering and design, permitting, and constructing each conceptual design. The opinions of cost do not include other tasks following construction of each alternative presented such as operations and maintenance, or monitoring.

Contingency used in these opinions of probable cost are intended to help identify an estimated construction cost amount for the minor items included in the current Project scope, but have not yet been quantified or estimated directly during the feasibility evaluation. Stated another way, contingency is the resultant of the pluses and minuses that cannot be estimated at the level of project definition that exists. The contingency includes the cost of ancillary items not currently itemized in the quantity summaries but

commonly identified in more detailed design and required for completeness of the work. A 25% contingency is applied to the estimated construction cost to account for the costs of these items.

Industry resources for cost estimating (*AACE International Recommended Practice No. 18R-97*, and *ASTM E2516-06 Standard Classification for Cost Estimate Classification System*) provide guidance on cost uncertainty, depending on the level of project design developed. The opinion of probable cost for the alternatives evaluated generally corresponds to a Class 4 estimate characterized by completion of limited engineering and use of deterministic estimating methods. As the level of design detail increases, the level of uncertainty is reduced. Figure B-1 provides a graphic representation of how uncertainty (or accuracy) of cost estimates can be expected to improve as more detailed design is developed.

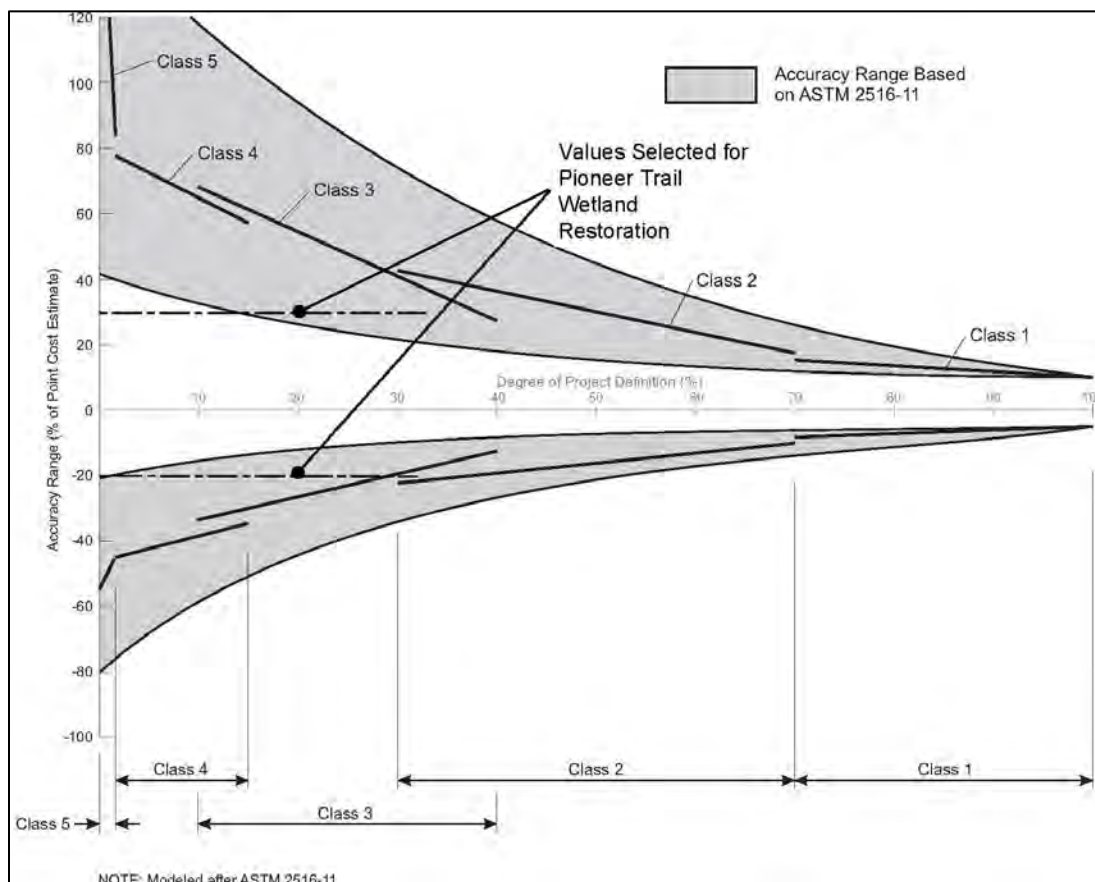


Figure B-1 Relationship between Cost Accuracy and Degree of Project Definition

At this early stage of design, the range of uncertainty of total project cost is high. Due to the early stage of design, it is standard practice to place a broad accuracy range around the point cost estimate.

The accuracy range is based on professional judgment considering the level of design completed, the complexity of the project, and the uncertainties in the project scope; the accuracy range does not include costs for future scope changes that are not part of the project as currently defined or risk contingency. The estimated accuracy range for this point estimate is -20% to +30%.

The opinion of probable cost provided in this memorandum is made on the basis of Barr Engineering's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. It is acknowledged that additional investigations and additional site specific information that becomes available in the next stage of design may result in changes to the proposed configuration, cost and functioning of project features. This opinion is based on project-related information available to Barr Engineering at this time and includes a conceptual-level feasibility design of the project. The opinion of cost may change as more information becomes available and further design is completed. In addition, because we have no control over the eventual cost of labor, materials, equipment or services furnished by others, or over the contractor's methods of determining prices, or over competitive bidding or market conditions, Barr Engineering cannot and does not guarantee that proposals, bids, or actual costs will not vary from the opinion of probable cost presented in this memorandum. If the RPBCWD wishes greater assurance as to the probable project cost, the RPBCWD should authorize further investigation and design of a selected alternative.

Table B-1 provides a comparison of the opinion of costs for each of the four conceptual design combinations plus the optional floatpath and boardwalk. These costs assume that all work will be completed within City owned parcels or in private parcels where permission to work has been granted. These costs also assume that no purchase of additional easements will be required. Table B-3 through Table B-7 include opinion of cost for each of the four conceptual design combinations plus the optional floatpath and boardwalk..

Table B-1 Engineer’s Opinion of Probable Cost – Feasibility Estimate Summary

Conceptual Design	Engineer’s Opinion of Probable Cost (\$)⁽¹⁾
Concept A with Outlet Option1 (Excludes Footpath and Boardwalk)	\$500,000 (\$400,000 - \$650,000)
Concept A with Outlet Option2 (Excludes Footpath and Boardwalk)	\$630,000 (\$504,000 - \$819,000)
Concept B with Outlet Option1 (Excludes Footpath and Boardwalk)	\$594,000 (\$476,000 - \$773,000)
Concept B with Outlet Option2 (Excludes Footpath and Boardwalk)	\$731,000 (\$571,000 - \$927,000)
Optional Footpath and Boardwalk	\$423,000 (\$339,000 - \$550,000)
Note(s): (1) Approximate values based on available information. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%.	

The opinions of costs above do not include the cost to maintain the wetland and its outlet structures following restoration. The planning level cost to maintain the wetland and its outlet structures over a 30 year period are provided in Table B-2.

Table B-2 Engineer’s Opinion of Probable Maintenance Cost – Feasibility Estimate Summary

Conceptual Design	Engineer’s Opinion of Probable Maintenance Cost Over a 30 Year Lifecycle (\$)⁽¹⁾
Concept A with Outlet Option1 (Excludes Footpath and Boardwalk)	\$56,300 (\$45,100 - \$84,500)
Concept A with Outlet Option2 (Excludes Footpath and Boardwalk)	\$56,300 (\$45,100 - \$84,500)
Concept B with Outlet Option1 (Excludes Footpath and Boardwalk)	\$56,300 (\$45,100 - \$84,500)
Concept B with Outlet Option2 (excludes footpath and boardwalk)	\$56,300 (\$45,100 - \$84,500)
Optional Footpath and Boardwalk ²	-
Note(s): (1) Anticipated maintenance cost includes spot herbicide treatments and annual mowing over a 30-year period. The cost does not include management of invasive species outside of the project area. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%. (2) Operations and maintenance costs have not been calculated for this optional feature.	

2.0 References

American Society for Testing and Materials. 2006. ASTM E2516-06 Standard Classification for Cost Estimate Classification System. ASTM International, West Conshohocken, PA, DOI: 10.1520/E2516-06

Association for the Advancement of Cost Estimating. 2005. *AACE International Recommended Practice NO. 18R-97*, February 2, 2005

Table B-4 Engineer's Opinion of Probable Project Cost: Conceptual Design A with Outlet Option2 (Excludes Footpath and Boardwalk)

PREPARED BY: BARR ENGINEERING COMPANY BARR PRELIMINARY ENGINEERING REPORT ENGINEER'S OPINION OF PROBABLE PROJECT COST PROJECT: Pioneer Wetland Restoration Feasibility LOCATION: City of Chanhassen, MN PROJECT #: 23/27-0053.14-030A OPINION OF COST - SUMMARY	REV 1	SHEET: 2	OF 6
	BY: JH2		DATE: 3/1/2020
	CHECKED BY: SAS		DATE:
	APPROVED BY: SAS		DATE:
	ISSUED:	DATE:	
	ISSUED:	DATE:	
	ISSUED:	DATE:	

Engineer's Opinion of Probable Project Cost
Conceptual Design A with Outlet Option2 (Excludes Boardwalk)
 Pioneer Trail Wetland Restoration

Cat. No.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST	NOTES
A	Mobilization/Demobilization	L.S.	1	\$ 67,200	\$67,200.00	1,2,3,4,5
B	Rock Erosion Control Construction Entrance	Each	1	\$ 2,700	\$2,700.00	1,2,3,4,5
C	Clearing & Grubbing	Acre	1	\$ 5,000	\$5,000.00	1,2,3,4,5
F	Remove Existing Storm Sewer Pipe	L.F.	250	\$ 20	\$5,000.00	1,2,3,4,5
E	Remove Existing Manholes	Each	2	\$ 500	\$1,000.00	1,2,3,4,5
G	Tree Removal (<12")	Each	10	\$ 210	\$2,100.00	1,2,3,4,5
H	Tree Removal (12" to 24")	Each	6	\$ 290	\$1,740.00	1,2,3,4,5
I	Tree Removal (>24")	Each	2	\$ 350	\$700.00	1,2,3,4,5
J	Erosion Control Silt Fence	L.F.	2600	\$ 4	\$9,360.00	1,2,3,4,5
K	Erosion Control Blanket	S.Y.	4000	\$ 3	\$10,000.00	1,2,3,4,5
O	Common Excavation	C.Y.	5200	\$ 19	\$96,200.00	1,2,3,4,5
DD	Backfill with Excavated Material	C.Y.	380	\$ 4	\$1,520.00	1,2,3,4,5
D	Grading	S.Y.	18600	\$ 2	\$34,410.00	1,2,3,4,5
P	Site Restoration (Seed & Mulch)	Acre	7.32	\$ 3,500	\$25,620.00	1,2,3,4,5
Q	24" RCP Storm Sewer Class III	L.F.	8	\$ 150	\$1,200.00	1,2,3,4,5
R	27" RCP Storm Sewer Class III	L.F.	200	\$ 175	\$35,000.00	1,2,3,4,5
S	24" RCP Storm Sewer FES	Each	1	\$ 3,000	\$3,000.00	1,2,3,4,5
T	27" RCP Storm Sewer FES	Each	2	\$ 3,600	\$7,200.00	1,2,3,4,5
U	48" Manhole & Casting	Each	2	\$ 8,000	\$16,000.00	1,2,3,4,5
W	60" Outlet Control Structure and Trash Rack	Each	1	\$ 12,000	\$12,000.00	1,2,3,4,5
N	Riprap, MnDot Class II w/Type IV Geotextile	Ton	20	\$ 90	\$1,800.00	1,2,3,4,5
M	Riprap, MnDot Class III w/Type IV Geotextile	Ton	10	\$ 90	\$900.00	1,2,3,4,5
AA	Herbicide Treatment	Acre	7.32	\$ 147	\$1,076.00	1,2,3,4,5
EE	Annual Vegetation Establishment and Warranty Period (5 Years)	YR	5	\$ 12,500	\$62,500.00	1,2,3,4,5
CONSTRUCTION SUBTOTAL					\$403,000.00	1,2,3,4,5,8
CONSTRUCTION CONTINGENCY (25%)					\$101,000.00	1,5,8
ESTIMATED CONSTRUCTION COST					\$504,000.00	1,2,3,4,5,8
PLANNING, ENGINEERING & DESIGN					\$76,000.00	1,2,3,4,5,8
PERMITTING & REGULATORY APPROVALS					\$15,000.00	1,5,6,8
CONSTRUCTION MANAGEMENT					\$35,000.00	1,5,8
ESTIMATED TOTAL PROJECT COST					\$630,000.00	1,2,3,4,5,7,8
ESTIMATED ACCURACY RANGE				-20%	\$504,000.00	5,7,8
				30%	\$819,000.00	5,7,8

Notes
¹ Limited Design Work Completed (15 - 25%)
² Quantities Based on Design Work Completed.
³ Unit Prices Based on Information Available at This Time.
⁴ No Soil Borings Available, Limited Field Investigation Completed, and No Site Survey or Wetland Delineation.
⁵ This feasibility-level (Class 3, 15-25% design completion per ASTM E 2516-06) cost estimate is based on feasibility-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the Final Total Project Cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and Maintenance costs are not included.
⁶ Estimate assumes that wetland mitigation/replacement is not required since this is a wetland restoration project. Included are the cost for agency communication and application preparation for a permit from the City of Chanhassen, MN. If replacement/mitigation is required, the total cost may increase to approximately \$20,000 plus an additional \$100,000/acre of wetland disturbed.
⁷ Estimate costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.
⁸ Estimate costs are reported to nearest thousand dollars.

Table B-6 Engineer's Opinion of Probable Project Cost: Conceptual Design B with Outlet Option2 (Excludes Footpath and Boardwalk)

PREPARED BY: BARR ENGINEERING COMPANY BARR PRELIMINARY ENGINEERING REPORT ENGINEER'S OPINION OF PROBABLE PROJECT COST PROJECT: Pioneer Wetland Restoration Feasibility LOCATION: City of Chanhassen, MN PROJECT #: 23/27-0053.14-030A OPINION OF COST - SUMMARY	REV 1	SHEET: 4	OF 6
	BY: JH2		DATE: 3/1/2020
	CHECKED BY: SAS		DATE:
	APPROVED BY: SAS		DATE:
	ISSUED:	DATE:	
	ISSUED:	DATE:	
	ISSUED:	DATE:	

Engineer's Opinion of Probable Project Cost
Conceptual Design B with Outlet Option2 (Excludes Boardwalk)
 Pioneer Trail Wetland Restoration

Cat. No.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST	NOTES
A	Mobilization/Demobilization	L.S.	1	\$ 76,000	\$76,000.00	1,2,3,4,5
B	Rock Erosion Control Construction Entrance	Each	1	\$ 2,700	\$2,700.00	1,2,3,4,5
C	Clearing & Grubbing	Acre	1	\$ 5,000	\$5,000.00	1,2,3,4,5
F	Remove Existing Storm Sewer Pipe	L.F.	250	\$ 20	\$5,000.00	1,2,3,4,5
E	Remove Existing Manholes	Each	2	\$ 500	\$1,000.00	1,2,3,4,5
G	Tree Removal (<12")	Each	10	\$ 210	\$2,100.00	1,2,3,4,5
H	Tree Removal (12" to 24")	Each	6	\$ 290	\$1,740.00	1,2,3,4,5
I	Tree Removal (>24")	Each	2	\$ 350	\$700.00	1,2,3,4,5
J	Erosion Control Silt Fence	L.F.	2600	\$ 4	\$9,360.00	1,2,3,4,5
K	Erosion Control Blanket	S.Y.	4000	\$ 3	\$10,000.00	1,2,3,4,5
O	Common Excavation	C.Y.	7100	\$ 19	\$131,350.00	1,2,3,4,5
DD	Backfill with Excavated Material	C.Y.	380	\$ 4	\$1,520.00	1,2,3,4,5
D	Grading	S.Y.	23450	\$ 2	\$43,382.50	1,2,3,4,5
P	Site Restoration (Seed & Mulch)	Acre	7.32	\$ 3,500	\$25,620.00	1,2,3,4,5
Q	24" RCP Storm Sewer Class III	L.F.	8	\$ 150	\$1,200.00	1,2,3,4,5
R	27" RCP Storm Sewer Class III	L.F.	200	\$ 175	\$35,000.00	1,2,3,4,5
S	24" RCP Storm Sewer FES	Each	1	\$ 3,000	\$3,000.00	1,2,3,4,5
T	27" RCP Storm Sewer FES	Each	2	\$ 3,600	\$7,200.00	1,2,3,4,5
U	48" Manhole & Casting	Each	2	\$ 8,000	\$16,000.00	1,2,3,4,5
W	60" Outlet Control Structure and Trash Rack	Each	1	\$ 12,000	\$12,000.00	1,2,3,4,5
N	Riprap, MnDot Class II w/Type IV Geotextile	Ton	20	\$ 90	\$1,800.00	1,2,3,4,5
M	Riprap, MnDot Class III w/Type IV Geotextile	Ton	10	\$ 90	\$900.00	1,2,3,4,5
AA	Herbicide Treatment	Acre	7.32	\$ 147	\$1,076.00	1,2,3,4,5
EE	Annual Vegetation Establishment and Warranty Period (5 Years)	YR	5	\$ 12,500	\$62,500.00	1,2,3,4,5
CONSTRUCTION SUBTOTAL					\$456,000.00	1,2,3,4,5,8
CONSTRUCTION CONTINGENCY (25%)					\$114,000.00	1,5,8
ESTIMATED CONSTRUCTION COST					\$570,000.00	1,2,3,4,5,8
PLANNING, ENGINEERING & DESIGN					\$86,000.00	1,2,3,4,5,8
PERMITTING & REGULATORY APPROVALS					\$17,000.00	1,5,6,8
CONSTRUCTION MANAGEMENT					\$40,000.00	1,5,8
ESTIMATED TOTAL PROJECT COST					\$713,000.00	1,2,3,4,5,7,8
ESTIMATED ACCURACY RANGE				-20%	\$571,000.00	5,7,8
				30%	\$927,000.00	5,7,8

Notes
¹ Limited Design Work Completed (15 - 25%)
² Quantities Based on Design Work Completed.
³ Unit Prices Based on Information Available at This Time.
⁴ No Soil Borings Available, Limited Field Investigation Completed, and No Site Survey or Wetland Delineation.
⁵ This feasibility-level (Class 3, 15-25% design completion per ASTM E 2516-06) cost estimate is based on feasibility-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the Final Total Project Cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the Total Project Cost as the project is defined is -20% to +30%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and Maintenance costs are not included.
⁶ Estimate assumes that wetland mitigation/replacement is not required since this is a wetland restoration project. Included are the cost for agency communication and application preparation for a permit from the City of Chanhassen, MN. If replacement/mitigation is required, the total cost may increase to approximately \$20,000 plus an additional \$100,000/acre of wetland disturbed.
⁷ Estimate costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.
⁸ Estimate costs are reported to nearest thousand dollars.

