Prepared by Emmons & Olivier Resources, Inc.
Prepared for Prior Lake-Spring Lake Watershed District

Spring Lake West Subwatershed

BMP Feasibility Study

04.28.22

Cover image: Spring Lake West Subwatershed, Google Earth Image

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1 SUMMARY

The Watershed District authorized the following study to determine the feasibility of developing water quality improvement practices in the Spring Lake West Subwatershed (see Figure 1). A detailed investigation of the subwatershed, including field-surveys of potential project sites was conducted in the fall of 2019. Three locations within the subwatershed were identified as having potential for water quality improvement, flood retention and wetland habitat creation (see Figure 2). Feasibility study level designs were developed for each of the sites along with cost estimates and an estimate of the potential benefits of each site.

The first site, referred to as the Hylland Property, has the potential to provide water quality improvement for the majority of the subwatershed prior to discharge into Spring Lake. Specifically, the site would be used to address dissolved phosphorus via an off-line iron-enhanced sand filter (IESF) that would be constructed immediately adjacent to the existing ditch. A second site, the Krueger Property, was identified as an alternative location for an IESF. This site is immediately upstream of the Hylland Property. A third site, a large, agricultural field referred to as the Hentges and Ames Property, was investigated for flood retention benefits and for wetland restoration potential.

Hylland Property and Krueger Property

Eight alternative IESF designs/locations were developed for the Hylland Property and the Krueger Property (four on each property). Size and configurations of the IESFs vary among each of the alternatives. The Hylland property alternatives use a gravity bypass whereas the Krueger property alternatives make use of a pump system (see Appendix A). A summary of the estimated performance and cost effectiveness for each of the options are shown in Table 1.

Table 1. Estimated Iron-Enhanced Sand Filter Performance

Option		Total Phosphorus (TP) Captured Load (lb/yr)	Orthophosphorus (OP) Captured Load (lb/yr)	Equivalent Annual Cost (EAC)/TP Captured ($/lb TP/yr)
Hylland	1	138	68	$351
	2	129	64	$405
	3	121	60	$361
	4	72	36	$586
Krueger	5	138	69	$500
	6	121	60	$577
	7	90	45	$958
	8	127	63	$542

Hentges and Ames Property

Option 1 – Wetland Bank

This option has the potential to generate a range of 21.8 to 36.3 wetland credits that could be sold through a wetland bank. These credits could generate a range of potential sales from $1,090,000 to $1,815,000. The estimated project cost range of $720,000 to $1,060,000 has the potential to offer a net return of as much as approximately $1,000,000 but vetting by BWSR staff will be necessary to get a more accurate assessment of credit potential.

Option 2- Flood Reduction

Alternatively, this site could focus on flood reduction by temporarily impounding 4-feet of runoff water from the 254-acre drainage area. Flood storage however appears to provide minor benefits at Prior Lake: around 0.01-feet of reduction in peak elevation during 2014. The estimated project cost for this option ranges from $757,000 to $1,113,000.

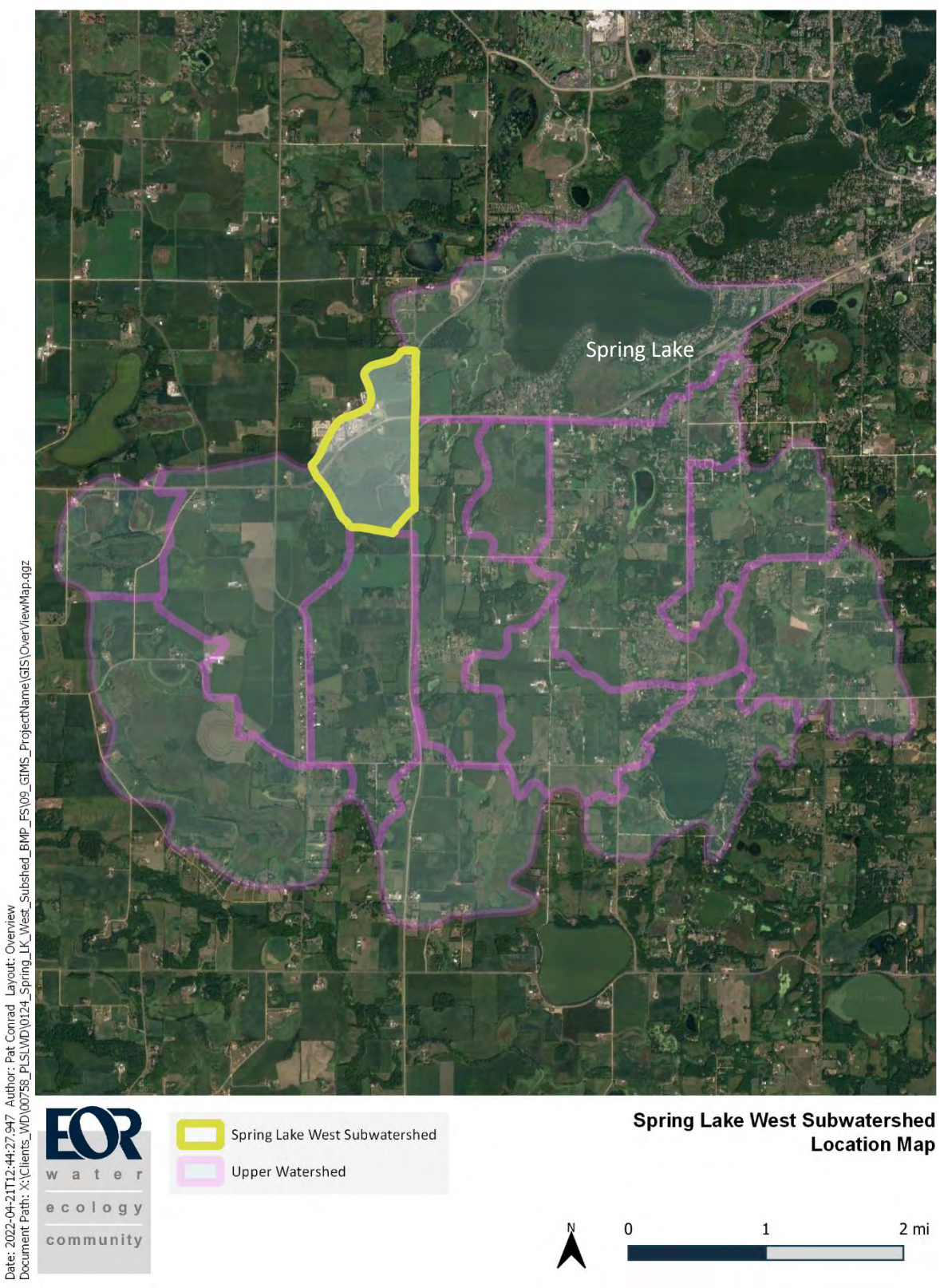

Figure 1. Spring Lake West Subwatershed within the Upper Watershed.

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 the lake was not meeting its aquatic recreation use due to excess nutrients which lead to algal blooms and low water clarity. Water quality monitoring conducted by the Watershed District has identified that phosphorus is the nutrient contributing most to the lake's water quality impairment.

Over the years, the Watershed District has undertaken significant efforts to improve water quality in Spring Lake. The efforts have ranged from small scale raingardens and lakeshore restorations to large public improvement projects. The District has attempted to control phosphorus loading in Spring Lake by managing internal and external sources. Internal phosphorus sources have been managed through an aggressive carp control 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 the largest ditch (County Ditch 13) flowing to Spring Lake since 1998. This system strips an estimated 60% of the dissolved phosphorus from the ditch flows. The District has also worked with watershed farmers to adopt agricultural conservation practices that help reduce erosion and nutrient export from their fields.

In 2019, the Watershed District applied for and was awarded a Metro Watershed Based Funding Grant from the Board of Water and Soil Resources (BWSR) which included funds to look into reducing pollutant loading to Spring Lake from the area known as the Spring Lake West subwatershed (see Figure 1). Watershed-conducted monitoring of this subwatershed (specifically in the ditch running east of the Scott County Highway department into the west side of Spring Lake) has shown high levels of nutrients, conductivity, and *E. coli*. The Watershed District authorized this feasibility study in 2019 to review data and recommend a water quality BMP along the ditch.

Three sites within the subwatershed were identified as having potential for addressing water quality, flood retention, and/or wetland habitat creation. The sites are referred to as the Hylland Property, the Krueger Property, and the Hentges and Ames Properties which are shown in Figure 2.

Figure 2. Potential Project Sites within the Spring Lake West Subwatershed

3 METHODS

Data Collection

EOR staff visited the Hylland, Hentges, and Ames properties on November 26, 2019 to document existing conditions and conduct a site survey. The survey included a profile of the existing ditch on both properties, recording spot elevations and surveying culvert inverts. The survey was conducted before snow cover that year and should provide a high degree of accuracy. To advance the feasibility study, EOR staff reviewed existing data and as the study continued, it was determined that additional alternative sites should be investigated on the west side of Marschall Road and north of County Trail E on the Krueger Property. An additional site survey was subsequently conducted on the Krueger property.

Following the field work, EOR processed the survey data and began analyzing the information collected. Topographical data was imported into Autodesk AutoCAD Civil 3D drafting software along with aerial imagery, County LiDAR contours (2-foot intervals) and County GIS parcel linework. Once base map construction was completed, concept level design drawings were developed to help illustrate the information collected to date and to provide preliminary construction drawings.

Modeling Analysis

Design concepts were initially analyzed based on the surrounding landscape, hydrologic modeling and the water quality monitoring data provided by the District. The District's PCSWMM model was first updated and revised upstream of Marschall Road (monitoring location ST_19) to reflect more detailed information regarding both hydraulics (e.g. culvert invert elevations) and hydrology (e.g. drainage boundaries) collected through surveying and field verification. Several subcatchments were subdivided both to provide a higher level of detail and to rectify incorrect assumptions that were made during model construction regarding drainage direction (in particular, the area near the intersection of County Trail E and Langford Ave, which drains to the east rather than to the west).

Simulated flows were compared against observed flows for 2014, 2017, and 2018, and it was determined that a recalibration of the model was unnecessary as the updates and revisions to the model improved upon the original calibration to 2014 rainfall such that model performance was statistically acceptable (Nash-Sutcliffe Efficiency > 0).

A long-term (10-year) simulation was performed from 2008-2017 to estimate average water quality loading using the flow-weighted mean concentrations for orthophosphorus (OP) and total phosphorus (TP) calculated from monitoring performed in 2017 and 2018. The flow-weighted mean concentrations and average annual loads at monitoring location ST_19 are shown in Table 2. The flow-weighted mean concentrations were calculated using a filtered dataset where concentrations greater than 1.5 times the interquartile range were removed from the dataset (or TP concentrations greater than 0.696 mg/L and SRP concentrations greater than 0.439 mg/L). These samples were left out because the high concentrations are believed to be temporary and will be resolved in the near future.

If the full dataset with the high phosphorus concentrations had been utilized for this feasibility study, the estimated flow-weighted mean concentrations would more closely represent current conditions

and be nearly double, but the analysis would not have recognized the planned improvements (by others). Future monitoring should be used to verify that the improvements have greatly reduced phosphorus concentrations in the stream as assumed as part of this feasibility study.

Table 2. Flow-weighted mean concentrations and average annual loads at Station ST_19

Parameter	Flow-weighted mean concentration (mg/l)	Average annual loads (lbs/yr)
Orthophosphorus	0.154	139
Total Phosphorus	0.264	237

Preliminary Design Concept

Guided by the modeling exercise, topographical survey, landowner feedback, and LiDAR, EOR selected the most practical locations for the proposed BMP's. The Hylland and Krueger properties were identified as areas where an iron-enhanced sand filter (IESF) could be optimized to address the dissolved phosphorus loading from the 384-acre contributing drainage area. 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. Based on direction from District staff, all design options for the IESF were sited to maximize use of non-tilled agricultural land.

The Hentges & Ames property was identified as a location for a wetland restoration and flood retention project. The property has existing wetlands located within it but has been ditched to allow for more productive agricultural land. A review of historical aerial photography indicated that a significant portion of the site was previously wetland (see Figure 3). A ditch plug and control structure at the northwest corner of the property would be the most practical option to achieve the largest wetland footprint. Two sub options within this design were analyzed. One option would be a wetland that would provide deeper pools with year-round ponding to create a diverse wetland habitat that could be put into a wetland bank. A second option would be an outlet control structure that could drain and provide flood storage downstream for Spring Lake. Both options were further analyzed as a part of this feasibility project.

Figure 3. Historical Aerial Photography of Hentges & Ames site (1937)

4 FINDINGS

Hylland Property

As identified in the preliminary concept design phase, EOR furthered the design of four optional IESFs on the Hylland property. Landowner feedback required the IESF designs to be placed on the north side of the ditch to avoid being placed on land in a conservation program. Each of the design options would have a ditch diversion structure placed in the ditch upstream of the filter to divert base flows and a portion of storm flows to the filter. The structure would be designed with an overflow bypass as to not inundate the filter for too long. From the diversion structure would be a 12" HDPE pipe to the filter. Water would flow through the filter and 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 larger rain events. The filter surface would allow for 2 feet of ponding in the basin before the emergency overflow is activated (see Appendix A).

Hylland Property Options

Option 1: Sited along the northern edge of the ditch, the design of Option 1 optimizes the footprint for the filter at 22,600 ft^2.

Option 2: The design of Option 2 constrains the filter to the western tract within the Hylland property and avoids the wetland area riparian to the ditch. Filter footprint is 15,000 ft^2.

Option 3: Option 3 is a smaller version of Option 2 with a footprint of 10,400 ft^2. It further constrains the filter to the western tract within the Hylland property and continues to avoid the wetland area riparian to the ditch.

Option 4: The smallest of the Hylland property options at 2,350 ft^2, Option 4 is sited within the eastern tract of the Hylland property and has encroachment into the wetland area that is riparian to the ditch.

Pumps were not considered for the Hylland property options because the existing site conditions allowed for water to flow to the filter via gravitational non-pressurized pipes. The effluent also did not require pumping because the elevation drop throughout the ditch profile provide positive drainage at the outlet. With avoiding pumps for the IESF, this creates a significant cost savings compared to layouts on the Krueger property where pumping is required. This design would also be compatible with future developments in the surrounding area that could include a subdivision and residential road on adjacent properties.

Krueger Property

Following the initial IESF siting and design, it was determined that additional opportunities should be investigated on the Krueger property located west of Marschall Road. Four options were developed, each of which utilizes a pump system rather than the gravity bypasses used in the Hylland property options. All of the Krueger property options completely avoid wetland riparian to the ditch.

Krueger Property Options

Option 5: This option is located along the northern edge of the ditch and optimizes the filter size. With a footprint of 22,900 ft^2, Option 5 is the largest potential filter.

Option 6: Options 6 is sited along the eastern/southern edge of the ditch at the upstream end of the property. Filter footprint is 10,500 ft^2.

Option 7: Option 7 is the smallest option on the Krueger property with a footprint of 3,500 ft^2. It is sited north of the ditch at the downstream end of the property.

Option 8: Option 8 is sited southeast of the ditch near the east end of the property with a footprint of 13,500 ft^2. It is adjacent to Marschall Road which affords this option the best access for construction and maintenance.

Iron-Enhanced Sand Filter Performance

Based on the long-term simulation, water quality pollutant loading and characteristics of the IESFs, the estimated performance for total phosphorus (TP) and ortho-phosphorus (OP) of each option was determined (Table 3). The volume of water treated by the IESF is estimated from the footprint of the filter and the infiltration rate of the sand matrix. Of the water that gets treated, 60% of the Soluble Reactive Phosphorus (SRP) and 85% of the particulate phosphorus is captured according to literature values in the Minnesota Stormwater Manual which equates to approximately 70% TP captured for the SRP to TP ratio at Station ST_19. The performance ranges from 72-138 lbs/yr for TP and from 36-69 lbs/yr for OP. The performance ranges are based on the size of each IESF.

Table 3 Total Phosphorus (TP) and Ortho-Phosphorus (OP) Performance by IESF Option

Option		Volume Treated (ac-ft/yr) [%]	TP Influent Load (lb/yr)	OP Influent Load (lb/yr)	TP Captured Load (lb/yr)	OP Captured Load (lb/yr)
Hylland	1	272 [83%]	195	114	138	68
	2	255 [77%]	183	107	129	64
	3	239 [73%]	172	100	121	60
	4	142 [43%]	102	59	72	36
Krueger	5	273 [83%]	196	114	138	69
	6	240 [73%]	172	100	121	60
	7	179 [54%]	128	75	90	45
	8	250 [76%]	180	105	127	63

Construction and maintenance costs were estimated for each option (Appendix B). The predicted life span for each option was determined using the OP loading from Table 3 along with the estimated iron content/consumption within the filter. To compare the cost of each option, the equivalent annual cost was determined using the construction and maintenance cost along with a discount rate of 4.5% (Iowa DOT). Given the performance data provided in Table 3, the cost effectiveness of each option was estimated (Table 4). The cost effectiveness is expressed in terms of equivalent annual cost for the practice per pound of TP captured per year. Option 1 on the Hylland property was estimated to be the most cost effective at $351/lb TP/yr.

Table 4. Equivalent Annual Cost and Cost/Total Phosphorus Captured

Option	Construction Cost ($)	Legal and Easement Costs ($)	Pump Maintenance Cost ($)	Annual Maintenance Cost ($)	Predicted Life (yrs)	Equivalent Annual Cost (EAC) ($/yr)	EAC/TP Captured ($/lb TP/yr)
1	$553,000	$25,000	$0	$2,500	19	$48,000	$351
2	$461,000	$25,000	$0	$2,000	13	$52,000	$405
3	$313,000	$20,000	$0	$1,500	10	$44,000	$361
4	$104,000	$10,000	$0	500	3	$42,000	$586
5	$690,000	$20,000	$10,000	$2,500	19	$69,000	$500
6	$451,000	$10,000	$10,000	$1,500	10	$70,000	$577
7	$263,000	$10,000	$10,000	500	4	$87,000	$958
8	$510,000	$10,000	$10,000	$1,500	12	$69,000	$542

Hentges & Ames Property

The District's PCSWMM model was used to evaluate the potential for efficacious flood storage upstream of County Trail E. The simulation year 2014 was used in order to evaluate the impact of flood storage on the 2014 flooding event. A maximum potential water level reduction of 0.01-feet on Prior Lake was achieved without significantly impacting adjacent structures and major roadways, so this location was deemed more suitable for other projects – notably wetland banking.

Option 1 – Wetland Bank

At the Hentges & Ames property, two wetland designs were developed. The first option could be used to develop a wetland bank for District. The design would plug the existing agricultural drainage ditch through the property with a ditch plug located in the northwest corner of the property. A berm would be built with an elevation of 936.00 and a water control structure (with inlet/outlet pipes, stop logs and control valve) would be placed in the centerline of the existing ditch. The stop logs would be at elevation 934.00 which would set the water surface elevation. The top of the overflow grate on the structure would be at an elevation of 935.00 and would create 1 foot of bounce within the wetland (see Appendix A).

EOR evaluated the wetland banking credit potential of the Hentges & Ames property (Table 5) by use of the most recent USACE/BWSR guidance for determining the wetland credit potential from cultivated fields[1]. There is the potential for between 21.8-36.3 bank credits based on the design of Option 1.

Table 5. Potential wetland banking credits at Hentges & Ames Property[2]

Action	WCA Section 8420.0526	Percent of Acreage Receiving Credit	Estimated Acres	Potential Credits
Establish upland buffer adjacent to the wetland	Subpart 2	10%, 25%, 50%	21.7	2.2-10.9
Restoration of cropped areas that were formerly a wetland	Subparts 3 & 4A	100%	13.8	13.8
Restoration of existing wetland areas that are not cropped	Subpart 4B & 2019 BWSR Guidance	50%, 75%, 100%	11.6	5.8-11.6
			Total Potential Credits	21.8-36.3

In this scenario, the bank would be a mix of wetland types 2, 3, 4 and 5 with the majority being type 4, which is deep marsh. Types 1-3 (seasonal wetland, wet meadow and shallow marsh respectively)

[1] http://bwsr.state.mn.us/sites/default/files/2019-05/WETLANDS_Banking_Crediting_Cultivated_Fields_5_6_19.pdf
[2] Chart adapted from: http://bwsr.state.mn.us/sites/default/files/2018-12/Wetland_Banking_Generating_Wetland_Credits_Guidance.pdf

are more sought-after, because there are often fewer credits available of those types in the service area, and they are the types of wetland most often impacted.

BWSR Credit Market

A review of the BWSR wetland credit market reveals that there are not many credits currently available within the watershed of the project site. Here is the breakdown by type (Table 6).

Table 6. BWSR Wetland Credits Available in the Minnesota (Shakopee) Watershed

Type	Credits
1 – Seasonally Flooded	2.44
2 – Wet Meadow	4.04
3 – Shallow Marsh	4.61
4 – Deep Marsh	4.12
5 – Open Water	0
6 – Shrub Swamp	0
7 – Wooded Swamp	0
8 – Bog	0
Unknown Type	3.91
Upland (non-wetland)	0.43

To assess the value of these credits, the most recent transactions within the bank service area were accessed on the BWSR's Wetland Bank Credits and Fees website[3]. The value of credits in the bank service area that the project is in (BSA 9) has fluctuated over the last few years. After steadily rising from 2014 to 2018, the value dropped in 2019, which is the most recent year in which credit values have been reported on the BWSR website.

Table 7. Average cost of wetland credit by year in Bank Service Area 9 (Minnesota River)

Year	Average Credit Value in BSA 9
2014	$31,400
2015	$39,800
2016	$40,800
2017	$43,400
2018	$57,400
2019	$50,000

The average value of a wetland credit from transactions reported in 2019 was approximately $50,000. At that rate, there is the potential range of $1,090,000 - $1,815,000 return, however more study would be required to arrive at a more precise estimate.

[3] http://bwsr.state.mn.us/wetland-bank-credits-and-fees

Option 2 – Flood Storage

The second option at the Hentges & Ames property would not qualify as a wetland bank but would provide flood storage to downstream water bodies such as Spring Lake. The ditch plug would be very similar to the Wetland Bank Option (Option 1) except there would be no stop logs and the inlet invert would be at elevation 931.00, creating a water surface elevation that is 3 feet lower than the previous option. The entire wetland could now provide 4 feet of storm bounce to the overflow grate at elevation 935.00 (see Appendix A).

- Total drainage area: 254 acres
- Flood storage at this location appears to provide minor benefits at Prior Lake:
    - The peak elevation in the storage feature was 935.32'
    - Around 0.01-feet of reduction in peak elevation during 2014 (0.01-feet is the limit of reporting precision)

5 CONCLUSIONS

Hylland Property and Kruger Property

EOR developed Engineer Opinions of Probable Cost for eight IESF options on the Hylland and Krueger properties. Construction costs range from $104,000 to $690,000 (Per ASTM E 2516-06 design level (concept phase) see Appendix B). In addition to the construction cost, the equivalent annual cost for each alternative was calculated. The equivalent annual cost incorporates maintenance costs and the variable life span estimated for each option. Cost effectiveness was estimated for each of the alternatives and ranges from $351 to $958 per pound of TP captured per year.

Hentges & Ames Property Wetland Bank –Option 1

The Engineer Opinion of Probable Cost for the wetland bank option on the Hentges & Ames property was a construction total of $148,000. Easement and/or land acquisition was based on current property values in the area, and it was determined that land acquisition or easements along with associated legal fees could cost $700,000.

The total cost of the project would equal $848,000. Per ASTM E 2516-06 design level (concept phase), a -15% and +25% range was applied to create a total project cost range of $720,000 to $1,060,000 (see Appendix B). This cost could be offset by the creation and sale of wetland banking credits that are estimated to be valued between $1,090,000 - $1,815,000.

Hentges & Ames Property Flood Storage –Option 2

An Engineer Opinion of Probable Cost for the flood storage option on the Hentges & Ames property was also developed. A construction total of $191,000 was estimated. Easement and/or land acquisition was based on current property values in the area and it was determined that land acquisition or easement along with associated legal fees could cost $700,000.

The total cost of the project would equal $891,000. Per ASTM E 2516-06 design level (concept phase), a -15% and +25% range was applied to create a total project cost range of $757,000 to $1,113,000. (see Appendix B).

6 NEXT STEPS

Continue to pursue engagement opportunities with property owners to gauge interest in projects. Work with BWSR staff to fully vet wetland mitigation banking opportunities.

APPENDIX A

POTENTIAL IRON
ENHANCED SAND FILTER
KRUEGER PROPERTY

TO SPRING LAKE

MARSCHALL RD

POTENTIAL IRON
ENHANCED SAND FILTER
HYLLAND PROPERTY

LANGFORD BLVD

POTENTIAL WETLAND BANK
OR
POTENTIAL FLOOD STORAGE
HENTGES DEVELOPMENT & AMES PROPERTIES

COUNTY TRAIL E

N

SCALE IN FEET

0 250 500 1000

NO	DATE	BY	REVISION
6			
5			
4			
3			
2			
1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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

PLSLWD

SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

PROJECT OVERVIEW

SHEET 01 OF 11 SHEETS

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TO SPRING LAKE

COUNTY TRAIL E

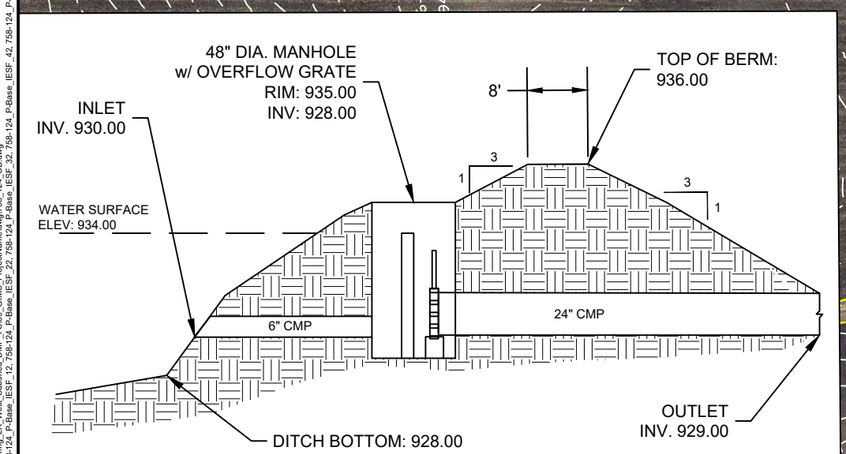
WETLAND OUTLET STRUCTURE

CROPPED FORMERLY WETLAND AREA

MINIMUM 50' WETLAND/UPLAND BUFFER

TOP OF BERM: 936.00

NON-CROPPED EXISTING NWI WETLAND



WETLAND OUTLET STRUCTURE

NOT TO SCALE

PROPOSED WETLAND BUFFER	21.7 AC	
CROPPED AREAS FORMERLY WETLANDS	13.8 AC	
NON-CROPPED EXISTING NWI WETLANDS	11.6 AC	

SCALE IN FEET

0 100 200 400

NO	DATE	BY	REVISION
6			
5			
4			
3			
2			
1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

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SPRING LAKE WEST SUBSHED FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

WETLAND BANK OPTION

SHEET 02 OF 11 SHEETS

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TO SPRING LAKE

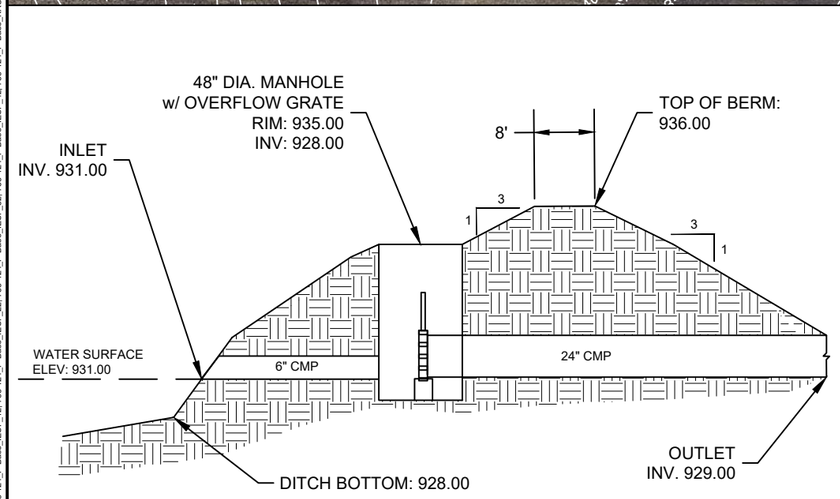
COUNTY TRAIL E

WETLAND OUTLET STRUCTURE

EASEMENT BOUNDARY

TOP OF BERM: 936.00

MAXIMUM 4' FLOOD BOUNCE ELEV.: 935.00



WETLAND OUTLET STRUCTURE

NOT TO SCALE

SCALE IN FEET

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5			
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3			
2			
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DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

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water ecology community

PLSLWD

SPRING LAKE WEST SUBSHED FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

WETLAND FLOOD STORAGE OPTION

SHEET 03 OF 11 SHEETS

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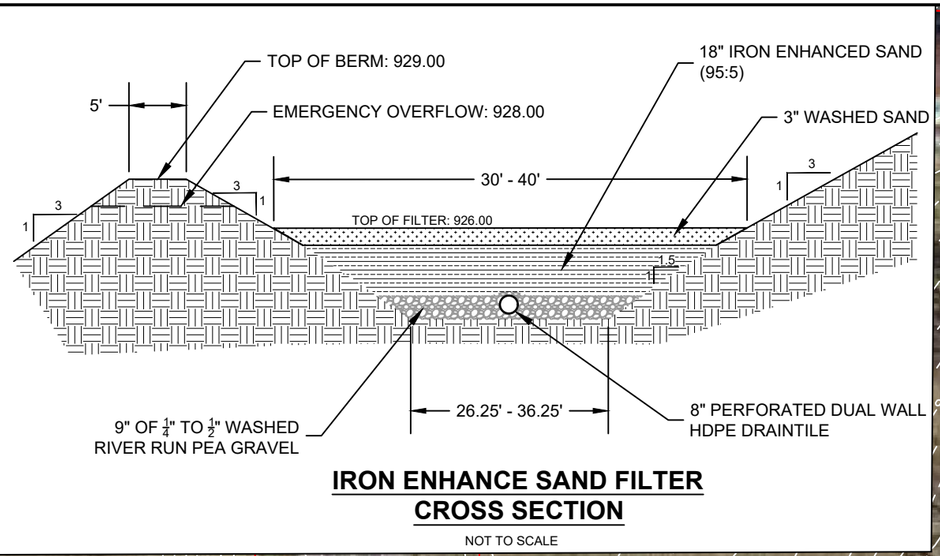

IRON ENHANCE SAND FILTER CROSS SECTION

NOT TO SCALE

12" HDPE
INV. 923.50

TO SPRING LAKE

12" HDPE
INV. 922.00

EMERGENCY OVERFLOW:
10' WIDE
928.00

TOP OF BERM:
929.00

TOP OF FILTER:
926.00
SURFACE AREA: 22,600 SQ-FT

MARSCHALL RD

DRAINAGE EASEMENT
1.40 AC

12" HDPE
INV. 926.00

12" HDPE
INV. 927.00

NWI WETLAND
BOUNDARY

DITCH DIVERSION
STRUCTURE

SCALE IN FEET

0 30 60 120

NO	DATE	BY	REVISION
6			
5			
4			
3			
2			
1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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

PLSLWD

SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 1

SHEET 04 OF 11 SHEETS

Plot Date: 03/01/2022
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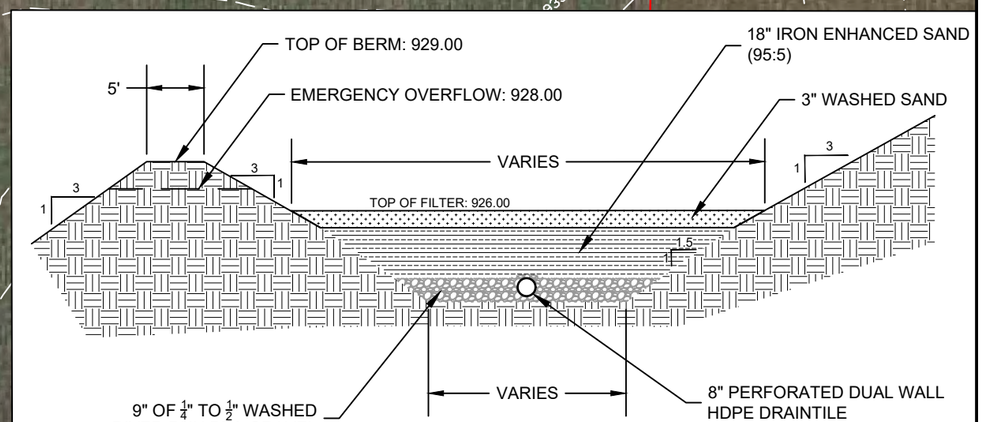

IRON ENHANCE SAND FILTER CROSS SECTION

NOT TO SCALE

NO	DATE	BY	REVISION
6			
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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 2

SHEET 05 OF 11 SHEETS

Plot Date: 03/01/2022
Drawing name: X:\Clients_WD\00758_PLSLWD\0124_Spring_LK_West_Subshed_BMP_FS\09_GIMS_ProjectName\dwg\758_124_CD.dwg
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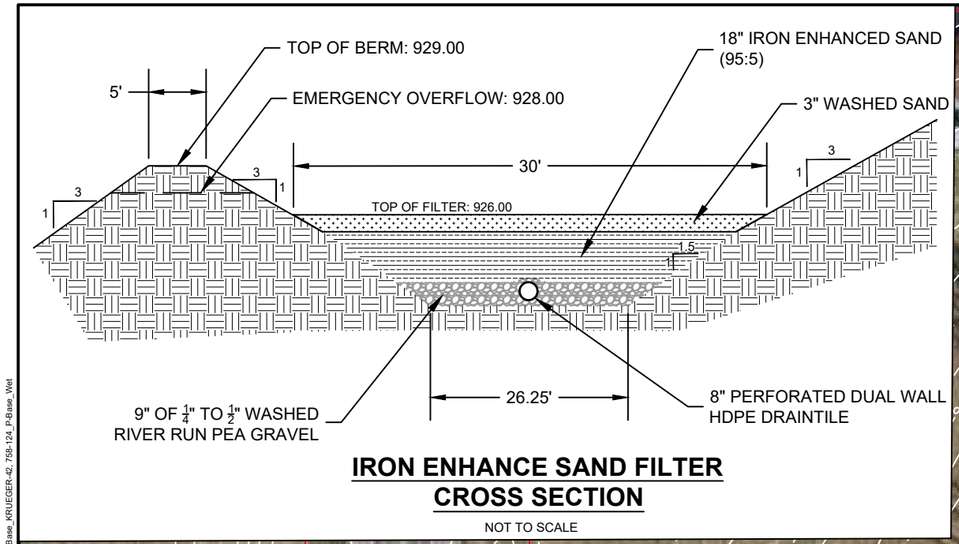

IRON ENHANCE SAND FILTER CROSS SECTION

NOT TO SCALE

TOP OF FILTER:
926.00
SURFACE AREA: 10,400 SQ-FT

DRAINAGE EASEMENT
1.10 AC

12" HDPE
INV. 926.00

DITCH DIVERSION
STRUCTURE

12" HDPE
INV. 927.50

12" HDPE
INV. 922.00

12" HDPE
INV. 923.50

EMERGENCY OVERFLOW:
10' WIDE
928.00

TOP OF BERM:
929.00

NWI WETLAND
BOUNDARY

TO SPRING LAKE

MARSCHALL RD

SCALE IN FEET

0 30 60 120

NO	DATE	BY	REVISION
6			
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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

Emmons & Olivier Resources, Inc.
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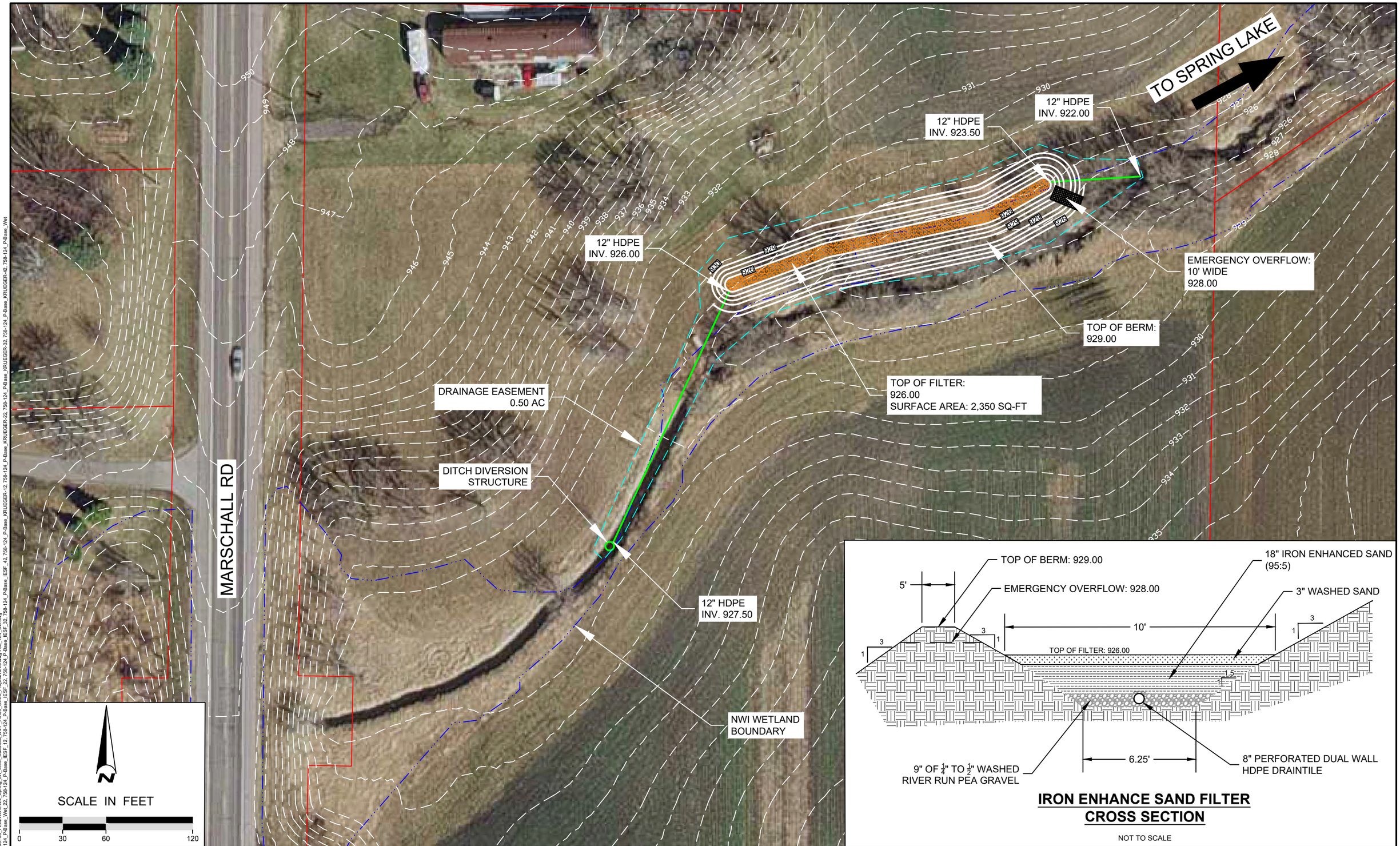
SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 3

SHEET 06 OF 11 SHEETS



IRON ENHANCE SAND FILTER CROSS SECTION

NOT TO SCALE

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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 4

SHEET 07 OF 11 SHEETS

Plot Date: 03/01/2022
Drawing name: X:\Clients_WD\00758_PLSLWD\0124_Spring_LK_West_Subshed_BMP_FS\09_GIMS_ProjectName\dwg\758_124_CD.dwg
Xrefs: 758-124_X-Base2_758-124_P-Base_Wet_22; 758-124_P-Base_IESF_12; 758-124_P-Base_IESF_22; 758-124_P-Base_IESF_32; 758-124_P-Base_KRUEGER-32; 758-124_P-Base_KRUEGER-42; 758-124_P-Base_Wet

NO	DATE	BY	REVISION
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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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

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SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

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

IRON ENHANCED SAND FIILTER
- OPTION 5

SHEET 08 OF 11 SHEETS

Plot Date: 03/01/2022
Drawing name: X:\Clients_WD\0758_PLSLWD\0124_Spring_LK_West_Subshed_BMP_FS\09_GIMS_ProjectName\dwg\758_124_CD.dwg
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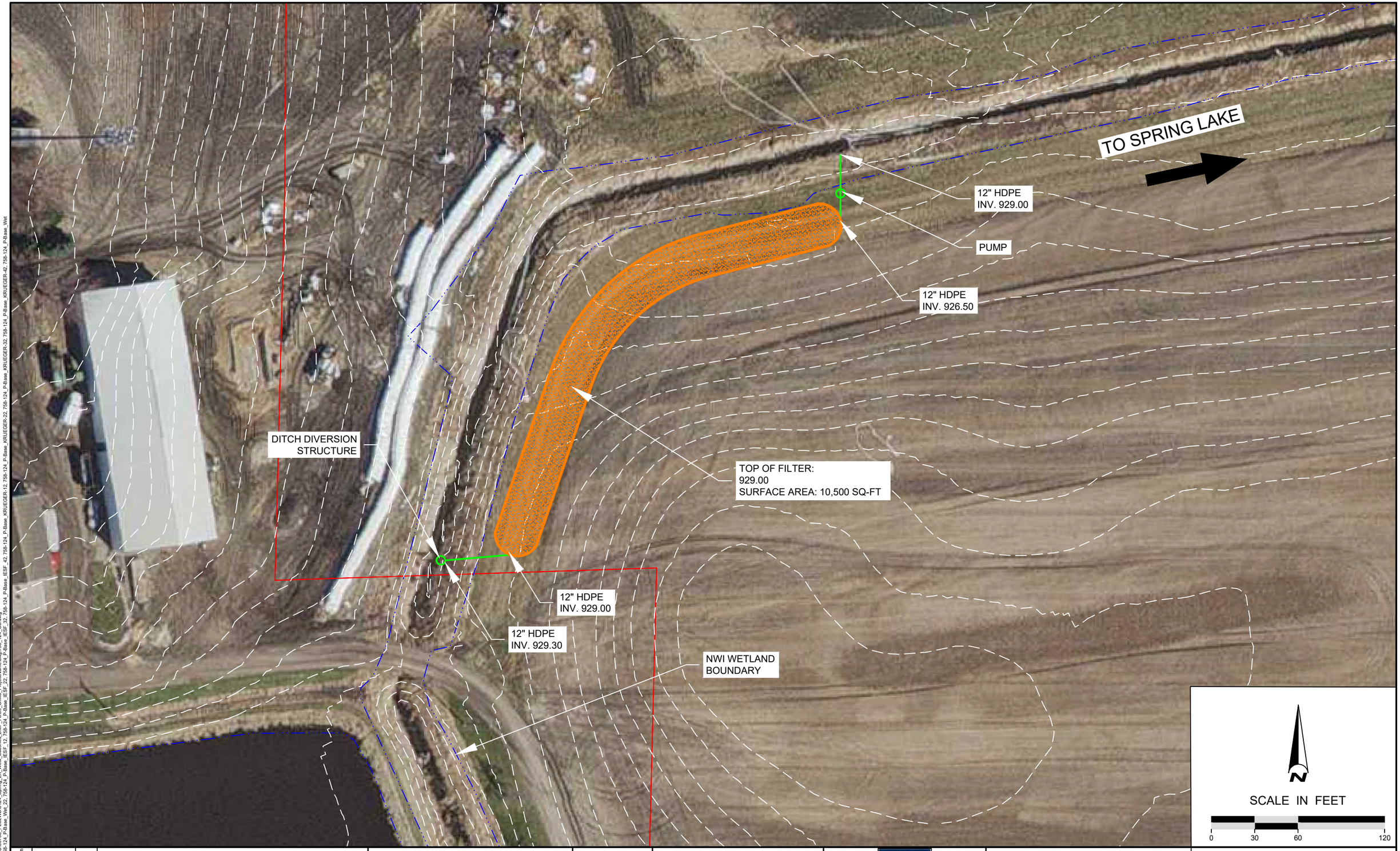

NO	DATE	BY	REVISION
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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 6

SHEET 09 OF 11 SHEETS

Plot Date: 03/01/2022
Drawing name: X:\Clients_WD\00758_PLSLWD\0124_Spring_LK_West_Subshed_BMP_FS\09_GIMS_ProjectNamedwg\758_124_CD.dwg
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NO	DATE	BY	REVISION
6			
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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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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SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 7

SHEET 10 OF 11 SHEETS

Plot Date: 03/01/2022
Drawing name: X:\Clients_WD\0758_PLSLWD\0124_Spring_LK_West_Subshed_BMP_FS09_GIMS_ProjectName\dwg\758_124_CD.dwg
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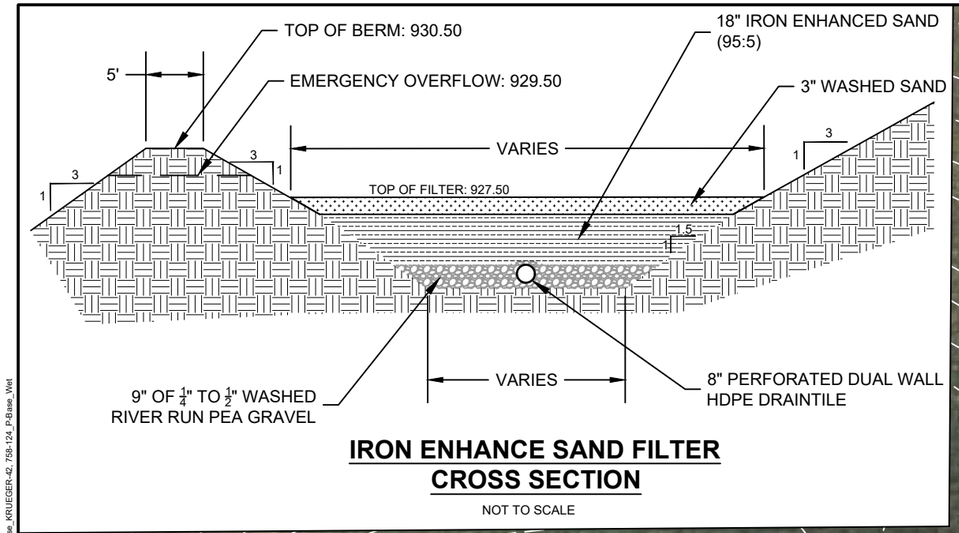

IRON ENHANCE SAND FILTER CROSS SECTION

NOT TO SCALE

NO	DATE	BY	REVISION
6			
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1	02/08/2022	DEM	FEASIBILITY PLANS

DRAFT

SUBMISSION DATE: 02/08/2022

DESIGN BY DEM | DRAWN BY DEM

EOR PROJECT NO. 0758-0124

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SPRING LAKE WEST SUBSHED
FEASIBILITY STUDY
JORDAN, SCOTT COUNTY, MINNESOTA

STATE PROJECT NO. ---

CITY PROJECT NO. ---

IRON ENHANCED SAND FIILTER
- OPTION 8

SHEET 11 OF 11 SHEETS

APPENDIX B

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 1

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 40,000.00	$ 40,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	5500	CY	$ 15.00	$ 82,500.00
4	12" HDPE STORM SEWER	80	LF	$ 30.00	$ 2,400.00
5	8" PERFORATED PVC DRAINTILE	700	LF	$ 30.00	$ 21,000.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	210	CY	$ 45.00	$ 9,450.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	550	CY	$ 70.00	$ 38,500.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	1170	CY	$ 160.00	$ 187,200.00
11	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 12,000.00	$ 12,000.00
12	EROSION CONTROL	1	LUMP SUM	$ 20,000.00	$ 20,000.00
				CONSTRUCTION SUBTOTAL:	$ 425,100.00
		30%		CONSTRUCTION CONTIGENCY	$ 127,530.00
				CONSTRUCTION TOTAL	**$ 552,630.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 25,000.00**
				TOTAL COST	**$ 577,630.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (86,644.50)**	**$ 490,985.50**
		25%		**$ 144,407.50**	**$ 722,037.50**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 2

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 35,000.00	$ 35,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	6375	CY	$ 15.00	$ 95,625.00
4	12" HDPE STORM SEWER	450	LF	$ 30.00	$ 13,500.00
5	8" PERFORATED PVC DRAINTILE	350	LF	$ 30.00	$ 10,500.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	140	CY	$ 45.00	$ 6,300.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	380	CY	$ 70.00	$ 26,600.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	800	CY	$ 160.00	$ 128,000.00
11	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 10,000.00
12	EROSION CONTROL	1	LUMP SUM	$ 17,000.00	$ 17,000.00
				CONSTRUCTION SUBTOTAL:	$ 354,575.00
		30%		CONSTRUCTION CONTIGENCY	$ 106,372.50
				CONSTRUCTION TOTAL	**$ 460,947.50**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 25,000.00**
				TOTAL COST	**$ 485,947.50**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (72,892.13)**	**$ 413,055.38**
		25%		**$ 121,486.88**	**$ 607,434.38**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 3

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 25,000.00	$ 25,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	3400	CY	$ 15.00	$ 51,000.00
4	12" HDPE STORM SEWER	360	LF	$ 30.00	$ 10,800.00
5	8" PERFORATED PVC DRAINTILE	350	LF	$ 30.00	$ 10,500.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	100	CY	$ 45.00	$ 4,500.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	250	CY	$ 70.00	$ 17,500.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	530	CY	$ 160.00	$ 84,800.00
11	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 10,000.00
12	EROSION CONTROL	1	LUMP SUM	$ 15,000.00	$ 15,000.00
				CONSTRUCTION SUBTOTAL:	$ 241,150.00
		30%		CONSTRUCTION CONTIGENCY	$ 72,345.00
				CONSTRUCTION TOTAL	**$ 313,495.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 20,000.00**
				TOTAL COST	**$ 333,495.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (50,024.25)**	**$ 283,470.75**
		25%		**$ 83,373.75**	**$ 416,868.75**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 4

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 10,000.00	$ 10,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	500	CY	$ 15.00	$ 7,500.00
4	12" HDPE STORM SEWER	270	LF	$ 30.00	$ 8,100.00
5	8" PERFORATED PVC DRAINTILE	240	LF	$ 30.00	$ 7,200.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	30	CY	$ 45.00	$ 1,350.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	40	CY	$ 70.00	$ 2,800.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	100	CY	$ 160.00	$ 16,000.00
11	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 5,000.00
12	EROSION CONTROL	1	LUMP SUM	$ 15,000.00	$ 10,000.00
				CONSTRUCTION SUBTOTAL:	$ 80,000.00
		30%		CONSTRUCTION CONTIGENCY	$ 24,000.00
				CONSTRUCTION TOTAL	**$ 104,000.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 10,000.00**
				TOTAL COST	**$ 114,000.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (17,100.00)**	**$ 96,900.00**
		25%		**$ 28,500.00**	**$ 142,500.00**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 5

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 50,000.00	$ 50,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	5000	CY	$ 15.00	$ 75,000.00
4	12" HDPE STORM SEWER	150	LF	$ 30.00	$ 4,500.00
5	8" PERFORATED PVC DRAINTILE	580	LF	$ 30.00	$ 17,400.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	220	CY	$ 45.00	$ 9,900.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	570	CY	$ 70.00	$ 39,900.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	1190	CY	$ 160.00	$ 190,400.00
11	Pump Station (Manhole, Pump, Controls, etc.)	1	EA	$ 100,000.00	$ 100,000.00
12	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 12,000.00
13	EROSION CONTROL	1	LUMP SUM	$ 15,000.00	$ 20,000.00
				CONSTRUCTION SUBTOTAL:	$ 531,150.00
		30%		CONSTRUCTION CONTIGENCY	$ 159,345.00
				CONSTRUCTION TOTAL	**$ 690,495.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 20,000.00**
				TOTAL COST	**$ 710,495.00**
ESTIMATED ACCURACY RANGE* **		-15%		**$ (106,574.25)**	**$ 603,920.75**
		25%		**$ 177,623.75**	**$ 888,118.75**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 6

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 30,000.00	$ 30,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	3400	CY	$ 15.00	$ 51,000.00
4	12" HDPE STORM SEWER	100	LF	$ 30.00	$ 3,000.00
5	8" PERFORATED PVC DRAINTILE	360	LF	$ 30.00	$ 10,800.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	100	CY	$ 45.00	$ 4,500.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	250	CY	$ 70.00	$ 17,500.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	540	CY	$ 160.00	$ 86,400.00
11	Pump Station (Manhole, Pump, Controls, etc.)	1	EA	$ 100,000.00	$ 100,000.00
12	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 12,000.00
13	EROSION CONTROL	1	LUMP SUM	$ 15,000.00	$ 20,000.00
				CONSTRUCTION SUBTOTAL:	$ 347,250.00
		30%		CONSTRUCTION CONTIGENCY	$ 104,175.00
				CONSTRUCTION TOTAL	**$ 451,425.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 10,000.00**
				TOTAL COST	**$ 461,425.00**
ESTIMATED ACCURACY RANGE* **		-15%		**$ (69,213.75)**	**$ 392,211.25**
		25%		**$ 115,356.25**	**$ 576,781.25**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 7

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 20,000.00	$ 20,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	800	CY	$ 15.00	$ 12,000.00
4	12" HDPE STORM SEWER	100	LF	$ 30.00	$ 3,000.00
5	8" PERFORATED PVC DRAINTILE	140	LF	$ 30.00	$ 4,200.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	40	CY	$ 45.00	$ 1,800.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	80	CY	$ 70.00	$ 5,600.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	180	CY	$ 160.00	$ 28,800.00
11	Pump Station (Manhole, Pump, Controls, etc.)	1	EA	$ 100,000.00	$ 100,000.00
12	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 5,000.00
13	EROSION CONTROL	1	LUMP SUM	$ 15,000.00	$ 10,000.00
				CONSTRUCTION SUBTOTAL:	$ 202,450.00
		30%		CONSTRUCTION CONTIGENCY	$ 60,735.00
				CONSTRUCTION TOTAL	**$ 263,185.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 10,000.00**
				TOTAL COST	**$ 273,185.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (40,977.75)**	**$ 232,207.25**
		25%		**$ 68,296.25**	**$ 341,481.25**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - IRON ENHANCED SAND FILTER OPTION 8

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 35,000.00	$ 35,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 5,000.00	$ 5,000.00
3	COMMON EXCAVATION	4200	CY	$ 15.00	$ 63,000.00
4	12" HDPE STORM SEWER	100	LF	$ 30.00	$ 3,000.00
5	8" PERFORATED PVC DRAINTILE	300	LF	$ 30.00	$ 9,000.00
6	DIVERSION STRUCTURE	1	EA	$ 6,000.00	$ 6,000.00
7	TURF REINFORCEMENT MAT	30	SY	$ 35.00	$ 1,050.00
8	WASHED SAND, (P)	130	CY	$ 45.00	$ 5,850.00
9	WASHED AGGREGATE - RIVER RUN PEA STONE, (P)	350	CY	$ 70.00	$ 24,500.00
10	IESF MIXTURE (IRON FILINGS - 5% BY WEIGHT)	720	CY	$ 160.00	$ 115,200.00
11	Pump Station (Manhole, Pump, Controls, etc.)	1	EA	$ 100,000.00	$ 100,000.00
12	SEEDING & RESTORATION (INCLUDING BUFFER STRIP)	1	LUMP SUM	$ 10,000.00	$ 10,000.00
13	EROSION CONTROL	1	LUMP SUM	$ 15,000.00	$ 15,000.00
				CONSTRUCTION SUBTOTAL:	$ 392,600.00
		30%		CONSTRUCTION CONTIGENCY	$ 117,780.00
				CONSTRUCTION TOTAL	**$ 510,380.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 10,000.00**
				TOTAL COST	**$ 520,380.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (78,057.00)**	**$ 442,323.00**
		25%		**$ 130,095.00**	**$ 650,475.00**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - WETLAND BANK OPTION

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 11,000.00	$ 11,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 2,000.00	$ 2,000.00
3	COMMON BORROW	300	CY	$ 30.00	$ 9,000.00
4	DRAINAGE STRUCTURE	1	LS	$ 7,000.00	$ 7,000.00
5	STORM SEWER, CMP 6"	20	LF	$ 60.00	$ 1,200.00
6	STORM SEWER, CMP 24"	20	LF	$ 80.00	$ 1,600.00
7	RANDOM RIPRAP, CLASS IV	30	CY	$ 125.00	$ 3,750.00
8	DEWATERING	1	LUMP SUM	$ 10,000.00	$ 10,000.00
9	SEEDING & RESTORATION	1	LUMP SUM	$ 60,000.00	$ 60,000.00
10	EROSION CONTROL	1	LUMP SUM	$ 8,000.00	$ 8,000.00
				CONSTRUCTION SUBTOTAL:	$ 113,550.00
		30%		CONSTRUCTION CONTIGENCY	$ 34,065.00
				CONSTRUCTION TOTAL	**$ 147,615.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 700,000.00**
				TOTAL COST	**$ 847,615.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (127,142.25)**	**$ 720,472.75**
		25%		**$ 211,903.75**	**$ 1,059,518.75**

ENGINEER'S OPINION OF PROBABLE PROJECT COST - FEASIBILITY STUDY

SPRING LAKE WEST - WETLAND FLOOD STORAGE OPTION

PREPARED BY EMMONS & OLIVIER RESOURCES, INC.

JOB NO. 00758-0124

REVISED: Tuesday, January 4, 2022

Item No.	Item	Estimated Quantity	Units	Unit Price	Total Price
1	MOBILIZATION	1	LUMP SUM	$ 14,000.00	$ 14,000.00
2	SITE CLEARING & GRUBBING	1	LUMP SUM	$ 2,000.00	$ 2,000.00
3	COMMON BORROW	300	CY	$ 30.00	$ 9,000.00
4	DRAINAGE STRUCTURE	1	LS	$ 7,000.00	$ 7,000.00
5	STORM SEWER, CMP 6"	20	LF	$ 60.00	$ 1,200.00
6	STORM SEWER, CMP 24"	20	LF	$ 80.00	$ 1,600.00
7	RANDOM RIPRAP, CLASS IV	30	CY	$ 125.00	$ 3,750.00
8	DEWATERING	1	LUMP SUM	$ 10,000.00	$ 10,000.00
9	SEEDING & RESTORATION	1	LUMP SUM	$ 90,000.00	$ 90,000.00
10	EROSION CONTROL	1	LUMP SUM	$ 8,000.00	$ 8,000.00
				CONSTRUCTION SUBTOTAL:	$ 146,550.00
		30%		CONSTRUCTION CONTIGENCY	$ 43,965.00
				CONSTRUCTION TOTAL	**$ 190,515.00**
				LAND ACQUISITION/EASEMENT AND LEGAL COSTS	**$ 700,000.00**
				TOTAL COST	**$ 890,515.00**
ESTIMATED ACCURACY RANGE* **		**-15%**		**$ (133,577.25)**	**$ 756,937.75**
		25%		**$ 222,628.75**	**$ 1,113,143.75**