Prepared by Emmons & Olivier Resources, Inc.
Prepared for Prior Lake-Spring Lake Watershed District
Adopted by PLSLWD Board of Managers March 8, 2022

Sutton Lake Iron Enhanced Sand Filter

Feasibility Study

02.28.22

EOR water ecology community

Cover image: Sutton Lake Iron Enhanced Filter Location, 2020 Aerial Image

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1 SUMMARY

The Prior Lake-Spring Lake Watershed District (PLSLWD) authorized the following study for an iron-enhanced sand filter (IESF) project at the outlet of Sutton Lake, a tributary to Spring Lake (Figure 1). Sutton Lake outflow was estimated to contribute 20% of the external load to Spring Lake, which is impaired for nutrients. PLSLWD recently completed the Upper Watershed Blueprint study to identify potential projects to address flooding and water quality opportunities. The Blueprint indicated that adding an iron-enhanced sand filter at that outlet of Sutton Lake could reduce up to 80% of the total phosphorus (TP) loading from the lake.

EOR conducted field reconnaissance in order to assess the viability of developing an IESF in the study area. In addition to collecting topographical survey data, a wetland delineation was conducted to determine the extent and type of wetlands on the site.

The District's PCSWMM model was used to understand the hydrology of the recently modified Sutton Lake Outlet and how that may affect potential performance of an IESF. The Sutton Lake Outlet was shown to produce a more consistent (less flashy) flow which is advantageous to an IESF performance because there will be less flow that exceeds the capacity of the IESF and is bypassed and more flow that is treated than with the past Sutton Lake open ditch outlet.

To fully assess the potential IESF performance, monitoring data collected at North Sutton Lake Blvd., Site ST_5D, was used. The monitoring data included six years of data: four years included water quality samples and flow data, two years included flow data only. Annual loads were approximated using the monitoring data and were found to be lower than the loads predicted in the Upper Watershed Blueprint study.

Several design iterations were developed through consultation with the landowner. Ultimately, a preferred design alternative was developed for a 51,500 sq-ft filter. The design incorporates a two-cell approach where a diversion structure allows flow to be diverted to one cell while the other is allowed to dry, to allow for aerobic conditions and oxidation of iron within the filter. Other design elements include a wetland depression upstream of the IESF to intercept and pre-treat agricultural runoff from the farm field before entering the ditch, a trail/field access from North Sutton Lake Blvd. that borders the filter for maintenance access, and ditch reshaping downstream of the filter diversion to provide a grassed waterway for bypass of high flows in a stable manner.

The predicted average TP captured by the proposed IESF is 44% of the total load or 345 lb/year based on the footprint and the ratio of soluble reactive phosphorus to TP in the ditch. Compared to the Spring Lake TMDL goal, the IESF is predicted to achieve 12% of the TP reduction needed to meet nutrient targets in the lake. Over an 18-year estimated lifespan, the TP removal is predicted to be approximately 6,100 lbs with a range of 5,400 lbs to 7,200 lbs, depending on the variability of streamflow and influent phosphorus concentrations.

The total cost of the project including construction, professional fees, legal fees, easement compensation, and annual operation and maintenance cost are estimated to range from $1,350,000 to $1,720,000, net present value. The cost effectiveness is estimated to range from $222 to $284 per pound of TP captured over the life of the IESF. Once TP effluent concentrations from the IESF consistently exceed 60 µg/l (approximately 18 years) the iron enhanced sand should be replaced to restore performance and extend the lifespan of the IESF. The predicted cost to replace the filter material ranges from $653,000 to $835,000, net present value (Appendix B).

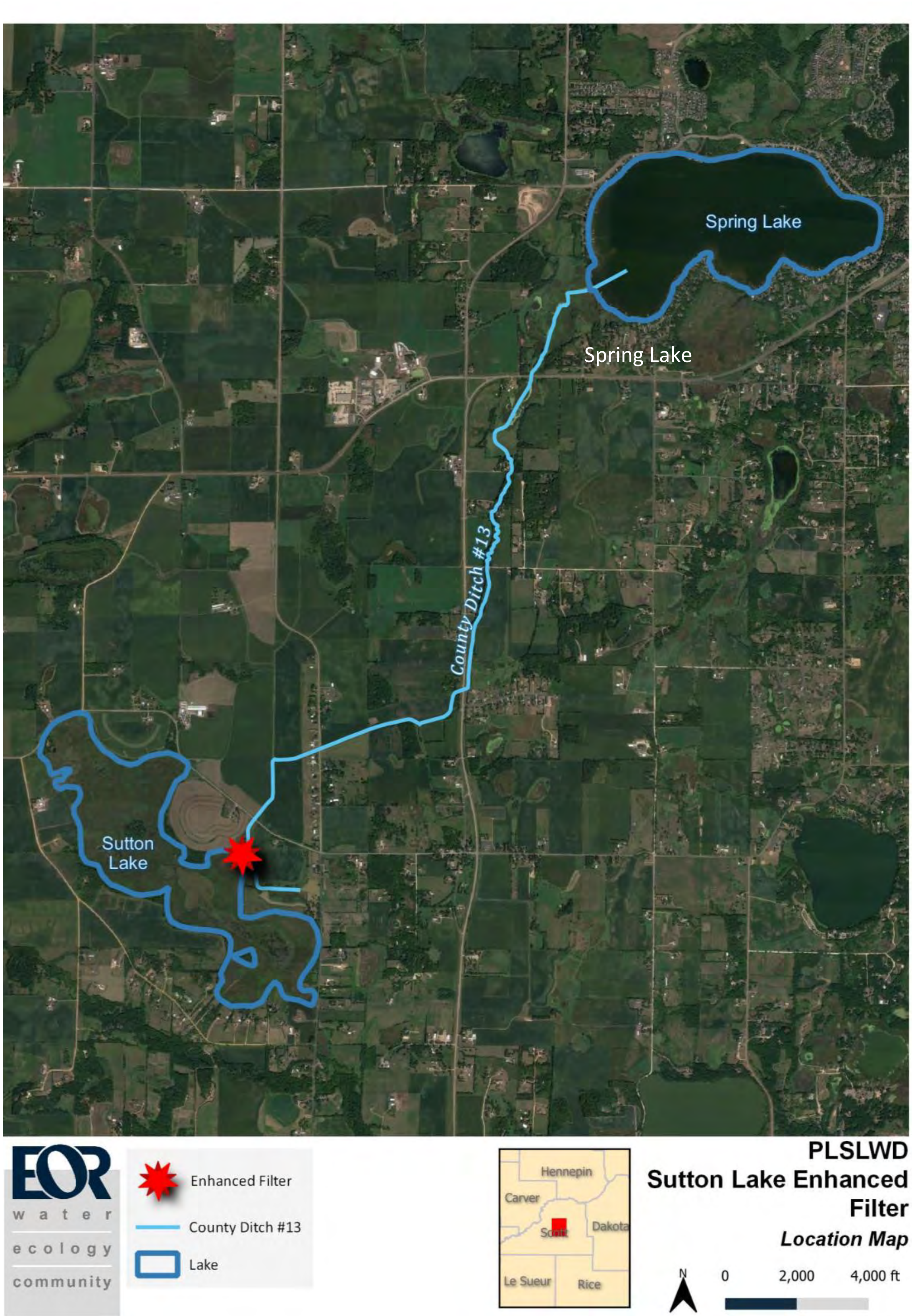


Figure 1. Sutton Lake Iron Enhanced Sand Filter Location and Flow Path to Spring Lake.

2 INTRODUCTION

Spring Lake is included on the state's Impaired Waters List. A lake is placed on this list when an assessment determines that it is not meeting one of its designated uses. In the case of Spring Lake, the assessment showed that among the identified impairments, the lake is impaired for aquatic life and recreation use due to excess nutrients which can lead to algal blooms and low water clarity. Water quality monitoring conducted by the District has identified that phosphorus is the nutrient contributing most to the lake's water quality impairment.

Over the years, the District has undertaken significant efforts to improve water quality in Spring Lake by attempting to control phosphorus loading by managing internal and external sources. The efforts have ranged from small scale raingardens and lakeshore restorations to large public improvement projects. Internal phosphorus sources have been managed through an aggressive carp removal and management program and by performing alum treatments. Alum is used to strip phosphorus from the water column and to create a short-term 'cap' on the lake's bottom sediment to prevent phosphorus release. The District constructed and has been operating a Ferric Chloride treatment system to treat external sources from the largest ditch (County Ditch 13) flowing to Spring Lake since 1998. This system captures an estimated 60% of the total phosphorus from the ditch flows. The District has also worked with watershed farmers to adopt agricultural conservation practices that help control external sources by reducing erosion and nutrient export from their fields.

The Upper Watershed Blueprint estimated that the discharge from Sutton Lake accounted for 20% of the watershed load reaching Spring Lake. Furthermore, the Blueprint estimated that an iron enhanced sand filter (IESF) located near the outlet of Sutton Lake could potentially capture 80% of the total phosphorus load from this drainage area. The Watershed District authorized this feasibility study in June 2021 to prepare design alternatives for an IESF, determine potential performance, and to estimate costs to complete the project.

3 METHODS

Base Mapping & Modeling

EOR collected data on site that would be appropriate for assessing site suitability. Data sets included, land use, topography, soils, existing wetland boundaries, and parcel ownership. The data was compiled into an internal GIS working map for use in project planning.

Design concepts were initially analyzed based on the surrounding landscape, hydrologic modeling, flow monitoring data, and the water quality monitoring data provided by the District. The District's PCSWMM model was first reviewed to understand how the changes to the Sutton Lake Outlet could affect performance of an IESF. The new Sutton Lake Outlet was shown to produce more consistent and less flashy peak flows. The more consistent flow is advantageous to performance of an IESF because less flow will be bypassed and more will be treated than with the prior ditched outlet.

To assess the potential IESF performance monitoring data collected at North Sutton Lake Blvd., monitoring location ST_5D was used. The monitoring data included six years of flow data, four of which with water quality samples and flow data, two years with flow data only. Table 1 summarizes the water quality conditions at ST_5D. Compared to reference values for warm water streams, classified as 2B, in the southern river nutrient region, the stream at ST_5D has slightly elevated total phosphorus (TP) with a larger percentage of soluble reactive phosphorus (SRP) than other streams in the Twin Cities Metro Area and very low total suspended solids (TSS) concentrations. The low TSS and high SRP concentrations reflects the influence of Sutton Lake at this location. Further evidence of Sutton Lake's influence is shown in the regression analysis between water quality and flow. All parameters assessed at the site had negative slopes which suggests that a constant source of TP from either Sutton Lake itself and/or tile drainage is a large contributor of pollutants at the site. A significant percentage of TSS is expected to be organic matter flowing from Sutton Lake.

Table 1. Annual Water Quality Concentration Conditions at ST_5D (2014-2016, 2019-2021)

Year	SRP FWMC (ug/L)	TP FWMC (ug/L)	SRP/TP	TSS FWMC (mg/L)
Reference Values	67.5[3]	150[1]	45%[2]	65[1]
2014	84	152	55%	6.7
2015	142	222	64%	3.5
2016	74	144	51%	3.4
2019	No Data	No Data	No Data	No Data
2020	No Data	No Data	No Data	No Data
2021	49	97	50%	6.3
2014-2016, 2021 Average	88	157	56%	5.4
Log Flow ~ Log Pollutant Regression Analysis Summary				
Slope	-0.12	-0.19	NA	-0.12
R^2	0.09	0.17	NA	0.07

[1] Reference water quality concentrations for streams in the Southern River Nutrient Region (MN Rules 7050.0222)

[2] Typical percentage of dissolved phosphorus in the Twin Cities Metro Area (MN Stormwater Manual)

[3] Calculated from the total phosphorus reference concentration and reference SRP/TP percentage

Table 2 summarizes the approximate volume and loads at ST_5D compared to the predicted pollutant loads in the Upper Watershed Blueprint study. To compare to the annual load estimated in the Upper Watershed Blueprint study, the average monitored baseflow conditions in October and November were used to approximate the unmonitored (winter) flow volume at the site. The unmonitored flow volume during winter months was estimated to be approximately 557 ac-ft. The annual loads approximated from monitoring at the site are lower than the loads predicted in the Upper Watershed Blueprint study. However, the relative magnitude of the load coming from the Sutton Lake drainage area to Spring Lake should be similar to what was predicted in the Upper Watershed Blueprint.

Table 2. Annual Volume and Loads at ST_5D (2014-2016, 2019-2021)

	Volume (ac-ft)	SRP Load (lbs)	TP Load (lbs)	TSS Load (tons)	Percent of Year
Upper Watershed Blueprint	1,971	NA	990	22	100%
Predicted Annual (including winter)	1,668	400	789	12	100%
2014-2016; 2021 Monitoring Average	1,111	267	551	7.9	65%
2014	2,078	474	860	18.8	61%
2015	803	310	486	3.9	62%
2016	1,122	226	417	5.2	71%
2019	2,597	NA	NA	NA	55%
2020	1,088	NA	NA	NA	65%
2021	442	59	117	3.8	64%

Survey & Wetland Delineation

A site visit was conducted on June 14, 2021 to collect field observations necessary to assess feasibility of the project. Survey data, including topography, significant trees, field edges, and ditch configuration was also collected during the field reconnaissance. Field data was compiled and incorporated into the base map to facilitate assessment of alternatives and concept designs.

EOR conducted a Level 2 onsite wetland delineation of the study area on June 25, 2021 (Appendix C). The purpose of the delineation was to provide an evaluation of potential existing wetlands and jurisdictional waters within the study area. A single wetland consisting of three wetland types, and one ditch were identified within the study. The findings of the wetland delineation were presented to the local government unit (LGU) for validation of the wetland boundary and wetland type. The LGU (Scott SWCD) convened an on-site Technical Evaluation Panel (TEP) meeting which included representatives from the Board of Water and Soil Resources (BWSR), and the Minnesota Department of Natural Resources (MNDNR) to review the delineation. The TEP recommended a revision to the wetland boundary and type originally delineated by EOR. The northern two thirds of the wetland feature originally delineated by EOR was determined to be non-wetland. This area retained wetland characteristics, in part dominance of Reed Canary Grass, because it contained spoils from historical dredging of the channel. The southern portion of the wetland feature was retained as delineated. The revised wetland boundary is summarized in a technical memorandum and attached as an addendum to the wetland delineation report (Appendix C).

Preliminary Assessment of Alternatives

EOR's preliminary assessment for the site was guided by the modeling, survey and wetland delineation completed as stated previously in this report. An IESF was identified in the Upper Watershed Blueprint as a beneficial practice for improving water quality to Spring Lake and siting it as far upstream to the outlet of Sutton Lake would provide the greatest benefit for nutrient removal. IESFs utilize filtration through a sand/iron mixed media (95% sand/5% iron filings) where the iron filings adsorb dissolved phosphorus to create an effluent with improved water quality.

Design Iteration #1 was developed creating a standard IESF in an area of land preferred by the landowner representative. This area was just east of the existing ditch that outlets from Sutton Lake and south of North Sutton Lake Blvd. Siting the filter footprint was guided by the constraints of the draft wetland boundary along the ditch and not impacting the farm field to the east. This area yielded a filter size of 36,100 sq-ft. This iteration would have a ditch diversion structure direct base flows and a portion of storm flows to the filter. The structure would include a pump to pull water from the channel to the filter surface. A pump was necessary because this filter was designed at the highest elevation possible to reduce excavation as much as possible.

From the diversion structure would be a 12" HDPE pipe to the filter which has a capacity of about 5 cfs depending on final layout. All water would flow through the filter until the discharge to the filter exceeds the infiltration capacity of the IESF at approximately 2.4 cfs and the head in the filter exceeds the overflow elevation at which point the remaining water would go untreated. Treated water would be captured in the underdrain and directed back to the ditch via a 12" HDPE pipe. The basins would include a 10' wide emergency overflow set at an elevation 1 foot below the top of berm elevation. The overflow would also be directed towards the ditch, to provide a stable outlet for large rainfall events. The filter surface would allow for 2 feet of ponding in the basin before the emergency overflow would be utilized (see Appendix A).

Design Iteration #2 built upon Iteration #1 with the intent of maximizing filter size to the fullest extent possible without impacting the farm field to the east while also eliminating the need for a pump. Baseflows in this design would be diverted to the filter via gravitational flow due to the filter being at a lower elevation. With this came the need for more excavation. Also with a lower filter, the outlet pipe needed to be lowered, which required the outlet pipe to be directionally bored to the north side of North Sutton Lake Blvd. The filter size for this iteration was increased to 45,600 sq-ft.

Concept Design for Preferred Alternative

EOR met with District staff and the landowner to review the initial design iterations. Based on this input Design Iteration #3 (the Preferred Alternative) was prepared. Building off of Design Iteration #2, this iteration would also not require a pump but would still require the outlet pipe to be directionally bored under North Sutton Lake Blvd. Also incorporated into this iteration was a wetland depression just south of the IESF. This wetland depression would be connected to the ditch via a diversion structure to provide hydrology to the wetland. The depression would also intercept and treat agricultural runoff from the farm field to the east before entering the ditch. A trail/field access from North Sutton Lake Blvd, around the filter and back across the ditch to where a bridge could be installed (by others) has also been included in the design.

This iteration also includes grading to stabilize any existing ditch banks experiencing failure, and to modify the ditch channel cross section downstream of the diversion to increase channel stability for high flow conveyance. This grading includes impact within delineated wetland, which will require future WCA permitting. Similar to wetland impact associated with construction of the Sutton Lake Outlet, it is anticipated that wetland impacts will be deemed temporary or quality for exemptions. The filter size of this iteration was further increased to 51,500 sq-ft.

This iteration also incorporates a two-cell approach where one cell receives flow for treatment while the other is allowed to dry since IESFs are meant to be aerobic for peak performance. A riprap divide with non-permeable liner is included to separate the cells. The elevation is only 1 ft above the top of filter, so during large storm events both cells will be utilized to maximize removal. This two-cell approach will also be useful to facilitate maintenance.

This iteration and associated cost estimate assumes manual operation of gates by District staff. The frequency of gate operation is dependent on seasonal baseflow conditions, timing of rainfall, length of service the filter has been in operation, and ideally, is informed by performance monitoring. Initial expectations are that gate operation would occur every 2-3 weeks and that this frequency could increase to weekly to maximize system performance if baseflows exhaust available adsorption sites of one of the cells. The scope of work for final design could include assessment of automated gate operation for consideration by the Board for inclusion in the construction bid package.

4 FINDINGS

Preferred Alternative Performance

Based on the monitoring data at ST_5D, the performance of a 51,500 sq-ft two-cell IESF (each cell 25,750 sq-ft) was estimated in Table 3. The predicted annual TP captured is 345 lb/yr which is a little under half the 735 TP lb/yr predicted in the Upper Watershed Blueprint study. This difference in predicted performance is due to the different methods for estimated phosphorus loading, reduction in the IESF footprint, and predicted performance. The Upper Watershed Blueprint study assumed one large cell and no drying period. Without a drying period, there is increased risk of phosphorus release from the filter. Alternating between two filter cells allows the filter to dry and limits the risk of phosphorus release from the filter. In both the UWB and this study the filter was assumed to operate year-round if water is flowing. The filter will not completely freeze as long as water is consistently flowing through the system. There could be a spring scenario where freeze/thaw cycles lead to sheet ice buildup and need to take the system offline.

The predicted lifespan of the IESF is 18 years and is related to the SRP concentration in the stream and the mass of iron in the IESF. On average the IESF is predicted to treat approximately 69% of the flow based on the filter footprint. Of the water that gets treated, 60% of the SRP and 85% of the particulate phosphorus is captured according to literature values in the Minnesota Stormwater Manual which equates to approximately 71% TP captured given the monitored SRP to TP ratio of site ST_5D. This means that the system is predicted to capture 44% of the average annual TP load.

The range of values provided in Table 3 is based on the variability in flow measured at the site. Years with flows close to or greater than the filter design flow of 2.4 cfs will result in a shorter lifespan while years with average flows less than the design flow will result in a longer lifespan. In addition, variability in the SRP concentration of the flow will also effect the lifespan of the IESF. The IESF is predicted to have a maximum SRP removal of 3,000 lbs before replacement of IESF media is required. Based on the lifespan, the TP removal is predicted to be 6,100 lbs with a range of 5,400 lbs to 7,200 lbs.

Table 3. Estimated IESF Performance

Performance	Average Estimate (Range)
Annual SRP Removal (lb/yr)	170 (75-290)
Annual TP Removal (lb/yr)	345 (181-529)
Lifespan (yrs)	18 (10-40)

Preferred Alternative Cost

EOR developed an Engineer Opinion of Probable Cost for the preferred alternative of the IESF. This capital cost ranges from $1,270,000 to $1,620,000 which includes both construction costs and professional fees for planning, engineering, permitting, bidding, and construction administration per ASTM E 2516-06 design level (concept phase), (Appendix B).

To calculate cost effectiveness additional soft costs for legal ($5,000) and easement ($22,000) costs was included. Easement cost was estimated based on the taxable land value (from Scott County's online GIS map) and the area of the proposed IESF. In addition, $4,000 per year over the range of approximated lifespan of the IESF was included for operation and maintenance.

In total, these costs represent a total net present value ranging from $1,350,000 to $1,720,000, assuming a discount rate of 4.5% (Appendix B). Dividing the net present value by the average predicted TP captured over the life of the IESF, 6,100 pounds, the cost effectiveness is estimated between $222 and $284 per pound of TP captured.

The lifespan of the project is calculated based on the mass of iron in the IESF and SRP loading to the IESF. Once the iron is used up, defined in the Minnesota Stormwater Mannual as when the effluent concentration consistently exceeds 60 µg/L TP and the TP:Iron ratio in the IESF exceeds 5 mg of TP per gram of iron, the iron enhanced sand needs to be replaced to restore performance. The associated costs to replace the filter material ranges from $653,000 to $835,000, present value (Appendix B).

5 CONCLUSIONS

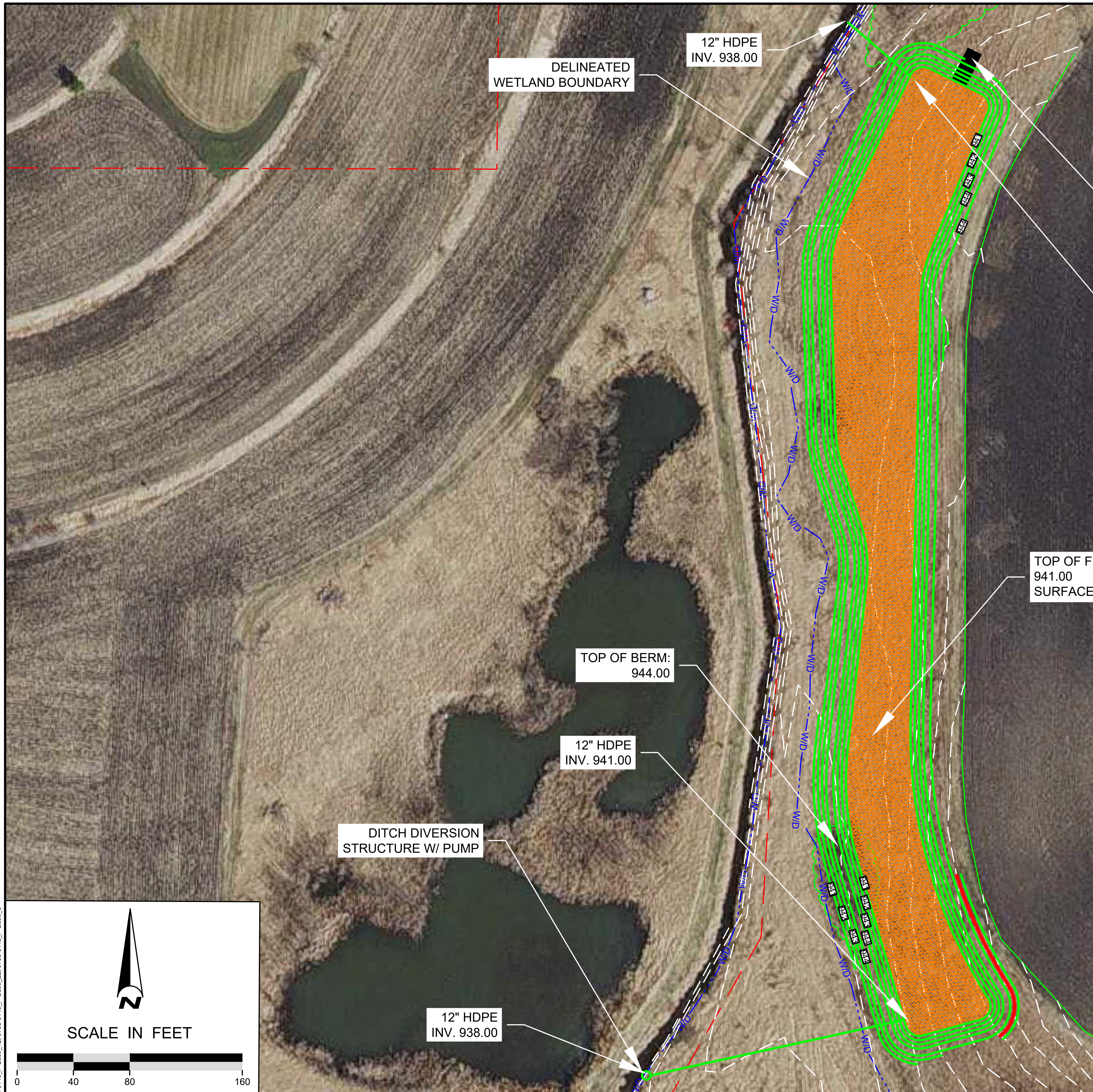
The IESF is predicted to capture 345 lb/yr of TP which is equal to approximately 12% of the TP reduction needed to meet the Spring Lake TMDL goal. EOR calculated the net present cost for the IESF between $1,350,000 to $1,720,000 and a cost effectiveness of $222 to $284 per pound of TP captured. The Blueprint originally estimated the construction costs to be much higher, at $1,760,000, and the cost effectiveness to be $166 per lb of TP captured. Even though this feasibility study shows a smaller percentage of TP reduction than stated in the Blueprint, lower construction costs put the cost effectiveness at a similar rate and more realistic phosphorus removal potential.

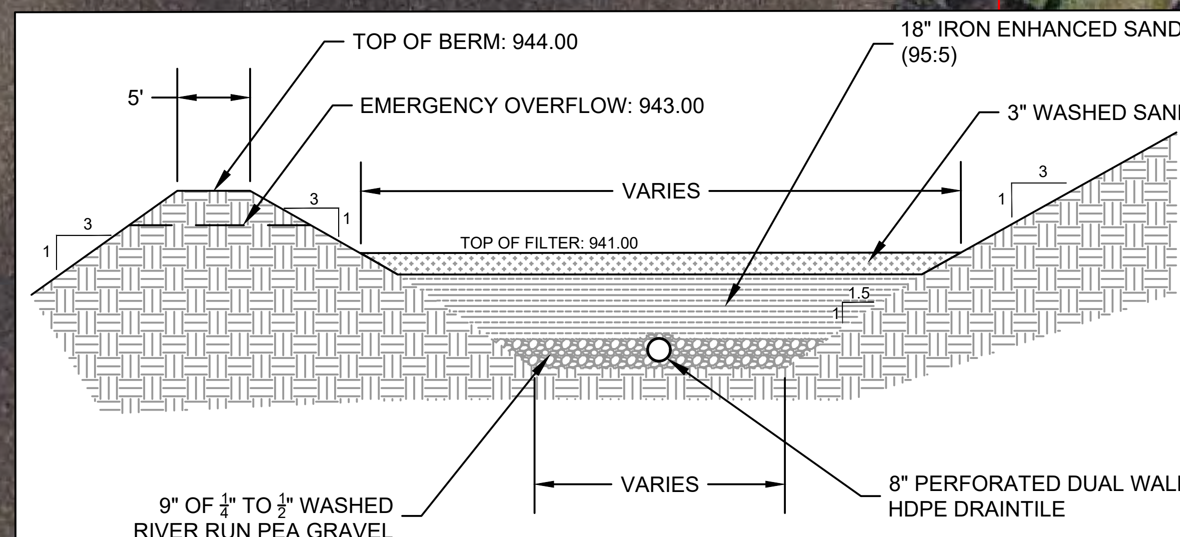
6 NEXT STEPS

The following are recommended next steps:

- Board approval of the Sutton Lake Iron Enhanced Filter Feasibility Study
- Submit Feasibility Study to the Board of Water & Soil Resources (BWSR)
- Pursue landowner agreement and easement acquisition
- Pursue grant funding
- Authorize final design and wetland permitting of the preferred option
- Coordinate with Scott County with respect to County Road 10 road bank stabilization and working within the right-of-way

APPENDIX A: DESIGN ITERATIONS #1, #2, & #3 (PREFEREED ALTERNATIVE)





IRON ENHANCE SAND FILTER CROSS SECTION

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GSOC GOPHER STATE ONE CALL — 811 Know what's below. Call before you dig.

DRAFT

SUBMISSION DATE: 02/07/2022

DESIGN BY	DRAWN BY	CHECKED BY
EOR	DEM	XXX

EOR PROJECT NO. 0758-0145

Emmons & Olivier Resources, Inc.
water ecology community
1919 University Ave W, Suite 300, St Paul, MN 55104
Tele: 651.770.8448
www.eorinc.com

PLSLWD

SUTTON LAKE IRON-ENHANCED SAND FILTER FEASIBILITY STUDY
SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. --- CITY PROJECT NO. ---

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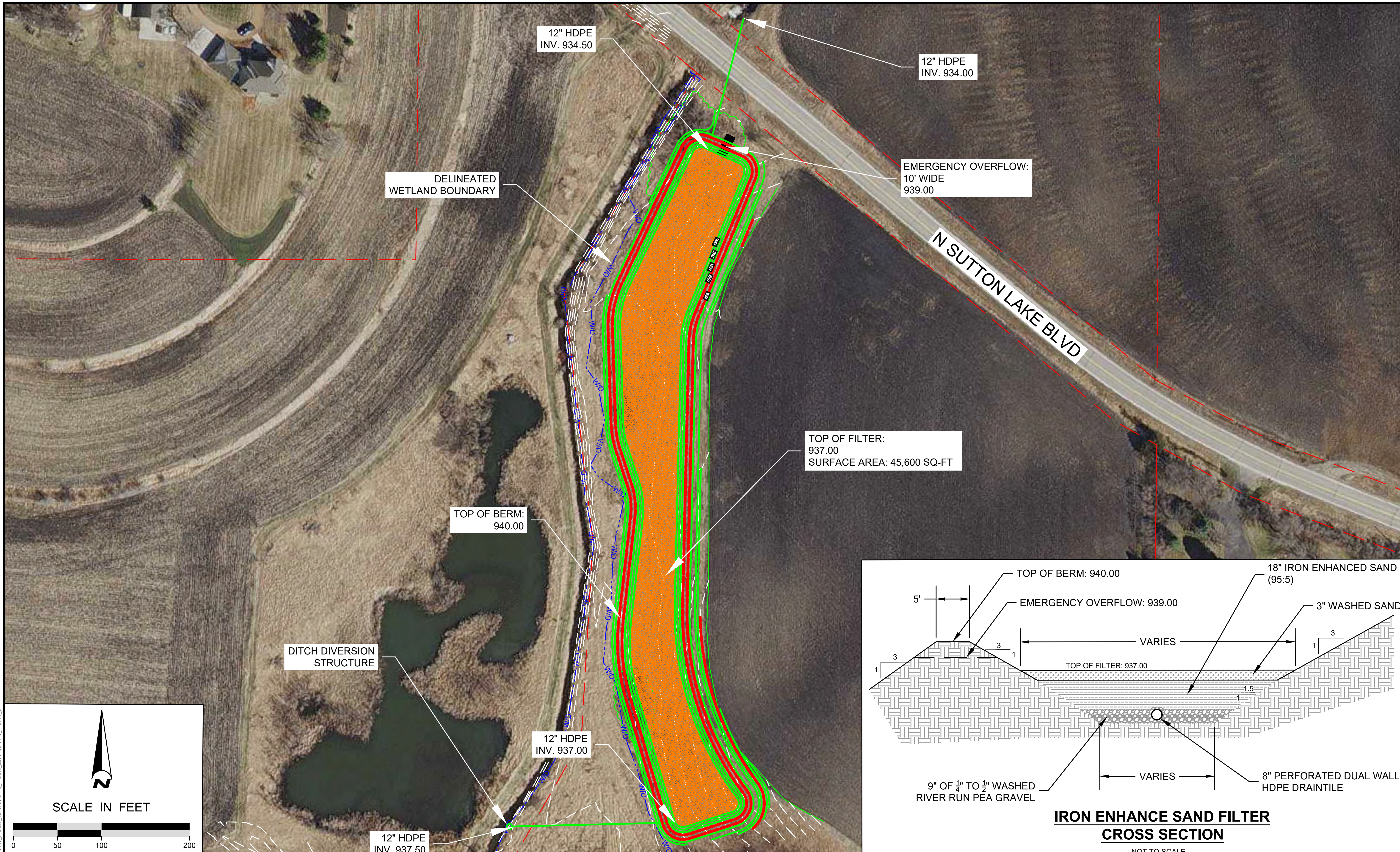

IRON ENHANCE SAND FILTER
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GSOC GOPHER STATE ONE CALL

811 Know what's below. Call before you dig.

DRAFT

SUBMISSION DATE:
02/07/2022

DESIGN BY	DRAWN BY	CHECKED BY
EOR	DEM	XXX

EOR PROJECT NO.
0758-0145

Emmons & Olivier Resources, Inc.
water ecology community
1919 University Ave W,
Suite 300, St Paul, MN 55104
Tele: 651.770.8448
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PLSLWD

SUTTON LAKE IRON-ENHANCED SAND FILTER
FEASIBILITY STUDY
SAND CREEK TOWNSHIP, SCOTT COUNTY,
MINNESOTA

STATE PROJECT NO. --- CITY PROJECT NO. ---

IRON ENHANCED SAND FILTER
- ITERATION 2

SHEET 02 OF 03 SHEETS

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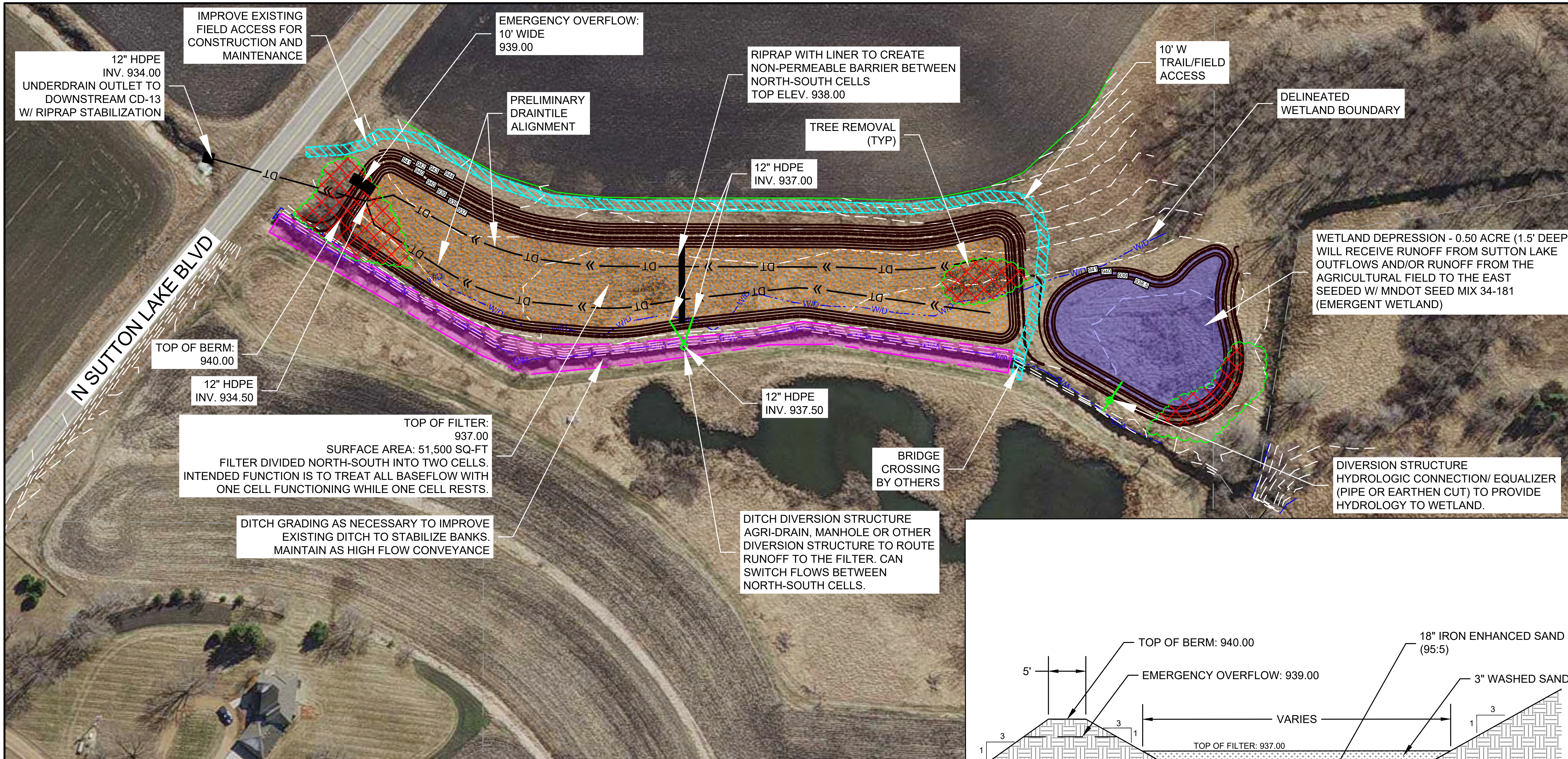

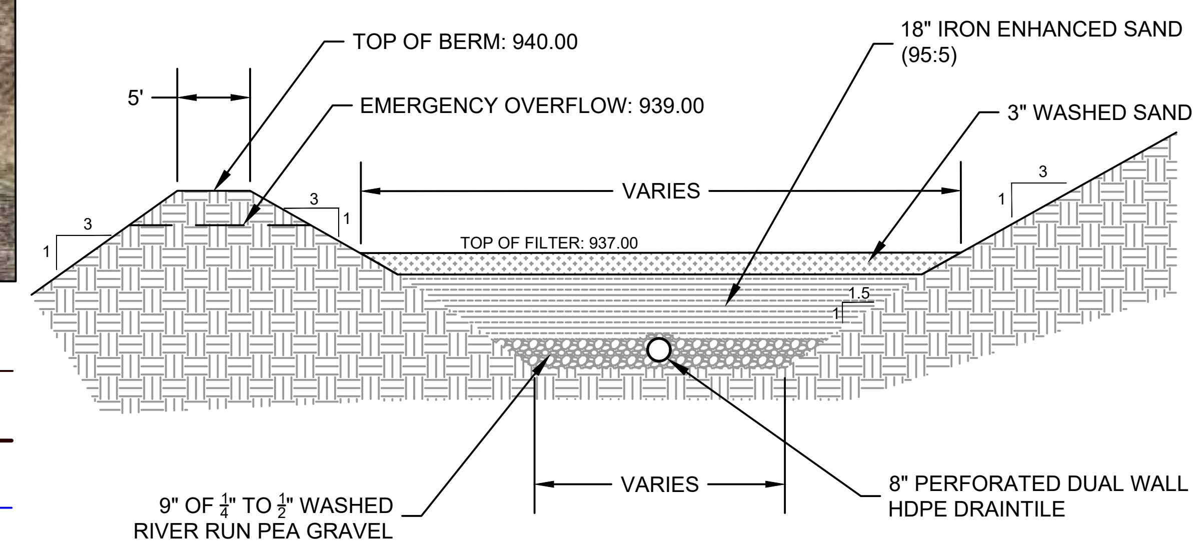

IRON ENHANCED SAND FILTER CROSS SECTION

NOT TO SCALE

KEY:

EXISTING CONTOURS

PROPOSED CONTOURS

WETLAND DELINEATION

TREE LINE

PROPERTY LINE

NOTES:

1. ALL SURROUNDING BUFFER AREA TO BE SEEDED W/ 34-271 (WET MEADOW SOUTH & WEST)

N

SCALE IN FEET

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GSOC GOPHER STATE ONE CALL

811 Know what's below. Call before you dig.

DRAFT

SUBMISSION DATE: 02/07/2022

DESIGN BY	DRAWN BY	CHECKED BY
EOR	DEM	XXX

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PLSLWD

SUTTON LAKE IRON-ENHANCED SAND FILTER FEASIBILITY STUDY
SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---
CITY PROJECT NO. ---

IRON ENHANCED SAND FILTER - PREFERRED ALTERNATIVE

SHEET 03 OF 03 SHEETS

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APPENDIX B: ENGINEERS OPINION OF PROBABLE COST FOR PREFERRED ALTERNATIVE

ENGINEER'S OPINION OF PROBABLE COST (EOPC) - Capital Improvement					
SUTTON LAKE IESF FEASIBILTY STUDY					
PREPARED BY EMMONS & OLIVIER RESOURCES, INC.					
EOR JOB NO.		00758-0145			
DATE PREPARED		2/9/2022			
Item	**MnDOT Reference #**	**Unit**	**Estimated**	**Estimated Unit Cost**	**Extended Cost**
Mobilization	2021.501	LS	1.00	45,000.00	$ 45,000.00
Clearing and Grubbing	2101.501	LS	1.00	5,000.00	$ 5,000.00
Common Excavation	2106.507	CY	17,100.00	10.00	$ 171,000.00
Storm Sewer, HDPE 8"	2503.503	LF	1,400.00	30.00	$ 42,000.00
Storm Sewer, HDPE 12"	2503.503	LF	100.00	40.00	$ 4,000.00
12" HDPE (Directional Drilled)	2504.603	LF	145.00	155.00	$ 22,475.00
Agri-Drain Outlet Control Structure	2506.602	EA	2.00	10,000.00	$ 20,000.00
Random Riprap	2511.507	CY	90.00	70.00	$ 6,300.00
Turf Reinforcement Mat	2575.504	SY	25.00	35.00	$ 875.00
Washed Sand (P)	2105.507	CY	480.00	45.00	$ 21,600.00
Washed Aggregate - River Run Pea Stone (P)	2105.507	CY	1,275.00	70.00	$ 89,250.00
IESF Mixture (Iron Filings - 5% by Weight)	2106.507	CY	2,700.00	140.00	$ 378,000.00
EPDM Liner, 45 mil	2511.504	SY	5,700.00	15.00	$ 85,500.00
Temporary Erosion and Sediment Control	SP	LS	1.00	20,000.00	$ 20,000.00
Seeding and Restoration	SP	LS	1.00	30,000.00	$ 30,000.00
			Construction Totals	**Refined Total**	**$ 941,000.00**
			Construction Contingency	**20.00%**	**$ 188,200.00**
				Final Construction Total	**$ 1,129,200.00**

EOR Professional Fees		
PLANNING AND ENGINEERING	**15.00%**	$ 169,380.00
PERMITTING AND APPROVALS	**4.00%**	$ 45,168.00
BIDDING AND CONSTRUCTION ADMIN	**6.00%**	$ 67,752.00
PROFESSIONAL FEES TOTAL		**$ 282,300.00**
TOTAL PROJECT COST		**$ 1,411,500.00**
ESTIMATED ACCURACY RANGE* **	**-10.0%**	**$ 1,270,350.00**
	15.0%	**$ 1,623,225.00**

ENGINEER'S OPINION OF PROBABLE COST (EOPC) - Future IESF Media Replacement					
SUTTON LAKE IESF FEASIBILTY STUDY					
PREPARED BY EMMONS & OLIVIER RESOURCES, INC.					
EOR JOB NO.		00758-0145			
DATE PREPARED		2/9/2022			
Item	**MnDOT Reference #**	**Unit**	**Estimated**	**Estimated Unit Cost**	**Extended Cost**
Mobilization	2021.501	LS	1.00	15,000.00	$ 15,000.00
Common Excavation	2106.507	CY	3,200.00	10.00	$ 32,000.00
12" HDPE (Directional Drilled)	2504.603	LF	145.00	155.00	$ 22,475.00
Washed Sand (P)	2105.507	CY	480.00	45.00	$ 21,600.00
IESF Mixture (Iron Filings - 5% by Weight)	2106.507	CY	2,700.00	140.00	$ 378,000.00
Temporary Erosion and Sediment Control	SP	LS	1.00	5,000.00	$ 5,000.00
Seeding and Restoration	SP	LS	1.00	10,000.00	$ 10,000.00
			Construction Totals	**Refined Total**	**$ 484,075.00**
			Construction Contingency	**20.00%**	**$ 96,815.00**
				Final Construction Total	**$ 580,890.00**

EOR Professional Fees		
PLANNING AND ENGINEERING	**15.00%**	$ 87,133.50
PERMITTING AND APPROVALS	**4.00%**	$ 23,235.60
BIDDING AND CONSTRUCTION ADMIN	**6.00%**	$ 34,853.40
PROFESSIONAL FEES TOTAL		**$ 145,222.50**
TOTAL PROJECT COST		**$ 726,112.50**
ESTIMATED ACCURACY RANGE* **	**-10.0%**	**$ 653,501.25**
	15.0%	**$ 835,029.38**

APPENDIX C: WETLAND DELINEATION & ADDENDUM

Prepared by Emmons & Olivier Resources, Inc.

Prepared for Prior Lake-Spring Lake Watershed District

Sutton Lake IESF

Wetland and Waters Delineation Report

Sand Creek Township, Scott County, Minnesota

07.15.21

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EXECUTIVE SUMMARY

The purpose of this report is to provide Prior Lake-Spring Lake Watershed District an evaluation of potential existing wetlands and jurisdictional waters of the **Study Area**. The Study Area includes the east side of the Sutton Lake outlet channel (**Figure 1**). The Study Area represents the focus of this report; this report was not developed to evaluate areas beyond the Study Area.

Evaluation of the Study Area began with a review of existing data including field surveyed and digital elevation data, Soil Survey Geographic (SSURGO) hydric soil classification data, National Wetland Inventory (NWI) Data, National Hydrography Dataset (NHD), and Minnesota Department of Natural Resources (MNDNR) Public Waters Inventory (PWI) data.

A Level 2 onsite delineation performed by EOR on June 25, 2021 identified one wetland and one ditch within the Study Area consisting of three wetland types. EOR recommends submittal of this report to the LGU to validate the boundary of the delineated wetland and wetland types.

1.1. Review Team and Contact Information

The wetland delineation was performed by Jimmy Marty and reviewed by Jason Naber of Emmons & Olivier Resources.

Wetland Delineators:

Jimmy Marty, CMWP #1322
jmarty@eorinc.com

Jason Naber, CMWP #1369
jnaber@eorinc.com

Emmons & Olivier Resources, Inc. (EOR)
1919 University Ave W #300
St. Paul, MN 55104
651.770.8448

Figure 1. Sutton Lake IESF Study Area.

Figure 2. The Study Area is located along the east side of the Sutton Lake outlet channel, just south of County Highway 10 and near the eastern boundary of Sand Creek Township.

INTRODUCTION

The proposed project includes construction of an iron-enhanced sand filter on the east side of the Sutton Lake outlet channel within a 3.6-acre Study Area in Sand Creek Township, Scott County (**Figure 2**). The proposed project is under feasibility study and has not been sited or designed.

The legal description of the Study Area is the SE ¼ of the NE ¼ of Section 25, Township 114N, Range 23W. The Study Area is located on two privately owned parcels with property ID numbers 099250021 and 099250033. The Scott County Soil & Water Conservation District is the Local Governing Unit for the Wetland Conservation Act.

METHODOLOGY

3.1. Preliminary Desktop Investigation

The following data were collected and reviewed prior to the field delineation:

- MNDNR high resolution 1-meter digital elevation data and lidar-derived 1-foot elevation contours of Study Area vicinity (**Figure 3**)
- Natural Resources Conservation Service (NRCS) SSURGO hydric soil classification data (**Figure 4**)
- U.S. Fish and Wildlife Service (USFWS) NWI (**Figure 5**)
- U.S. Geological Survey (USGS) NHD (**Figure 5**)
- MNDNR Public Waters Inventory (PWI) (**Figure 5**)

3.2. Onsite – Level 2 Wetland Delineation Methods

3.2.1. Data Collection and Tabulation

EOR followed methodology in accordance with the BWSR technical guidance documentation and methodology outlined in the 1987 Corps of Engineers Wetland Delineation Manual and supplemental methods identified in the Midwest Regional Supplement to delineate wetlands within the Study Area. Wetland and upland observations and data were recorded in the field and subsequently entered into the U.S. Army Corps of Engineers Automated Wetland Determination Data Form – Midwest. Streams were assessed based on observations of the Ordinary High Water Mark (OHWM) as defined by the U.S. Army Corps of Engineers. Sample points and delineated boundaries were collected in the field using a Virtual Reference Station corrected submeter differential Global Positioning System (GPS) and mapped using QGIS v. 3.16.

3.2.2. Wetland Indicator Methodology

EOR conducted field work on June 25, 2021to identify wetland boundaries. A transect was established in a representative transition zone of each potential wetland. The transect consisted of sample point in the potential wetland, and if wetland criteria were met, one point in the upland. Soils, vegetation, and hydrology were documented at each sample point and provided in data sheets.

Vegetation

Observed plant species were identified and assigned corresponding Midwest Region wetland indicator status. The wetland probability indicator status of dominant plant species was determined using the 2016 National Wetland Plant List v3.3 (**Appendix A**).

Soils

Soil samples were collected using a soil auger and were dug to a minimum of 24 inches or until restrictive layers were met. Soil colors were determined using the Munsell Soil Color Charts. Soils were described to include those hydric indicators immediately below the A-horizon. A hydric soil determination was made based upon soil characterization (texture, color), soil order, ponding, and flooding frequency.

Hydrology

As required in the 1987 Manual, the presence of subsurface hydrology or indicators thereof was characterized in the rooting zone to a minimum of 24 inches. Primary and secondary hydrology indicators were identified according to the Midwest Supplement.

3.2.3. Delineation Boundary and Type Determination

Wetland and stream boundaries were determined via consideration of soil, hydrology, vegetation, topography, and professional judgment at paired upland and wetland sample points. Boundary GPS data was collected at sufficient and appropriate intervals, depending on curvature and assumed accuracy. Wetland type boundaries were digitized using QGIS v. 3.16 based on field observations and desktop data.

4. RESULTS

4.1. Preliminary Desktop Investigation

4.1.1. Topography

The Study Area consists of a terrace sloping gently to the west toward the ditched Sutton Lake outlet channel (**Figure 3**). The terrace broadens into a large depression in the southern portion of the Study Area near Sutton Lake. The outlet channel flows generally to the north. Elevations range from 939 feet above sea level at the north end of the outlet to 950 feet on the hillslope in the southeastern corner of the Study Area.

4.1.2. Soils Data

NRCS SSURGO data mapped four soil units within the Study Area (**Figure 4**; **Table 1**). Hydric ratings were based on those identified in the SSURGO database.

Table 1. NRCS Soils and Hydric Rating

Soil Unit	Hydric Classification	Percent Hydric
Wb – Webster Glencoe silty clay loams	Hydric	100%
PaA – Klossner muck, 0 to 1 percent slopes	Hydric	100%
LcB – Lester loam, 2 to 6 percent slopes	Predominantly Non-Hydric	10%
LcC2 – Lester loam, 6 to 10 percent slopes	Predominantly Non-Hydric	2%

4.1.3. Water Resources Data

Mapped NWI wetlands within the Study Area include PEM1Cd and PFO1Ad-type wetlands along the western boundary (**Figure 5**). The Sutton Lake DNR public water basin is mapped in the southwestern corner of the Study Area. An NHD watercourse in approximate alignment with the outlet channel runs along the western boundary of the Study Area. Several additional NWI-mapped wetlands are located beyond the Study Area and associated with Sutton Lake to the south and west or the outlet channel north of County Highway 10.

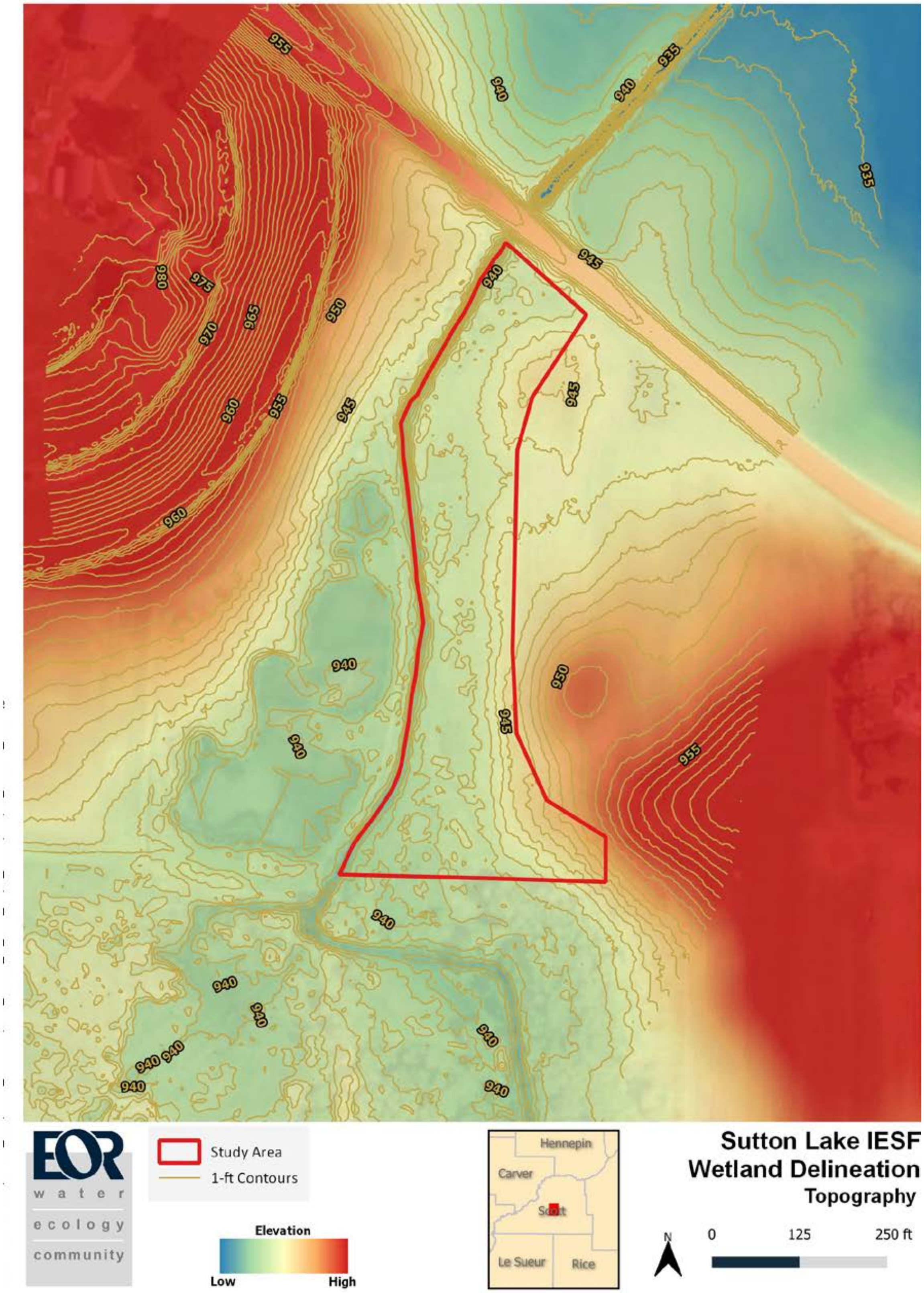

Figure 3. High resolution 1-meter DEM and lidar-derived 1-foot elevation contours for the Study Area.

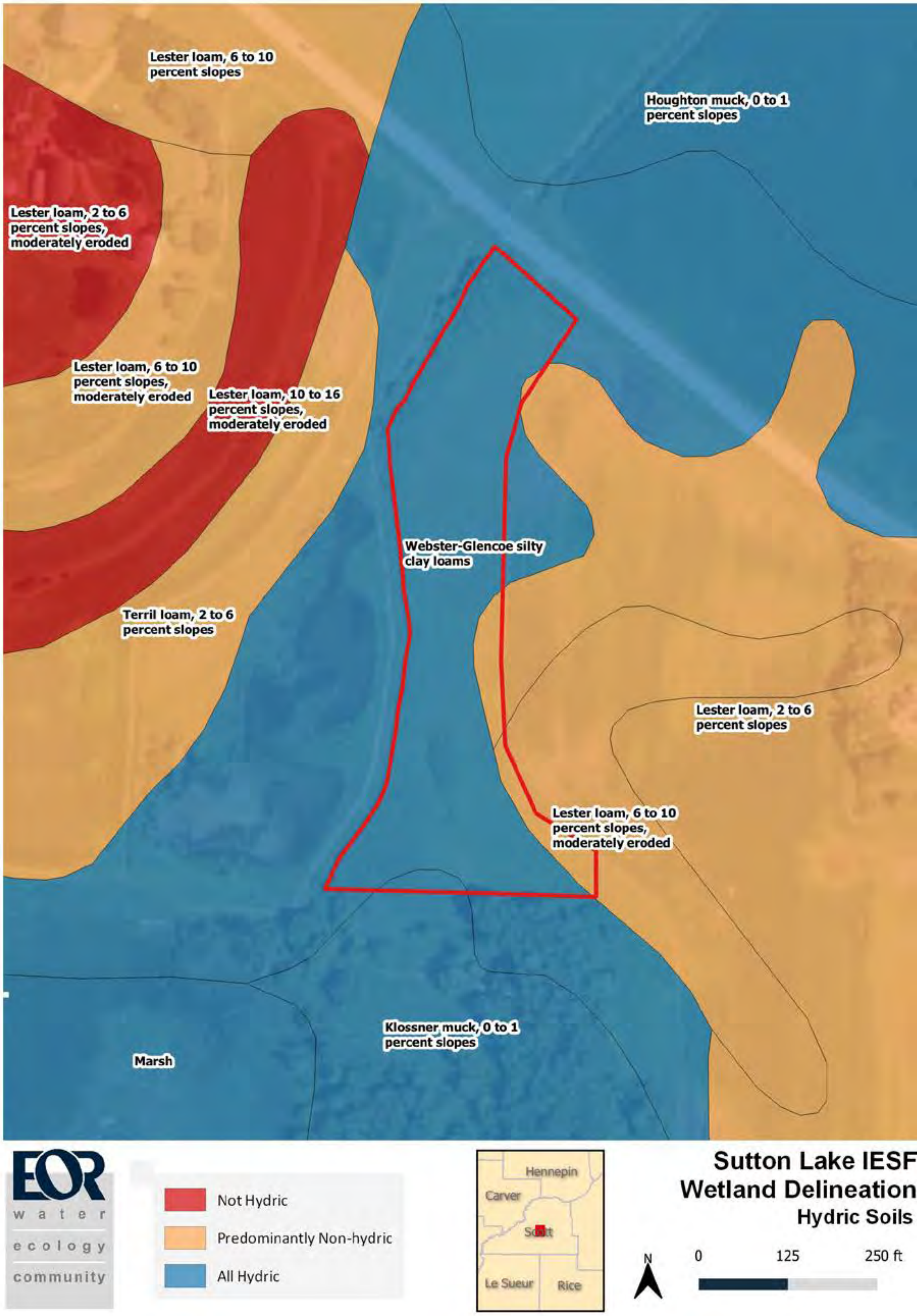

Figure 4. NRCS SSURGO soils data identified seven soil units within the Study Area.

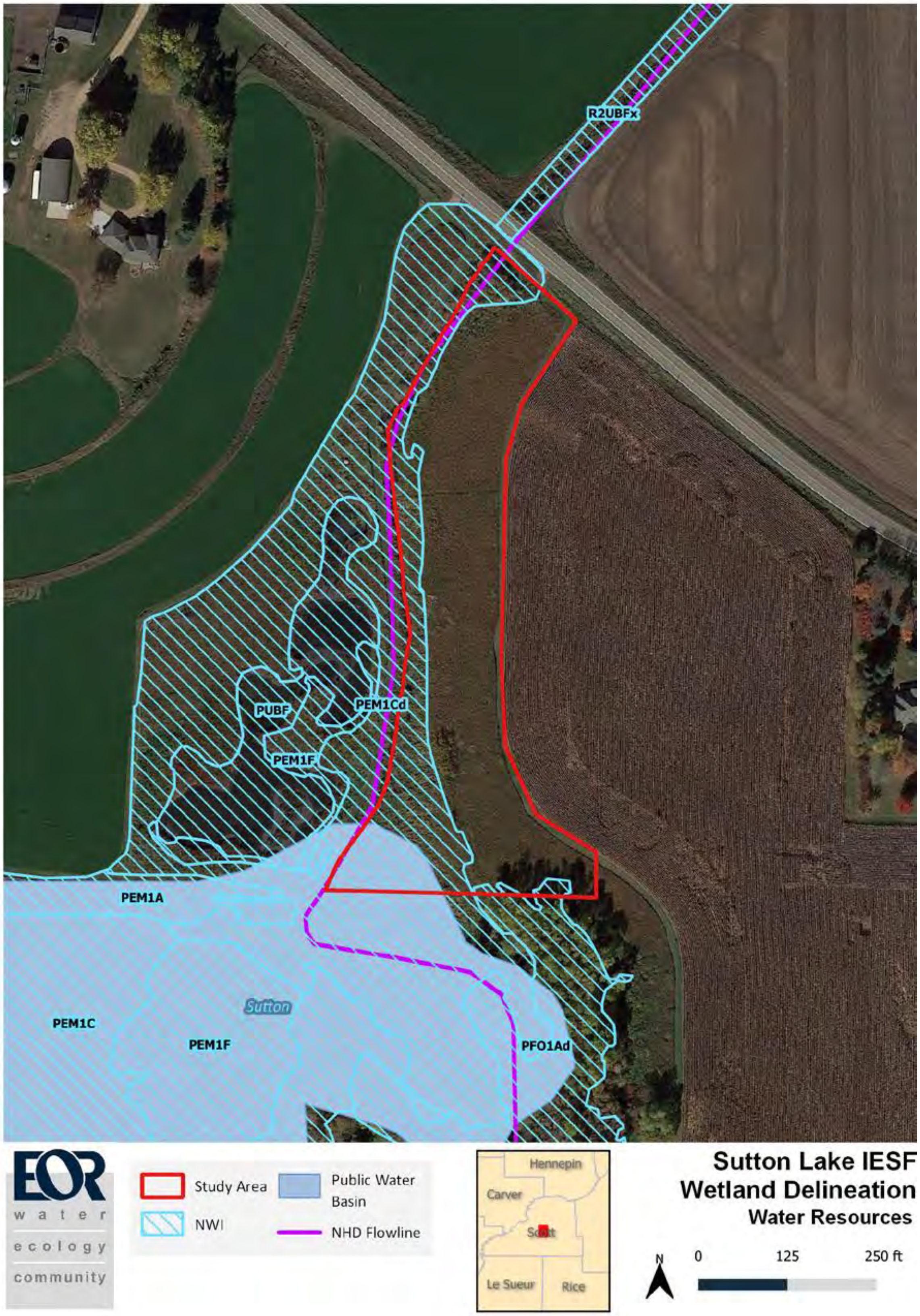

Figure 5. NWI, PWI, and NHD water resources in the Study Area vicinity.

4.2. Onsite – Level 2 Wetland Delineation Results

The wetland delineation was conducted on June 25, 2021. Weather conditions were clear at the time of the delineation. Antecedent precipitation data from the Minnesota Climatology Working Group indicated the three month antecedent precipitation was normal prior to field work (**Table 2**). However, the month of June was very dry with only 1.36 inches of precipitation, compared to a normal range of 3.48 to 4.84 inches.

Table 2. Antecedent Precipitation from Minnesota Climatology Working Group

Precipitation data for target wetland location:	
County: **Scott**	Township number: **114N**
Township name: **Sand Creek**	Range number: **23W**
Nearest community: **Lydia**	Section number: **25**

Score using 1981-2010 normal period for June 25, 2021 site visit:

(Values are in inches)	1st prior month: May 2021	2nd prior month: April 2021	3rd prior month: March 2021
Estimated precipitation total for this location:	**3.04***	**2.23***	**2.95***
There is a 30% chance this location will have less than:	2.47	1.87	1.20
There is a 30% chance this location will have more than:	4.37	2.72	1.96
Type of month: dry normal wet	**normal**	**normal**	**wet**
Monthly score	**3 * 2 = 6**	**2 * 2 = 4**	**1 * 3 = 3**
Multi-month score: 6 to 9 (dry) 10 to 14 (normal) 15 to 18 (wet)	**13 (Normal)**		

*Total derived from radar-based estimates

4.3. Wetland Descriptions

EOR identified one wetland and one ditch within the Study Area consisting of three wetland types (**Figure 6** and **Figure 7; Table 3**). Additional details of sample points are provided in the data sheets and photographs included in **Appendix B**.

Table 3. Delineated Wetlands

Aquatic Resource	Wetland Type			Area (acres)
	Cowardin *et al* / NWI	Circular 39	Eggers and Reed	
Wetland	PEM1Ad	Type 1	Seasonally Flooded Basin	0.53
	PEM1Bd	Type 2	Fresh (Wet) Meadow (Disturbed Subtype)	0.40
Wetland Area				**0.93**
Ditch	R2UBFx	N/A	N/A	0.13
Total Aquatic Resource Area within Study Area				**1.06**

The delineated wetland consisted of Type 1, PEM1Ad and Type 2, PEM1Bd wetlands along the Sutton Lake outlet channel ditch (**Figure 7**). At the northern/downstream edge, the wetland occupies a terrace along the ditch and consists of a narrow fringe of Type 1 wetland. The narrow fringe gradually broadens into a depressional basin at the upstream end near Sutton Lake and includes Type 2 wetland. One transect of paired sample points (**W1A** and **W1B**) was completed along the wetland boundary along with an additional non-wetland point where the Type 1 fringe constricts to a very narrow band along the top of the ditch (**W1C**).

Wetland sample point **W1A** was taken along the ditch terrace. Dominant vegetation at wetland sample point W1A consisted of reed canary grass (FACW) with a minor component of giant goldenrod (FACW) and several species at 2% cover or less. Soils at the wetland sample point met the requirements of hydric indicator A12 (Thick Dark Surface). No primary hydrology indicators were observed, but wetland hydrology criteria was met by the secondary indicators D2 (Geomorphic Position) and D5 (FAC-Neutral Test). The paired upland sample point **W1B** was located farther upslope on the terrace. Hydrophytic vegetation was not present and dominant vegetation consisted of indian grass (FACU), with a minor component of Canada goldenrod (FACU), Kentucky bluegrass (FAC), and wild bergamot (FACU). Several other species were present at 1% cover. Soils at the upland sample point met the requirements of hydric indicator A12 (Thick Dark Surface). Sample point W1B did not meet wetland hydrology criteria and not hydrology indicators were observed.

Non-wetland sample point **W1C** was taken along the terrace near the downstream end of the ditch where the wetland fringe appeared to narrow based on vegetation observations. Hydrophytic vegetation was not present, despite the presence of some wetland species as dominants. Dominant vegetation at sample point W1C consisted of box elder (FAC) in the tree stratum; sandbar willow (FACW) and exotic honeysuckle (FACU) in the shrub stratum; smooth brome (FACU), reed canary grass (FACW), and Canada goldenrod (FACU) in the herb stratum; and riverbank grape and Virginia creeper in the vine stratum. Wild plum (UPL) was not present within the sample point, but was observed as the dominant species along the ditch bank to the north. Soils at the wetland sample point were assumed to be hydric; a restrictive layer of gravel was encountered at 24 inches that prevented further observation. Soils were 10YR 2/1 through 24 inches and therefore potentially met requirements of A12 (Thick Dark Surface) at depths below the restrictive layer. No primary or secondary hydrology indicators were observed and the sample point did not meet wetland hydrology criteria.

The centerline of the ditch was surveyed and forms the west boundary of the Study Area. The ditch channel ranged in width from 5-6 feet wide. The centerline was buffered to a 6-foot width using GIS to digitize the ditch boundary. The ditch flows to the north and water depth at the thalweg was 6-8 inches.

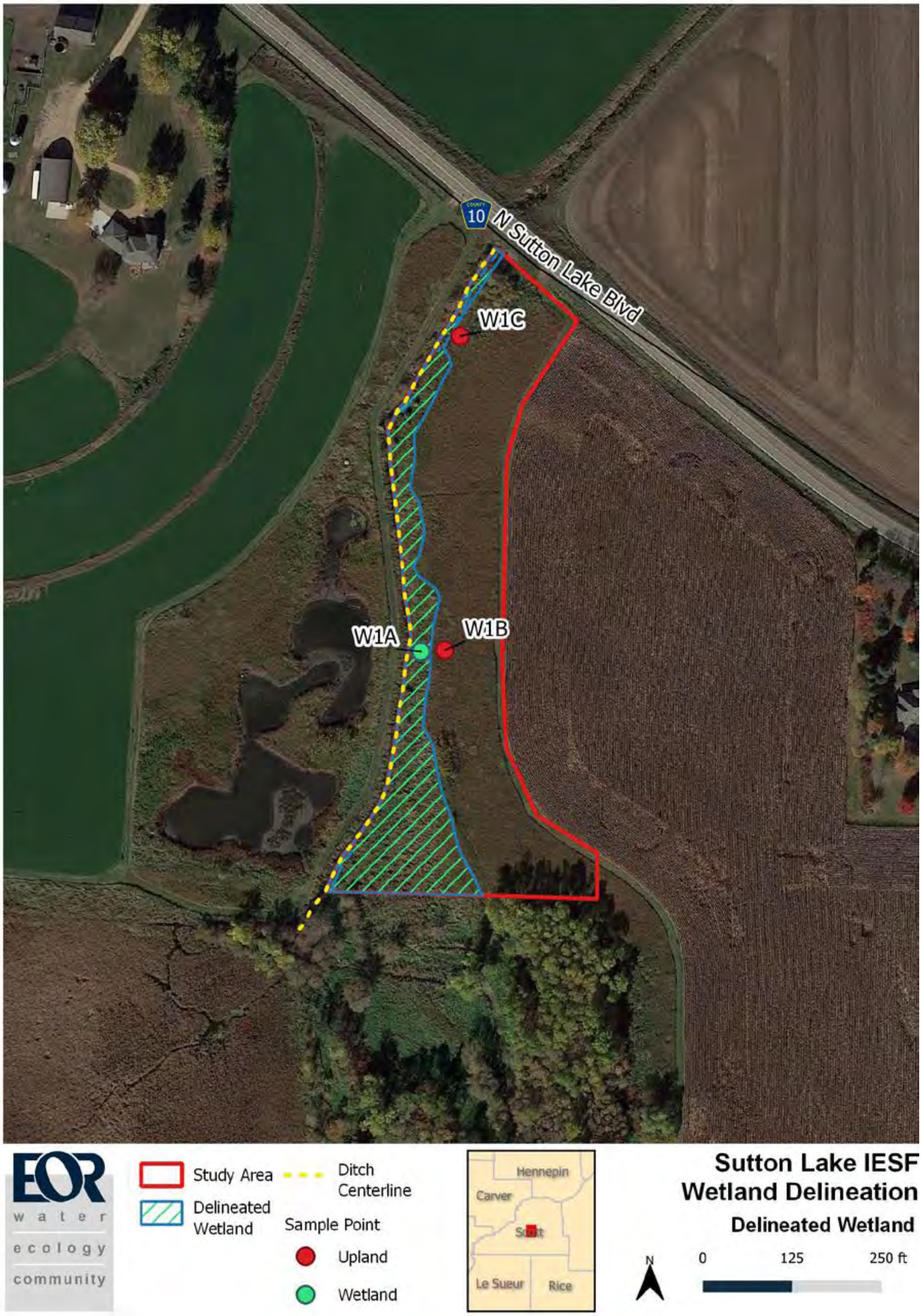

Figure 6. Delineated Wetland

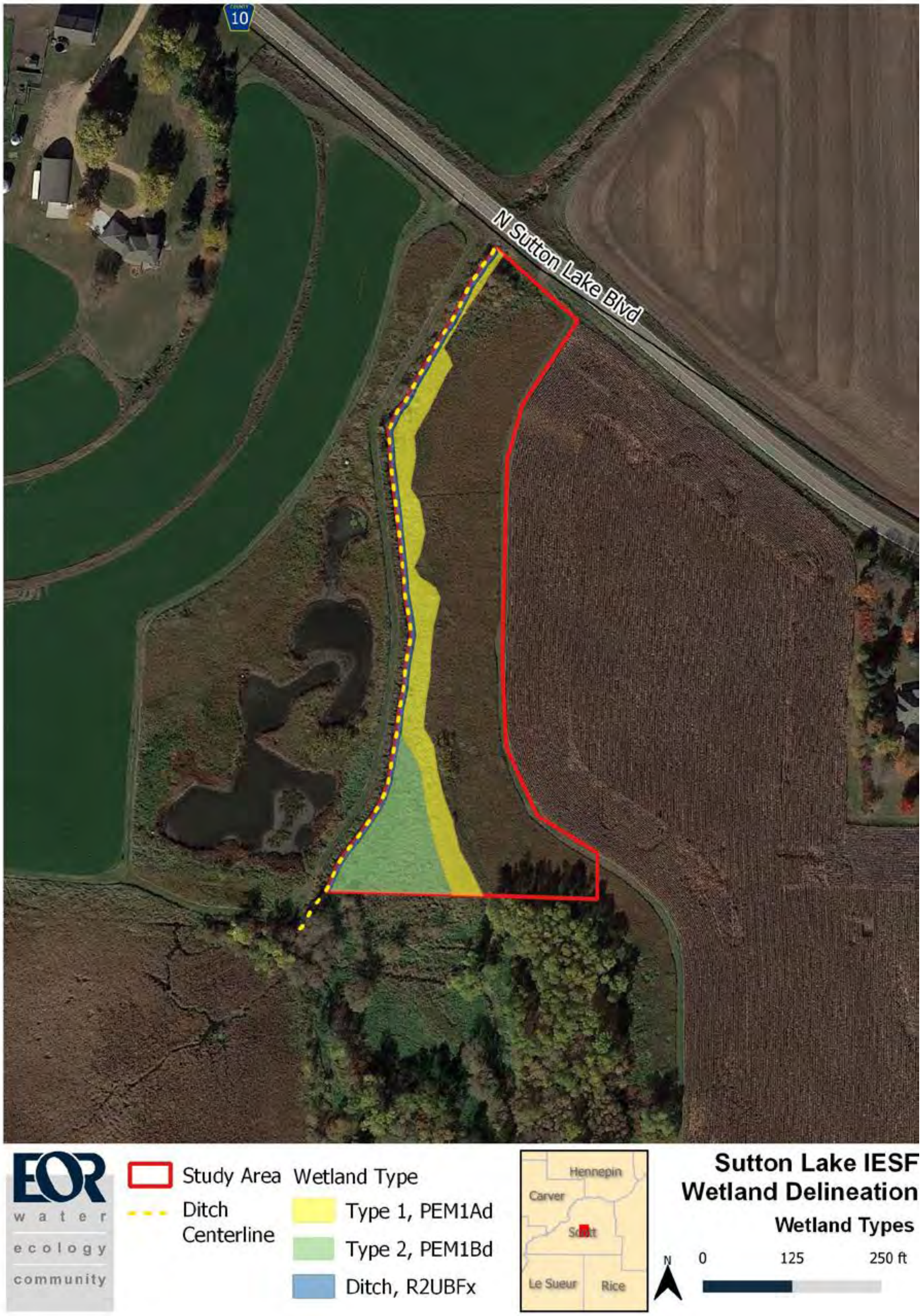

Figure 7. Wetland types within the Study Area.

APPENDIX A: WETLAND PLANT INDICATOR CLASSES

Obligate Wetland (OBL)	Species occurs almost always (estimated probability >99%) in wetlands under natural conditions.
Facultative Wetland (FACW)	Species usually occurs in wetlands (estimated probability 67 to 99%) but occasionally found in non-wetlands.
Facultative (FAC)	Species equally likely to occur in wetlands and non-wetlands (estimated probability 34 to 66%).
Facultative Upland (FACU)	Species usually occurs in non-wetlands (estimated probability 67 to 99%) but occasionally is found in wetlands (estimated probability 1 to 33%).
Obligate Upland (UPL)	Species occurs in wetlands in other region but, under normal conditions, occur almost always (estimated probability >99%) in non-wetlands within the region specified. Species that do not occur in wetlands in any region are not found on the National List.
No Indicator Status (NI)	Insufficient information available to establish indicator status.

APPENDIX B: WETLAND DETERMINATION DATA FORMS AND PHOTOGRAPHS

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site Sutton IESF	City/County: Scott	Sampling Date: 6/25/2021	
Applicant/Owner: PLSLWD	State: MN	Sampling Point: W1A	
Investigator(s): Jimmy Marty & Nick McReavy	Section, Township, Range: S25 T114N R23W		
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): concave		
Slope (%): 1	Lat: 44.653490N	Long: 93.523918W	Datum: NAT 83 UTM Zone 15N
Soil Map Unit Name Wb: Webster-Glencoe silty clay loams	NWI Classification: PEM1Cd		

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

Are vegetation ____, soil ____, or hydrology ____ significantly disturbed?

Are vegetation ____, soil ____, or hydrology ____ naturally problematic?

Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS

(If needed, explain any answers in remarks.)

Hydrophytic vegetation present?	Y		
Hydric soil present?	Y	**Is the sampled area within a wetland?**	Y
Indicators of wetland hydrology present?	Y	If yes, optional wetland site ID:	Wetland 1

Remarks: (Explain alternative procedures here or in a separate report.)

Wetland is a fringe of a ditch terrace, 35% side slope, channel is 5 feet wide at sample point with thalweg of 7 inches. RCG and native phragmites dominate

VEGETATION -- Use scientific names of plants.

	Absolute % Cover	Dominant Species	Indicator Staus
Tree Stratum (Plot size: 30 ft)			
1			
2			
3			
4			
5			
	0	= Total Cover	
Sapling/Shrub stratum (Plot size: 15 ft)			
1			
2			
3			
4			
5			
	0	= Total Cover	
Herb stratum (Plot size: 5 ft)			
1 *Phalaris arundinacea*	80	Y	FACW
2 *Solidago gigantea*	15	N	FACW
3 *Persicaria amphibia*	2	N	OBL
4 *Acer negundo*	1	N	FAC
5 *Taraxacum officinale*	1	N	FACU
6 *Rubus idaeus*	1	N	FACU
7 *Asclepias syriaca*	1	N	FACU
8			
9			
10			
	101	= Total Cover	
Woody vine stratum (Plot size: 30 ft)			
1			
2			
	0	= Total Cover	

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across all Strata:	1	(B)
Percent of Dominant Species that are OBL, FACW, or FAC:	100.00%	(A/B)

Prevalence Index Worksheet

Total % Cover of:			
OBL species	2	x 1 =	2
FACW species	95	x 2 =	190
FAC species	1	x 3 =	3
FACU species	3	x 4 =	12
UPL species	0	x 5 =	0
Column totals	101 (A)		207 (B)

Prevalence Index = B/A = 2.05

Hydrophytic Vegetation Indicators:

- ___ Rapid test for hydrophytic vegetation
- X Dominance test is >50%
- X Prevalence index is ≤3.0*
- ___ Morphogical adaptations* (provide supporting data in Remarks or on a separate sheet)
- ___ Problematic hydrophytic vegetation* (explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic vegetation present? Y

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

SOIL

Sampling Point: W1A

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

Depth (Inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type*	Loc**	Texture	Remarks
0-4	10YR 2/1	100					loam	dry and friable
4-20	10YR 2/1	100					clay loam	
20-24	10YR 2/1	98	7.5YR 3/4	2	C	PL	clay	
24-34	10YR 2/1	100					clay	
34-36	10YR 4/1	75	10YR 4/3	25	C	M	clay	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils:

- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L)**
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (explain in remarks)

*Indicators of hydrophytic vegetation and weltand hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric soil present? Y

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface water present?	Yes		No	X	Depth (inches):
Water table present?	Yes		No	X	Depth (inches):
Saturation present? (includes capillary fringe)	Yes		No	X	Depth (inches):

Indicators of wetland hydrology present? Y

Describe recorded data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: Sutton IESF	City/County: Scott	Sampling Date: 6/25/2021	
Applicant/Owner: PLSLWD	State: Minnesota	Sampling Point: W1B	
Investigator(s): Jimmy Marty & Nick McReavy	Section, Township, Range: S25 T114N R23W		
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): concave		
Slope (%): 1	Lat: 44.653498N	Long: 93.523789W	Datum: NAT 83 UTM Zone 15N
Soil Map Unit Name: Wb: Webster-Glencoe silty clay loams	NWI Classification: none		

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

Are vegetation ____, soil ____, or hydrology ____ significantly disturbed?

Are vegetation ____, soil ____, or hydrology ____ naturally problematic?

Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS

(If needed, explain any answers in remarks.)

Hydrophytic vegetation present?	N
Hydric soil present?	Y
Indicators of wetland hydrology present?	N

Is the sampled area within a wetland? N

If yes, optional wetland site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION -- Use scientific names of plants.

Stratum	Absolute % Cover	Dominant Species	Indicator Staus
Tree Stratum (Plot size: 30 ft)			
1			
2			
3			
4			
5			
	0	= Total Cover	
Sapling/Shrub stratum (Plot size: 15 ft)			
1			
2			
3			
4			
5			
	0	= Total Cover	
Herb stratum (Plot size: 5 ft)			
1 *Sorghastrum nutans*	65	Y	FACU
2 *Solidago canadensis*	20	N	FACU
3 *Poa pratensis*	15	N	FAC
4 *Monarda fistulosa*	5	N	FACU
5 *Medicago lupulina*	1	N	FACU
6 *Cirsium arvense*	1	N	FACU
7 *Solidago gigantea*	1	N	FACW
8 *Melilotus alba*	1	N	UPL
9			
10			
	109	= Total Cover	
Woody vine stratum (Plot size: 30 ft)			
1			
2			
	0	= Total Cover	

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across all Strata:	1	(B)
Percent of Dominant Species that are OBL, FACW, or FAC:	0.00%	(A/B)

Prevalence Index Worksheet

Total % Cover of:

OBL species	0	x 1 =	0	
FACW species	1	x 2 =	2	
FAC species	15	x 3 =	45	
FACU species	92	x 4 =	368	
UPL species	1	x 5 =	5	
Column totals	109	(A)	420	(B)

Prevalence Index = B/A = 3.85

Hydrophytic Vegetation Indicators:

- ____ Rapid test for hydrophytic vegetation
- ____ Dominance test is >50%
- ____ Prevalence index is ≤3.0*
- ____ Morphogical adaptations* (provide supporting data in Remarks or on a separate sheet)
- ____ Problematic hydrophytic vegetation* (explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic vegetation present? N

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

SOIL

Sampling Point: W1B

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

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type*	Loc**	Texture	Remarks
0-13	10YR 2/1	100					clay loam	very compact, dry, friable
13-19	10YR 2/1	100					clay	
19-24	10YR 2/1	98	10YR 4/2	2	D	PL	clay	
24-28	10YR 3/1	100					clay	
28-34	10YR 4/1	70	10YR 4/3	30	C	M	clay	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils:

___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ Dark Surface (S7) (**LRR K, L)**
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Very Shallow Dark Surface (TF12)
___ Other (explain in remarks)

*Indicators of hydrophytic vegetation and weltand hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric soil present? Y

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface water present?	Yes	___	No	X	Depth (inches): ___
Water table present?	Yes	___	No	X	Depth (inches): ___
Saturation present? (includes capillary fringe)	Yes	___	No	X	Depth (inches): ___

Indicators of wetland hydrology present? N

Describe recorded data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site	Sutton IESF	City/County:	Scott	Sampling Date:	6/25/2021
Applicant/Owner:	PLSLWD	State:	MN	Sampling Point:	W1C
Investigator(s):	Jimmy Marty & Nick McReavy	Section, Township, Range:	S25 T114N R23W		
Landform (hillslope, terrace, etc.):	terrace	Local relief (concave, convex, none):	concave		
Slope (%):	1	Lat:	44.654702N	Long:	93.523717
Datum:	NAT 83 UTM Zone 15N				
Soil Map Unit Name	Wb: Webster-Glencoe silty clay loams	NWI Classification:	none		

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

Are vegetation ____, soil ____, or hydrology ____ significantly disturbed? Are "normal circumstances" present? No

Are vegetation ____, soil ____, or hydrology ____ naturally problematic?

SUMMARY OF FINDINGS

(If needed, explain any answers in remarks.)

Hydrophytic vegetation present?	N
Hydric soil present?	Y
Indicators of wetland hydrology present?	N

Is the sampled area within a wetland? N

If yes, optional wetland site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION -- Use scientific names of plants.

	Absolute % Cover	Dominant Species	Indicator Staus
Tree Stratum (Plot size: 30 ft)			
1 *Acer negundo*	15	Y	FAC
2			
3			
4			
5			
	15	= Total Cover	
Sapling/Shrub stratum (Plot size: 15 ft)			
1 *Salix interior*	15	Y	FACW
2 *Lonicera morrowii*	10	Y	FACU
3 *Rubus idaeus*	1	N	FACU
4			
5			
	26	= Total Cover	
Herb stratum (Plot size: 5 ft)			
1 *Phalaris arundinacea*	40	Y	FACW
2 *Bromus inermis*	40	Y	FACU
3 *Solidago canadensis*	25	Y	FACU
4 *Asclepias syriaca*	5	N	FACU
5 *Taraxacum officinale*	1	N	FACU
6 *Cirsium arvense*	1	N	FACU
7 *Acer negundo*	1	N	FAC
8 *Ulmus pumila*	1	N	UPL
9			
10			
	114	= Total Cover	
Woody vine stratum (Plot size: 30 ft)			
1 *Vitis riparia*	5	Y	FACW
2 *Parthenocissus quinquefolia*	5	Y	FACU
	10	= Total Cover	

Dominance Test Worksheet

Number of Dominant Species that are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across all Strata:	8	(B)
Percent of Dominant Species that are OBL, FACW, or FAC:	50.00%	(A/B)

Prevalence Index Worksheet

Total % Cover of:			
OBL species	0	x 1 =	0
FACW species	60	x 2 =	120
FAC species	16	x 3 =	48
FACU species	88	x 4 =	352
UPL species	1	x 5 =	5
Column totals	165 (A)		525 (B)

Prevalence Index = B/A = 3.18

Hydrophytic Vegetation Indicators:

- ___ Rapid test for hydrophytic vegetation
- ___ Dominance test is >50%
- ___ Prevalence index is ≤3.0*
- ___ Morphogical adaptations* (provide supporting data in Remarks or on a separate sheet)
- ___ Problematic hydrophytic vegetation* (explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Hydrophytic vegetation present? N

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

SOIL

Sampling Point: W1C

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

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type*	Loc**	Texture	Remarks
0-24	10YR 2/1	100					loam	very compact, no clay, friable

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils:

___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ Dark Surface (S7) (**LRR K, L)**
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Very Shallow Dark Surface (TF12)
___ Other (explain in remarks)

*Indicators of hydrophytic vegetation and weltand hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: rock/gravel
Depth (inches): 24"

Hydric soil present? Y

Remarks:
Assume A12

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
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___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

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

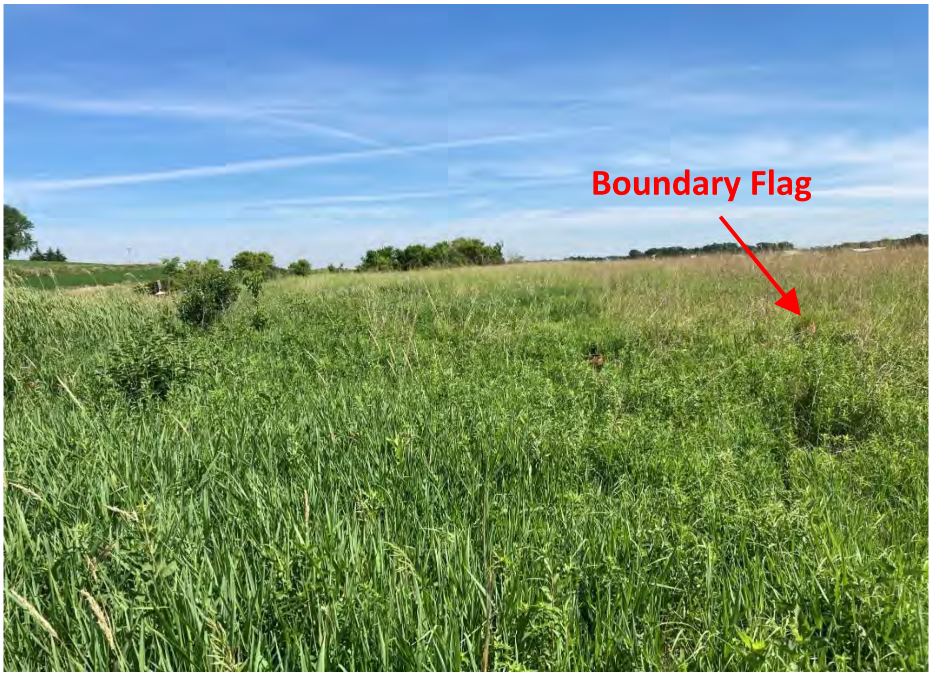
Field Observations:

	Yes	No	Depth (inches)
Surface water present?		X	
Water table present?		X	
Saturation present? (includes capillary fringe)		X	

Indicators of wetland hydrology present? N

Describe recorded data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:



Overview of the delineated wetland looking north along the boundary. A boundary flag is visible at the transition from reedcanary grass-dominated wetland to indian grass-dominated upland.

Wetland sample point W1A.

Upland sample point W1B.

Non-wetland sample point W1C.

Wetland boundary overview looking north near non-wetland sample point W1C.

Looking south toward the southern boundary where the wetland broadens near Sutton Lake.

Looking west across the ditch.

memo

Project Name	Sutton Lake IESF	**Date**	11/10/2021
To / Contact info	Collin Schoenecker, Jon Utrecht (Scott SWCD); Ben Carlson (BWSR); Taylor Huinker (DNR)		
Cc / Contact info	Joni Gies (PLSLWD); Troy Kuphal (Scott SWCD)		
From / Contact info	Jason Naber, Chris Long		
Regarding	Wetland Boundary and Type Addendum – Sutton Lake IESF (LGU Project No. WCA-21-044)		

Background

The following memo summarizes revisions made to the boundary and type of a wetland complex delineated at the proposed site for an iron-enhanced sand filter on the east side of the Sutton Lake outlet channel. A Level 2 delineation report and joint project application were received by the LGU from EOR on 10/5/2021. The TEP reviewed the delineation in the field on 11/1/2021. The TEP recommended a major revision to the wetland boundary and type originally delineated by EOR.

Delineation Revisions

The northern two thirds of the wetland feature originally delineated by EOR was determined to be upland. This area retained some wetland characteristics, in part dominance of reed canary grass (*Phalaris arundinacea*), because it contained spoils from historical dredging of the channel. The southern portion of the wetland feature was retained as delineated. (**Figure 1**). The wetland types in this area remain the same as delineated. An updated summary of the revised wetland types and areas are provided below in **Table 1.**

Table 1. Revised Delineated Wetland Table

Aquatic Resource	Wetland Type			Area (acres)
	Cowardin *et al* / NWI	Circular 39	Eggers and Reed	
Wetland	PEM1Ad	Type 1	Seasonally Flooded Basin	0.19
	PEM1Bd	Type 2	Fresh (Wet) Meadow (Disturbed Subtype)	0.40
Wetland Area				**0.59**
Ditch	R2UBFx	N/A	N/A	0.13
Total Aquatic Resource Area within Study Area				**0.72**

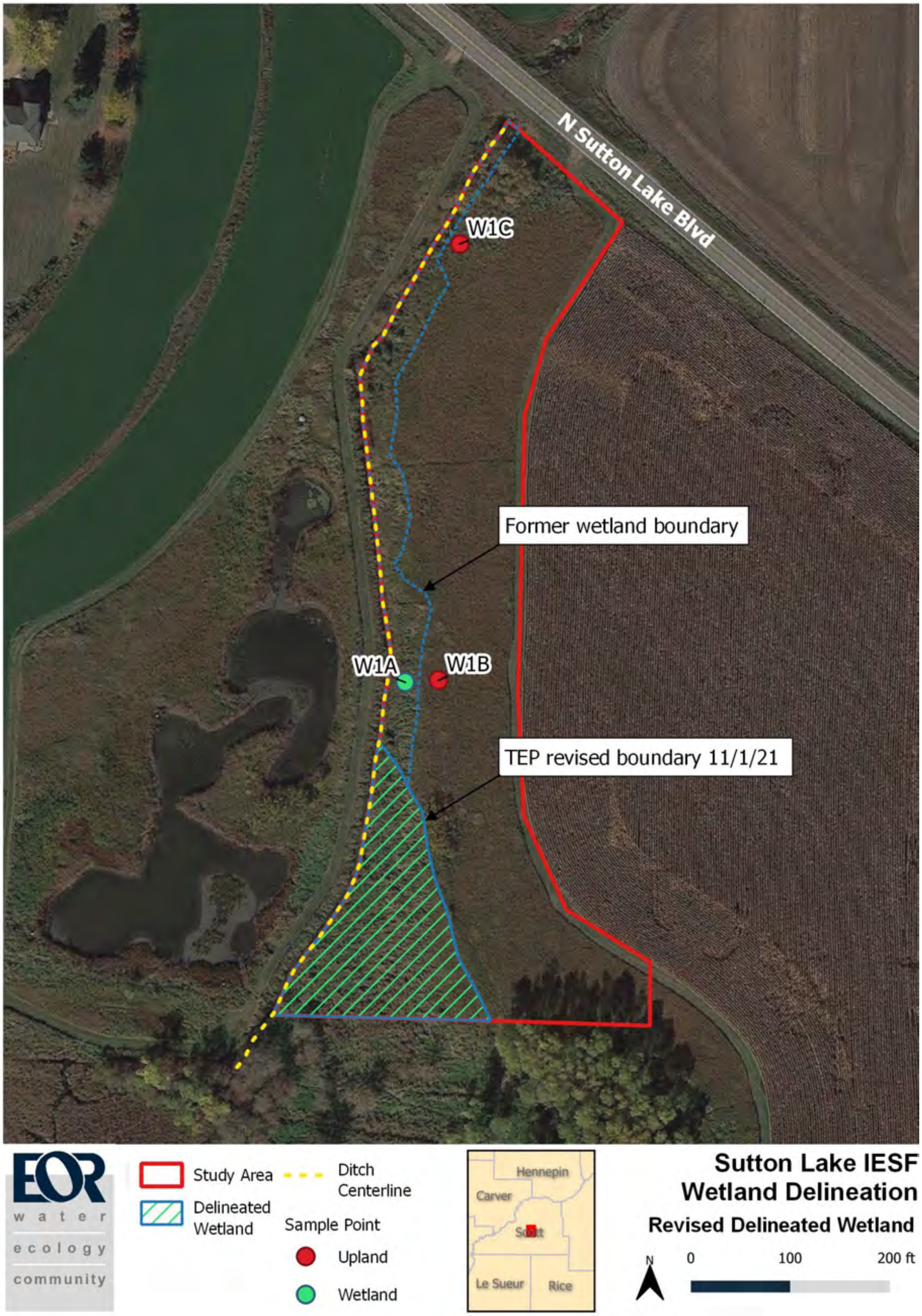


Figure 1. Wetland boundary revisions recommended by the TEP.

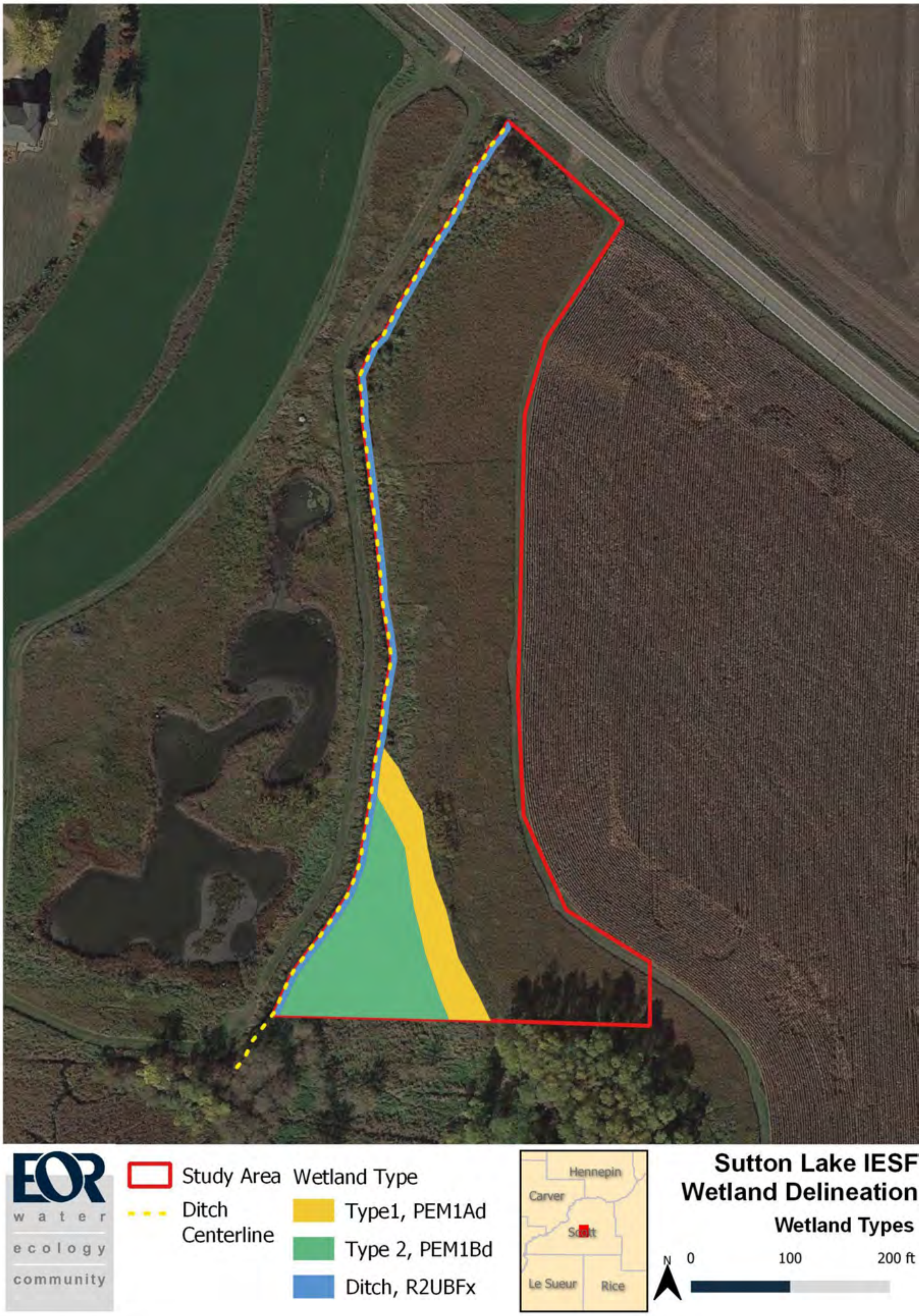


Figure 2. Revised wetland types and boundaries.