Appendix I
Civil Engineering

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Table of Contents

1 Existing Conditions

1.1 Project Location

The Two Rivers National Wildlife Refuge (Refuge) is located near the confluence of the Mississippi River and Illinois River. The Refuge consists of three primary areas: Gilbert Lake on the north side of the Mississippi River, Swan Lake, and the Calhoun Wetlands area. The study area for this Habitat Rehabilitation and Enhancement Project (Project) is primarily within the Calhoun Wetlands area.

There is a previously completed HREP project for Swan Lake, adjacent to the study area. The water level in the lakes is carefully managed by the U.S. Fish and Wildlife Service (USFWS). Adjacent to the study area is Calhoun Point at the confluence of the Mississippi and Illinois River. Calhoun Point is managed by Illinois Department of Natural Resources.

1.2 Existing Features

USFWS manages the water level within various Moist Soil Units (MSUs) through the use of constructed berms, natural topography, some ditches, many water control structures, and three existing diesel-powered supply wells. Water levels in Swan Lake are managed through a 16' wide gravity operated stoplog structure and a pump station. Additional details on existing features not explained in this appendix may be found in other engineering appendices.

1.2.1 Berms

Existing berms separate MSUs and separate the Yorkinut Slough area from Swan Lake. The berms vary in width, height, and slope. In some cases, small berms were constructed by Refuge staff to further separate MSUs of varying elevation. Many, but not all existing berms, are wide enough for vehicle access. Some berms are surfaced with crushed stone. Some berms serve as public access for vehicles. Others serve as public hiking trails, but not vehicle access.

1.2.2 Ditches

The existing MSUs drain via sheet flow to a water control structure, except in some instances a small amount of ditching exists to convey water primarily from the existing well pumps to the MSUs.

Running parallel to the north/south access road through the middle of the Refuge is a ditch which has the primary purpose to carry upland water through the Refuge to Swan Lake. The excavated material from the ditch was used to construct a berm separating the ditch from the adjacent MSUs. The ditch is not used for MSU management. Refuge management has expressed concern with the ditch as it is a constant maintenance item while not serving a purpose to meet the Refuge goals. The ditch requires regular clean out and vegetation management. The Refuge has suggested the ditch to be filled in and the upland flow rerouted.

1.2.3 Water Control Structures

The existing water control structures are corrugated metal pipe (CMP), and are deteriorating with age (e.g., Figure 1). Many structures also utilized CMP stoplog structures with the stoplogs being wood.

Figure 1. Existing CMP Water Control Structure and Berm

1.2.4 Swan Lake Features

1.2.4.1 *Swan Lake Berm Spillway*

The Swan Lake berm separates Swan Lake from the Illinois River. Immediately upstream of the Swan Lake stoplog structure is several hundred feet of berm roughly 2' lower in elevation than the rest of berm. This area is protected with stone revetment and serves as a controlled location for the berm to overtop in the event of flooding on the Illinois River, allowing Swan Lake to backflow and prevent further damage on the berm as the river continues to rise and the rest of the berm overtops.

Refuge management has stated that the increased overtopping of the Swan Lake berm is undesirable and is causing unnecessary flooding of Swan Lake, and by extension, the rest of the study area.

1.2.4.2 *Swan Lake Water Sources*

Swan Lake is fed by a large majority of the Calhoun County watershed through tributaries north of the project area. However, of particular interest for this project Swan Lake is supplied water via the ditch running directly north and south through our project area. The ditch carries flow from the agriculture fields south of the project area, through the project area, and then discharging into Swan Lake. For further discussion, see the H&H appendix.

1.2.4.3 *Swan Lake Gravity Structure*

Swan Lake drains to the Illinois River through a 16' stop log structure at the furthers downstream end of the lake (Figure 2). By extension, the structure drains much of the Calhoun County watershed as much of this area flows to Swan Lake. The structure consists of 4 stop log slots each 4' wide. Stop logs are manually put in place via a hoist system permanently installed on the structure.

The structure is operated according to the water levels in Swan Lake and the Illinois river. With higher water on the Illinois River, the structure may either be completely closed to hold lower water level in Swan Lake or opened (either partially for controlled flow or fully open) to allow backflow into Swan Lake. Higher water within Swan Lake compared to the Illinois River is a rarer occurrence as this would require a heavy, localized rain event. However, when this is the case, the structure is opened to allow flow out of Swan Lake to the Illinois River. A higher water level within Swan Lake is never intentionally held.

Refuge management has expressed that the gate operates well and meets their needs. However, they expressed numerous concerns with the structure. When the gate was first built, it included many small stoplogs for fine-tuning of the water level in Swan Lake. These were not desirable and proved difficult to remove with water flowing over top of them. These small stoplogs have since been replaced. The Refuge has also expressed an opinion that the gate is undersized for its purpose. Given the large watershed, the gate provides only a small opening to allow drainage. Further, the Refuge has stated operating the gate (removing or adding stoplogs) requires a minimum of two people. This requirement can be troublesome if the gate needs to be opened or closed in an urgent situation, on a weekend, or in the night. Inefficiencies in the gate increases the frequency of flooding of the study area.

Figure 2. Swan Lake Gravity Structure

1.3 Surveys

The existing ground surface for the study area was taken from LiDAR data collected in 2018. Additional LiDAR and bathymetry data for the Swan Lake area was also used. This LiDAR was collected in XXXX by XXXX. The bathymetry was collected in XXXX by XXXX. For modeling efforts, all data was converted to horizontal datum of State Plane Illinois West, North American Datum of 1983 (NAD83) and the vertical datum of North American Vertical Datum of 1988 (NAVD88).

Additionally, all water control structures in the study area were surveyed by in-house surveyors of the St. Louis District. Invert coordinates and elevations were collected for all structures on two separate survey trips.

Further survey needs will need to be examined for PED (Preconstruction engineering design). Detailed topography and planimetric surveying will likely be required for the proposed pump station and large gravity structure. Small-scale topographic surveying may also be required as needed during design.

1.4 Access

The Refuge can be accessed by public roads and contains many access roads throughout the Refuge that will likely be utilized for construction. Some crushed stone access roads may require improvement (i.e. additional rock placement) prior to use of heavy construction equipment. Haul roads within MSUs may also be required during construction, however these will be removed, and the area reseeded before Project completion.

The Refuge is most easily accessed by ferry. From the Illinois side, the Brussels Ferry connects the Great River Road to County Highway 1 across the Illinois River. The ferry is operated by Illinois Department of Transportation and is free of charge. From the Missouri side, The Golden Eagle Ferry connects across the Mississippi River. The Golden Eagle Ferry is a toll ferry operated by Calhoun County. In all cases of moving construction equipment, further coordination will be needed with the ferry operators to verify requirements. The Refuge may also be reached via the bridge in Hardin, IL, significantly increasing travel time.

1.5 Staging

No permanent staging is expected, and temporary staging within an MSU will be kept to 0.5 acre or less to minimize temporary impacts to habitat. Assumption is staging areas (trailer, stockpiles of RCP, other staging needs) will take place in areas outside of MSU's: existing parking, near refuge headquarters, etc).

2 Measure Types

2.1 General Design Information

All earthwork measures for the analyzed alternatives were modeled in three-dimensional space using Bentley OpenRoads Designer software. These 3D models were used to calculate quantities and provide proposed terrains for hydrologic modeling. 3D models for this study should be consider preliminary. Models were only created to estimate quantities, approximate footprints, and provide a base for hydrologic modeling. More detailed civil modeling will be required during PED to support detailed quantities calculations, earthwork mass balance, refinements to hydraulic and hydrologic modelling, transitions between proposed and existing features, and any design changes that arise during PED.

2.2 Berm Modifications

2.2.1 Berm Removal

Berm removals are a key component of the Project as the goal of many measures is to decrease the overall number of MSUs while increasing the size of the units. Berm removals consist of removing the berm down to the elevation of the surrounding grade to allow for water to sheet flow across the degraded berm footprint. Berms will be stripped prior to degrading and the stripped material will be stockpiled for use as final dressing on the degraded berm footprint. Material from the berm removals will be used to construct other embankment measures or disposed of on site.

2.2.2 Berm Enhancements

The only enhancement to existing berms will take place on the berm separating Swan Lake and Yorkinut Slough (Figure 3). This berm will be raised to a consistent elevation to reduce overtopping into the Yorkinut Slough. Along with the raise, the berm slope will be decreased from approximately 1 Vertical to 4 Horizontal (1V:4H) to 1V:8H to make the berm more resilient to erosion. The models used for this study raised the berm to an elevation of 426, utilizing a landside raise. Above that elevation, raising the berm effectively would require a raise along the entire length of the berm instead of just raising the low points near the center, about a third of the total berm length. For the simplicity of modeling, the new berm slope was only added to the landside raise. In essence, the berm would be raised and the slope decreased entirely on the landside of the existing berm. The design of this measure will be refined during PED.

Figure 3. Berm Separating Swan Lake and Yorkinut Slough

2.2.3 Berm Additions

Berm additions will consist of embankment placement to create berms for management unit boundaries. Embankment will be constructed to the required elevation to allow for appropriate inundation depths and adequate free board in the sub-units to prevent overtopping of the berms.

Berms will have a minimum top width of 12 feet. Berm side slopes will be a minimum of 1V:4H to allow for maintenance equipment to traverse the slopes. The slope of the side slopes will be further refined and determined during PED when further geotechnical analysis is completed. Trees and other large diameter vegetation will be removed within the new berm footprints along with grubbing of the foundation soils.

2.3 North-South Ditch Fill

The north-south ditch fill will consist of filling in the entire portion of the ditch running parallel to the access road running through the middle of the Refuge (Figure 4). As stated, the ditch is only used for upland flow conveyance to Swan Lake. This flow will be diverted through a new ditch and allowed to flow out of the southeast corner of the Refuge through Calhoun Point. The ditch, road, and berm will be filled and degraded where applicable to achieve sheet flow across the area. Where the road will remain, the ditch and berm will be filled and graded to drain away from the access road. See *Civil Engineering Sheets* for layout. Note: in the main report, this ditch fill is included under measure 1 – Modify MSUs.

Figure 3. North-South Ditch to be Filled

2.4 Surfacing

Surfacing will be added to the top of some berms where access is deemed necessary for construction access. For this study, an estimated length for surfacing was used for cost estimating purposes but a more complete access plan will need to be developed during PED. The surfacing will consist of 6 inches of crushed stone surfacing on top of 10 inches of a larger crushed stone base. The two layers of stone construction method has been used successfully on other ecosystem restoration projects in the St. Louis area to provide a more resilient surface that is able to resist some overtopping. During PED, the risk of berms overtopping will be further considered, and surfacing type will be adjusted if necessary. The width of the embankment at the top of the berms which have surfacing will be increased to maintain a minimum 12-foot wide driving surface.

2.5 Channels to Increase Water Conveyance

Drainage within units would be improved by grading of new shallow swales to drain toward water control structures and removing and grading existing berms to allow sheet flow across the old footprint of the berm. Swales will be trapezoidal in shape and consist of a wide 35' bottom width and 1V:4H side slopes. These swales are utilized to both connect existing units and improve drainage within large units. Design dimensions of the swales are based on a nearby UMRR project at Clarence Cannon National Wildlife Refuge, where historic meander restoration was utilized in a similar manner to improve drainage within most soil units. For that project, channel width was chosen for cut/fill balance. Dimensions of the swales for this project will be further refined as part of the cut/fill balance during PED. Additionally, new ditch excavation will take place in the southeast corner off the Project are to convey water along the highway and through a nearby culvert. This ditch is assumed to match the existing ditch with a bottom width of 15' and 1V:3H side slopes, but will be analyzed as part of the PED H&H analysis, to ensure full function while minimizing impacts to MSU footprints. Contractors would remove trees and other large diameter vegetation within the ditch footprints along with grubbing of the foundation soils. Stripped and stockpiled material is the final dressing on the ditches to ensure natural re-vegetation. Frequent flood events also deposit native seed and organic materials to the subunits.

2.6 Water Control Structures

Water control structures will consist of reinforced concrete pipe and flared end sections with gates to control water within the management units. For this report it was assume concrete pipe would be used due to operation and maintenance (O&M) considerations, unknown soil conditions, and other considerations. Concrete pipe would limit the damage caused by mowers and other equipment. The water control structures will be constructed by excavating down to the required grades, placing the pipe and structures, backfilling, and seeding the disturbed areas.

2.7 Removal of Existing Water Control Structures

Removal of existing water control structures will consist of excavating down to the structures and removing them. They will be salvaged or hauled off site and disposed of in accordance with all state and federal regulations. New structures will be constructed in place of the existing structure, or the area will be backfilled with embankment and seeded if a new structure is not needed at the same location as the old structure.

2.8 Pump Stations

Pump stations will require excavation and grading for access, pump station pad, discharge pipes, and intake channels. Site layouts will be further defined as design progresses during PED. See Mechanical, Electrical, and Structural Appendices for additional details on the pump stations.

2.9 Large Gravity Structure

Due to the separation of Swan Lake an additional large gravity structure similar to the existing 16' wide stoplog structure will be constructed. The structure will require grading, an outlet channel, and other site features. Site layouts will be further defined as design progresses during PED. See Mechanical and Structural Appendices for additional details on the large gravity structure.

2.10 Well Pumps

At the time of this study, three aging diesel-powered well pumps (e.g., Figure 5) and two newly constructed electric well pumps existed. All three diesel well pumps will be abandoned. The two new electric well pumps were constructed by Ducks Unlimited. In order to accommodate the revised MSU layout, Ducks Unlimited only installed the wells, pumps, and manifold on concrete slab. Outlet piping and/or ditching will be completed on those wells as part of this Project. In addition, two other wells will be constructed along with the associated piping or ditching.

Figure 4. Existing Diesel-Powered Well Pump

3 Borrow and Disposal

All borrow is anticipated to come from onsite material. Excavated material from berm degrades, ditches, and other excavations will be used for embankment material. Any excess or unsuitable material from excavations will be used to increase ridge and swale topography and will require further design details during PED. Alternatively, the material may be wasted on site in a manner that will not negatively impact drainage.

4 Utilities and Relocations

No utility relocations are anticipated. Further investigation into existing utilities will take place during PED.

5 Rights of Way

It is not anticipated any right of way will need to be acquired for the Project. All measures will be constructed on federally owned property.

6 Cultural Areas

Culturally sensitive areas will be further defined after the completion of the cultural survey.

7 Other Items to Address During Preconstruction Engineering and Design (PED)

There are several items, not stated in the above paragraphs, which will need further investigation as more detailed design is performed and will be addressed during PED. Those items include the following:

- Whether to reseed berm degrades or let them naturally grow with native species
- Defining a more detailed layout of which berms will require access roads, and the overall access road plan
- Defining the side-slopes of the berm raise for the berm between Swan Lake and Yorkinut Slough.
- Establishing a detailed pump station layout
- Choosing a large gravity structure type and how its functionality will fit with the Refuge operational plans
- Final location of 2 wells to be built. Refuge has suggested moving closer to MSU's
- Develop a Cut-Fill balance; identifying borrow and spoil areas, as needed.
- Additional coordination with Calhoun Point personnel on additional flow pushed through Calhoun Point
- Coordination with Calhoun County on replacement of culvert underneath highway
- Temporary staging within MSU areas must be 0.5 acres or less
- Reuse of stripped material: Are there invasive species? Do stripped materials need disposal? Is herbicide use necessary to prevent invasives from regenerating prior to new seed establishment?

REFERENCES

US Army Corps of Engineers. (1998, March). Engineer Manual 1110-2-2902. *Engineering and Design Conduits, Culverts and Pipes*.

8 Quantities

Quantities: Earthwork

	Cut (in the dry)	Fill (in the dry)	Cut (in slough or Swan Lake)	Fill (in slough or Swan Lake)	Stripping	Seeding	Clearing
	CY	CY	CY	CY	ACRES	ACRES	ACRES
A4 - Maximum	180192	104799	75708	31913	36	134	5
A2 - Intermediate A	143707	107152	5663	80539	36	129	10
A3 - Intermediate B	148766	114381	0	31913	37	125	5
A1 - Minimum	30075	12716	0	0	5	19	0

Quantities: Water Supply

	Well Discharge Pipe	New Wells
	FT	QTY
A4 - Maximum	4851	2
A2 - Intermediate A	4851	0
A3 - Intermediate B	5394	2
A1 - Minimum	2000	0

Quantities: MSU Water Control Structures

	24" with Stoplog Gate	36" with Stoplog Gate	Total Length of all Pipes	Excavation	CA6 Bedding	Geotextile
	QTY	**QTY**	**FT**	**CY**	**Tons**	**SY**
A4 - Maximum	3	12	770	104	342	1027
A2 - Intermediate A	4	6	815	102	362	1087
A3 - Intermediate B	3	4	590	94	262	787
A1 - Minimum	1	2	320	43	142	427

Quantities: Riprap and Crushed Stone Surfacing

	400# Topsize Riprap	Riprap Bedding	Crushed Stone Surfacing
	TONS	**TONS**	**TONS**
A4 - Maximum	12244	4081	1533
A2 - Intermediate A	12244	4081	1533
A3 - Intermediate B	12244	4081	1533
A1 - Minimum	0	0	0

Quantities: Pump station, large gravity drainage structures, and box culverts

	Pump Station (GPM)	**Larger Gravity Drain Structures – Swan Lake Interior**	**Larger Gravity Drain Structures – To IL River**	**Box Culverts**
A4 - Maximum	60000	3 - 36" Culverts, 75' long, Stoplog controlled	See note	
A2 - Intermediate A	19400	3 - 36" Culverts, 75' long, Stoplog controlled	See note	2 - 10' wide x 5' tall precast box culverts. Both 40' long.
A3 - Intermediate B	23300	3 - 36" Culverts, 75' long, Stoplog controlled	See note	
A1 - Minimum	0	0		

Quantities: Road Culvert

	72" RCP	**Highway Replacement**
	FT	**SF**
A4 - Maximum	82	288
A2 - Intermediate A	82	288
A3 - Intermediate B	82	288
A1 - Minimum		

OMRR Quantities: Operation

Project Measure	Item of Work	Qty	Unit	Frequency
Berms	Inspection	4	Hours	Annual
Roads	Inspection	4	Hours	Annual
Water Control Structures	Inspection	4	Hours	Annual
Water Control Structures	Open & Close Gates	24	Hours	Annual
Ditches	Inspection	0	Hours	Annual
Pump Stations	Inspection	2	Hours	Annual
Pump Stations	Power	480	Hours	Bi-Annual (every other year)
Large Gravity Structure	Inspection	4	Hours	Annual
Large Gravity Structure	Open & Close Gates	24	Hours	Annual
Wells	Inspection	4	Hours	Annual
Wells	Power			Annual
Tree planting	Inspection	8	Hours	Annual

OMRR Quantities: Maintenance

Project Measure	Item of Work	Qty	Unit	Frequency
Berms	Mowing	129	Acres	Annual
Roads	Road Grading	16	Hr	Annual
Small Water Control Structures	Clearing of Debris	16	Hr	Bi-Annual
Ditches	Mowing	0	Acres	Bi-Annual
Ditches	Cleanout	0	CY	Every 10 Years
Pump Stations	Operation and Tests	64	Hrs	Annual
Large Gravity	Clearing of	64	Hrs	Annual

Structure	Debris			
Wells	Operation and Tests	20	Hrs	Annual
Tree planting	Mowing	209	Acres	Twice a year, 1st 5 Years
Tree planting	Spraying	32	Hrs	Once a year, 1st 5 Years

OMRR Quantities: Repair

Project Measure	**Item of Work**	**Qty**	**Unit**	**Frequency**
Berms	Erosion Repair	1463	CY	Annual
Roads	Crushed Stone	670	TN	Every 5 Years
Water Control Structures	N/A			
Ditches	N/A			
Pump Stations	Repair	2	LS	Annual
Large Gravity Structure	Repair	1		Annual
Wells	Repair	1	LS	Annual
Tree planting	NA			

OMRR Quantities: Replacement

Project Measure	**Item of Work**	**Qty**	**Unit**	**Frequency**
Berms	N/A			
Roads	N/A			
Water Control Structures	24" Gate and Operator	4	Each	Every 60 Years
Water Control Structures	36" Gate and Operator	6	Each	Every 60 Years
Ditches	N/A			
Pump Stations	13,500 gpm	2	Each	Every 25

	pump			Years
Large Gravity Structure		1	Each	Every 60 Years
Wells	Replace Pump	1	Each	Every 15 Years
Tree planting	Replacement	2.5	Acres	Annual

OMRR Quantities: Rehabilitation

Project Measure	Item of Work	Qty	Unit	Frequency
Berms	N/A			
Roads	N/A			
Water Control Structures	24" Gate and Operator	4	Each	Every 25 Years
Water Control Structures	36" Gate and Operator	6	Each	Every 25 Years
Ditches	N/A			
Pump Stations	13,500 gpm pump	2	Each	Every 25 Years
Large Gravity Structure				
Wells	Motor Rehab	2	Each	Every 25 Years
Tree planting	NA			

1 SITE PLAN

SCALE: 1"=200'

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GENERAL SHEET NOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

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Could include the general assumptions described in the appendix; e.g. that these are preliminary designs, etc.

SHEET KEYNOTES

1. NOTE 1
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GENERAL SHEET NOTES

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SHEET KEYNOTES

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1 SITE PLAN

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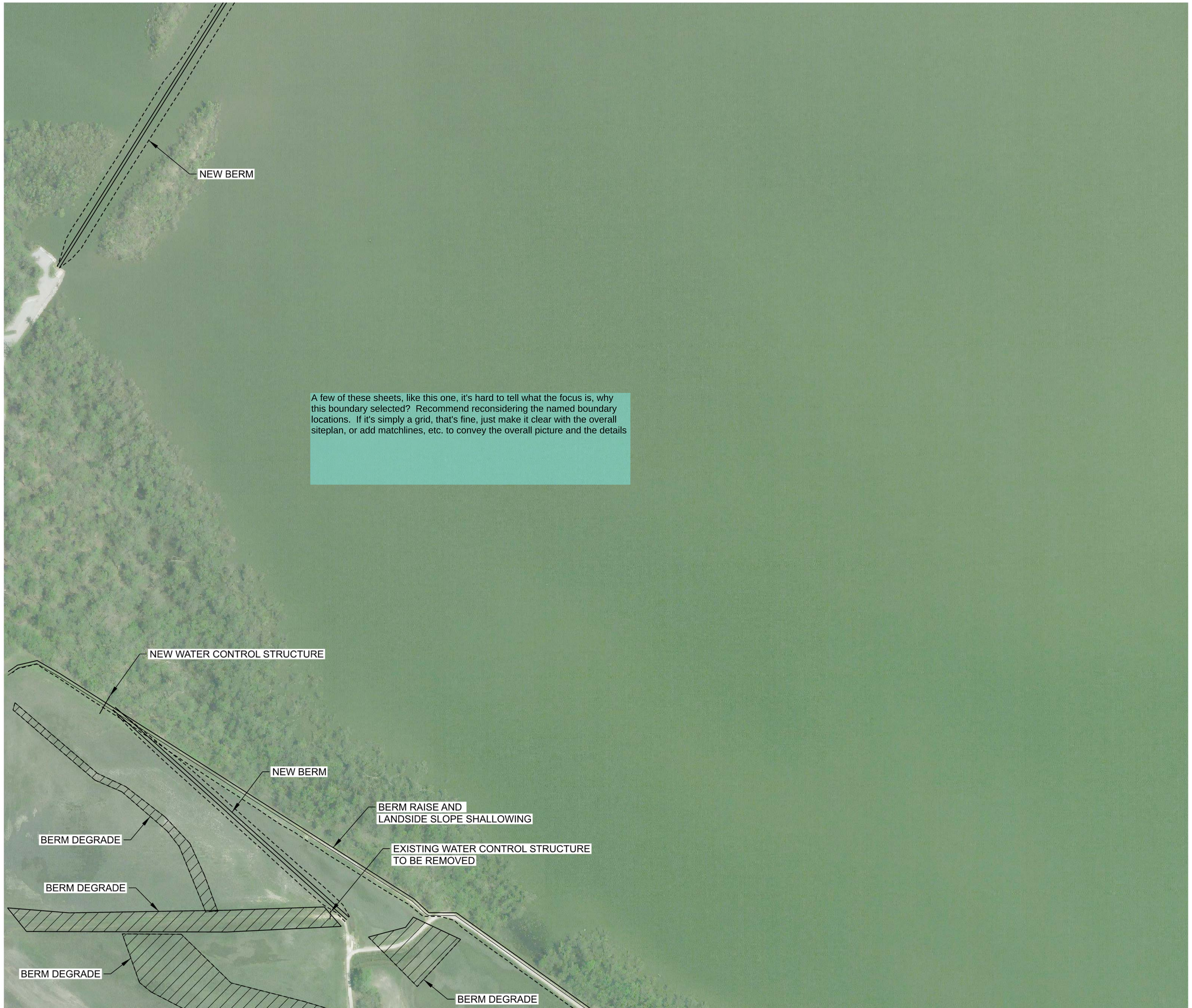

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DRAWN BY:
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

DISTRICT
ADDRESS
CITY, ST ZIP

PROJECT/CONTRACT LOCATION 1
PROJECT/CONTRACT DESCRIPTION 2
PROJECT/CONTRACT DESCRIPTION / IDENTIFIER 3
PROJECT/CONTRACT IDENTIFIER IF NEEDED 4

SITE PLAN

SHEET ID
C-113

%STATUS%

GENERAL SHEET NOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

SHEET KEYNOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

1 SITE PLAN
SCALE: 1"=200'

0 200' 400'

N

CALLOUTS

XXX XXX

LEGEND

● SANITARY SEWER MANHOLE

MARK	DESCRIPTION	DATE

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
ISSUE DATE: MMMMMMMM YYYY
SOLICITATION NO.: YXXXXXXXXXX
CONTRACT NO.: ZXXXXXXXXXX
SIZE: ANSI D

DISTRICT
ADDRESS
CITY, ST ZIP

PROJECT/CONTRACT LOCATION 1
PROJECT/CONTRACT DESCRIPTION 2
PROJECT/CONTRACT DESCRIPTION / IDENTIFIER 3
PROJECT/CONTRACT IDENTIFIER IF NEEDED 4

SITE PLAN

SHEET ID
C-114

%STATUS%

1 SITE PLAN

SCALE: 1"=200'

0 200' 400'

N

GENERAL SHEET NOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

SHEET KEYNOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

CALLOUTS

XXX XXX

LEGEND

● SANITARY SEWER MANHOLE

MARK	DESCRIPTION	DATE

DESIGNED BY:

DRAWN BY:

CHECKED BY:

SUBMITTED BY:

SIZE: ANSI D

ISSUE DATE: MMMMMMM YYYY

SOLICITATION NO.: YXXXXXXXXXX

CONTRACT NO.: ZXXXXXXXXX

DISTRICT
ADDRESS
CITY, ST ZIP

PROJECT/CONTRACT LOCATION 1
PROJECT/CONTRACT DESCRIPTION 2
PROJECT/CONTRACT DESCRIPTION / IDENTIFIER 3
PROJECT/CONTRACT IDENTIFIER IF NEEDED 4

SITE PLAN

SHEET ID

C-115

%STATUS%

1 SITE PLAN
SCALE: 1"=200'

0 200' 400'

N

GENERAL SHEET NOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

SHEET KEYNOTES

1. NOTE 1
2. NOTE 2
3. NOTE 3

CALLOUTS

XXX
XXX

LEGEND

● SANITARY SEWER MANHOLE

MARK	DESCRIPTION	DATE

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

ISSUE DATE: MMMMMMMM YYYY
SOLICITATION NO.: YXXXXXXXXXX
CONTRACT NO.: ZXXXXXXXXXX

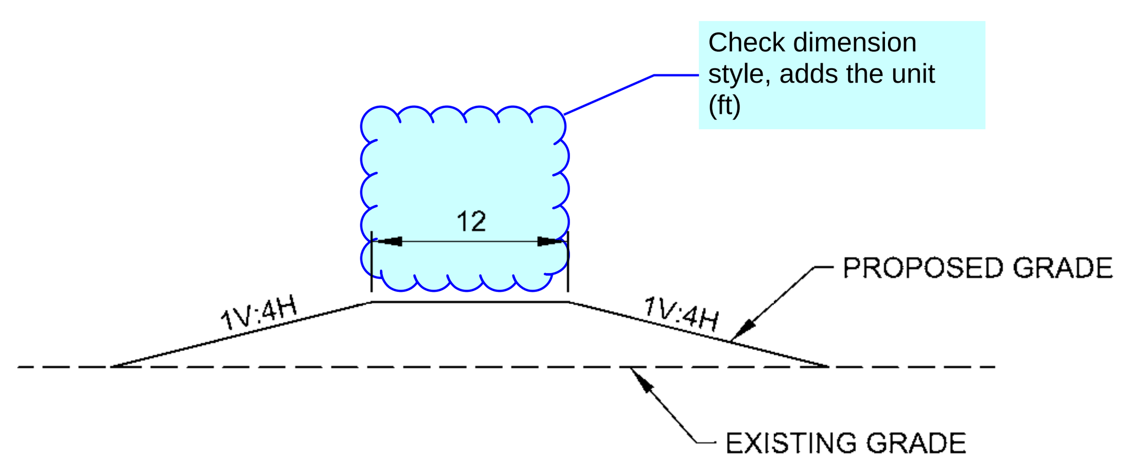
DISTRICT
ADDRESS
CITY, ST ZIP

PROJECT/CONTRACT LOCATION 1
PROJECT/CONTRACT DESCRIPTION 2
PROJECT/CONTRACT DESCRIPTION / IDENTIFIER 3
PROJECT/CONTRACT IDENTIFIER IF NEEDED 4

SITE PLAN

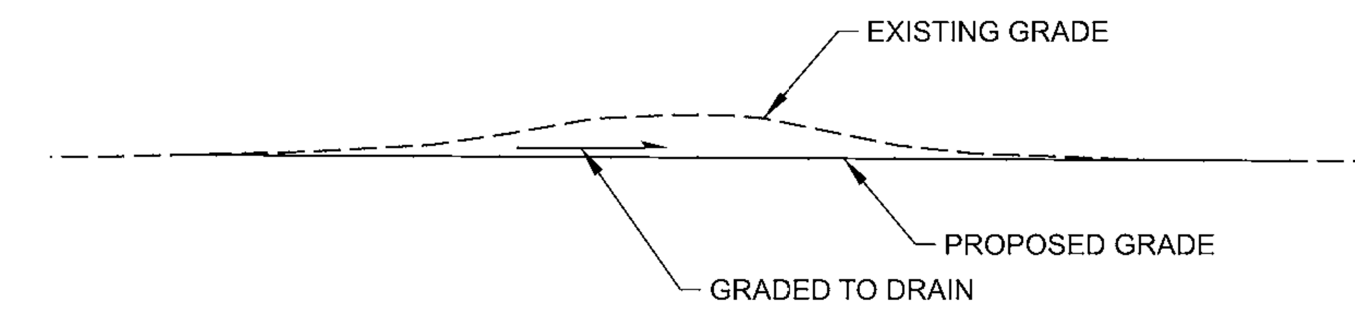
SHEET ID
C-116

%STATUS%



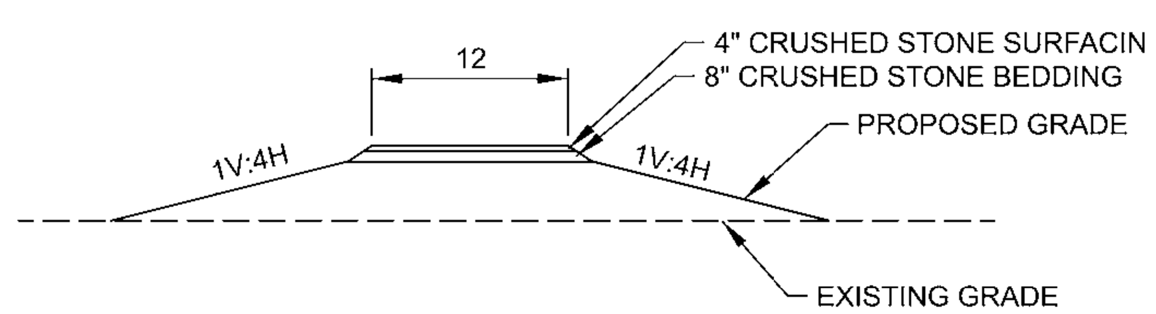
3 TYP SECTION - PROPOSED BERM

SCALE: 1"=10'



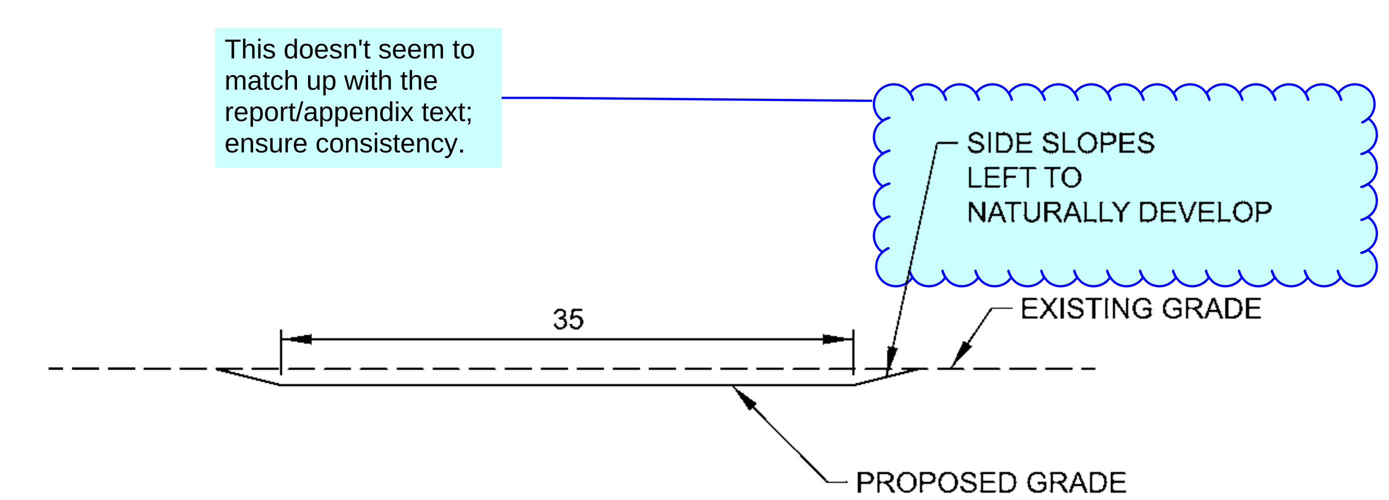
5 TYP SECTION - BERM DEGRADE

SCALE: 1" = 10'



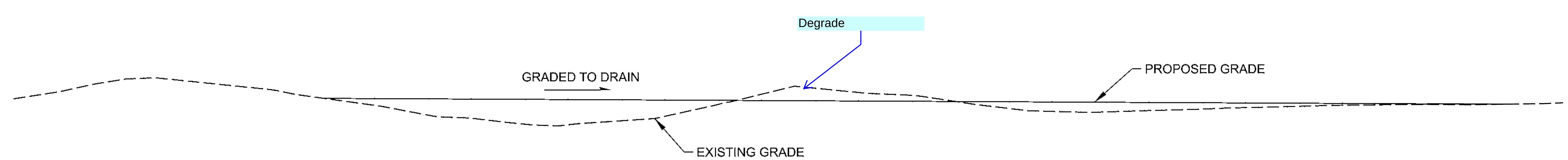
2 TYP SECTION - PROPOSED BERM WITH SURFACING

SCALE: 1" = 10'



4 TYP SECTION - DRAINAGE SWALE

SCALE: 1" = 10'



1 TYP SECTION - DITCH FILL

SCALE: 1" = 10'

??

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE:

SOLICITATION NO.:

CONTRACT NO.:

DESIGNED BY:

DRAWN BY:

CHECKED BY:

SUBMITTED BY:

SIZE:

U.S. ARMY CORPS OF ENGINEERS

SHEET ID