



# TECHNICAL MEMORANDUM

**To:** Kip Kovar, PE, District Engineer, Garrison Conservancy District

**From:** Brent Erickson, PE, Senior Project Manager, AE2S

**CC:** Kurt Ronnekamp, PE, Program Manager, Black & Veatch  
Grady Wolf, Environmental Program Manager, KLJ  
Mark Funston, PE, Engineering Manager, Black & Veatch

**Re:** **ENDAWS Preliminary Design TO5280**  
**ENDAWS Segment 1 and USFWS Easements TM301**

**Date:** January 31, 2023

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## 1 BACKGROUND & PURPOSE

### 1.1 Background

In 2019 and 2020, Black & Veatch (BV, Engineer) and its consultants completed an appraisal-level design (also known as a conceptual-level design) of facilities and transmission pipelines necessary to obtain water for the Red River Valley Water Supply (RRVWSP) project from the McClusky Canal. The engineering evaluation completed on behalf of the Garrison Conservancy District (GDCCD, Owner), became part of the U.S. Department of the Interior, Bureau of Reclamation's (Reclamation's) Environmental Impact Statement (EIS). A record of decision (ROD) signed on January 15, 2021, authorized the recommended project that obtains water from both the McClusky Canal, and the Missouri River near Washburn, North Dakota (ND). This project is named the Eastern North Dakota Alternate Water Supply (ENDAWS).

The appraisal-level design identified alternative components for delivering McClusky Canal water to eastern and central North Dakota, including various water sources, intakes, pumping stations, and biota water treatment. Multiple transmission main alignments were evaluated before selection of a preferred alignment, which is depicted by yellow and red lines on **Figure 1**. The preferred ENDAWS 72-inch diameter transmission main alignment GDCCD intends to proceed with 32-mile segment shown in yellow line on **Figure 1**. This segment (ENDAWS Segment 1) begins at the McClusky Canal near North Dakota Highway 200 and extends east to the site of the RRVWSP's Hydraulic Break Tanks.

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**Figure 1 ENDAWS and RRVWSP Program Features**

The ENDAWS EIS included considerations and commitments specific to USFWS easements and wetlands summarized as follows:

- **Prior to the start of the final design phase, coordinate with the USFWS personnel to identify where the proposed pipeline and USFWS lands interface** (ENDAWS EIS Section 3.5.1.1). Attached to this document is a set series of figures (Mapbook) showing the ENDAWS Segment 1 alignment, 150-foot EIS study area and proposed easement, and USFWS Wetland Basins and Easement Parcels. The USFWS Easements and Wetland Basins were provided as Shapefiles by the USFWS in September of 2022.
- **If the proposed pipeline alignment crosses an USFWS easements, meet with the USFWS personnel to review the interface of the ENDAWS project and USFWS easements** (ENDAWS EIS Section 3.5.3.3). This memorandum can serve as a starting point for the discussions between GDCD, BoR, and USFWS staff. The attached Mapbook summarizes locations where the known delineated USFWS Wetland Basins intersect the proposed ENDAWS Segment 1 alignment.
- **Reroutes of the pipeline alignment and construction impact is limited to the 150-foot ENDAWS EIS study area** (BoR email 11/28/2022). The trenched installation of the proposed ENDAWS Segment 1 pipe necessitates a minimum of a 150-foot-wide easement to accommodate construction access, excavated soils, and construction materials. For these reasons, it is not practical to reroute the pipeline inside of the 150-foot easement to avoid impacts to wetlands or other sensitive areas. Avoidance of sensitive areas requires rerouting the entire 150-foot easement.

## 1.2 Purpose

The proposed ENDAWS Segment 1 pipeline will intersect numerous USFWS Easements and Wetland Basins. Due to the space necessary to construct a 72-inch diameter steel pipeline temporary impacts to some USFWS Wetland Basins may be unavoidable.

The purpose of this memorandum is to:

1. Provide the BoR and USFWS the with proposed ENDAWS Segment 1 alignment with the location of known USFWS Easements and Wetland Basins,
2. Summarize the final design framework for the ENDAWS Segment 1 pipeline regarding avoidance and temporary impacts to USFWS wetland basins, and
3. Start the discussion for best management practices for temporary impacts.

In general, the criteria utilized for temporary impacts to USFWS Wetland Basins are as follows:

1. Delineated Wetland Basin is seasonally dry. Temporary impacts are only proposed for basins that appear to be seasonally dry, or do not continually hold water.
2. Rerouting of the pipe inside of the 150-foot ENDAWS EIS study area (easement) is not possible due to the size of the delineated basin. In many locations the delineated USFWS Wetland Basin extends completely across the 150-foot easement.
3. Temporary impact of less than 1.5 acres for individually delineated USFWS Wetland Basins, and
4. Specific locations where trenchless crossing would create a greater impact to environmental elements than a temporary impact through the USFWS Wetland Basin.

The following sections summarize the USFWS Wetland Basins that intersect the proposed ENDAWS Segment 1 pipeline route, construction considerations, and the final design considerations.

## 2 USFWS WETLAND EASEMENT SUMMARY

**Table 1** below is a summary of the locations where the proposed ENDAWS Segment 1 pipeline alignment intersects known delineated USFWS Wetland Basins. These locations are graphically presented in the Mapbook attached herewith.

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**Table 1 Summary of USFWS Easements and ENDAWS Segment 1 Intersections**

Location	Type	USFWS IFWS	USFWS TRACTNO	Avoided Acres	Temporary Impact Acres
USFWS-0001	Temporary	599	446X,1,2	0	0.419
USFWS-0002	Temporary	599	446X,1,2	0	0.138
USFWS-0003	Avoid	599	323X-2-12	1.691	0
USFWS-0004	Temporary	599	192X	0	0.851
USFWS-0005	Temporary	599	20X-1	0	0.373
USFWS-0006	Temporary	599	253X	0	0.010
USFWS-0007	Temporary	599	253X	0	0.316
USFWS-0008	Temporary	599	253X	0	0.090
USFWS-0009	Temporary	599	253X	0	0.076
USFWS-0010	Temporary	599	20X-1	0	1.433
USFWS-0011	Temporary	599	20X-1	0	0.041
USFWS-0012	Avoid	599	20X	1.611	0
USFWS-0013	Temporary	599	20X	0	0.212
USFWS-0014	Temporary	599	20X	0	0.076
USFWS-0015	Temporary	599	20X	0	0.266
USFWS-0016	Temporary	599	194X,1	0	0.170
USFWS-0017	Temporary	599	194X,1	0	0.328
USFWS-0018	Temporary	599	325X,1-4	0	0.239
USFWS-0019	Temporary	599	325X,1-4	0	0.316
USFWS-0020	Temporary	599	325X,1-4	0	0.184
USFWS-0021	Temporary	599	193X,1	0	0.187

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Location	Type	USFWS IFWS	USFWS TRACTNO	Avoided Acres	Temporary Impact Acres
USFWS-0022	Temporary	599	194X,1	0	0.082
USFWS-0023	Temporary	599	194X,1	0	0.037
USFWS-0024	Temporary	599	194X,1	0	0.016
USFWS-0025	Temporary	599	194X,1	0	0.148
USFWS-0026	Temporary	599	194X,1	0	0.021
USFWS-0027	Temporary	599	194X,1	0	0.450
USFWS-0028	Temporary	599	194X,1	0	0.072
USFWS-0029	Avoid	599	194X,1	0.374	0
USFWS-0030	Temporary	599	194X,1	0	0.010
USFWS-0031	Temporary	599	194X,1	0	0.474
USFWS-0032	Avoid	599	176X,1	1.159	0
USFWS-0033	Temporary	599	176X,1	0	0.153
USFWS-0034	Temporary	599	176X,1	0	0.358
USFWS-0035	Temporary	599	38X,1	0	0.488
USFWS-0036	Temporary	599	38X,1	0	0.415
USFWS-0037	Avoid	599	429X,1	2.749	0
USFWS-0038	Temporary	548	95X,1,2	0	0.355
USFWS-0039	Temporary	548	95X,1,2	0	0.080
USFWS-0040	Avoid	548	170X,1	0.359	0
USFWS-0041	Temporary	548	170X,1	0	0.038
USFWS-0042	Avoid	548	170X,1	1.155	0
USFWS-0043	Avoid	548	170X,1	0.424	0

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Location	Type	USFWS IFWS	USFWS TRACTNO	Avoided Acres	Temporary Impact Acres
USFWS-0044	Avoid	548	170X,1	0.007	0
USFWS-0045	Avoid	548	215X	0.284	0
USFWS-0046	Avoid	548	215X	0.019	0
USFWS-0047	Temporary	548	215X	0	0.039
USFWS-0048	Avoid	548	215X	0.478	0
USFWS-0049	Avoid	548	167X-2,3	0.422	0
USFWS-0050	Temporary	548	167X-2,3	0	0.023
USFWS-0051	Temporary	548	167X-2,3	0	0.039
USFWS-0052	Temporary	548	167X-2,3	0	0.207
USFWS-0053	Temporary	548	167X-2,3	0	0.563
USFWS-0054	Temporary	548	167X-2,3	0	1.003
USFWS-0055	Temporary	548	167X-2,3	0	0.154
<b>Total</b>				<b>10.732</b>	<b>10.95</b>

Notes:

1. "Location" is a unique identifier created by AE2S for each delineated USFWS Wetland Basin that intersects the proposed ENDAWS Segment 1 pipeline alignment. See the attached Mapbook for a visual depiction of the location.
2. "Type" indicated a proposed temporary impact to allow trenched pipeline installation or that an impact will be avoided at the location by utilizing a trenchless crossing.
3. "USFW ISWS" "USFWS TRACTNO" are attributes from the USFWS supplied Shapefiles.
4. "Avoided Acres" is the area of delineated USFWS Wetland Basin intersected by the proposed ENDAWS Segment 150-foot-wide easement that is proposed to be avoided using a trenchless crossing
5. "Temporary Impact Acres" is the area of delineated USFWS Wetland Basin intersected by the proposed ENDAWS Segment 150-foot-wide easement that is proposed to be temporarily impacted by installation of the ENDAWS pipeline.

### 3 PIPELINE CONSTRUCTION CONSIDERATIONS

Due to the size of ENDAWS Segment 1 pipeline (72-inch), it is not practical to move the location of the pipe inside of the proposed 150-foot easement to avoid environmentally sensitive areas. When utilizing trenched installation, the entire 150-foot easement will be impacted to install the 72-inch pipe due to the required depth of the pipe, resulting excavated materials, and storage of

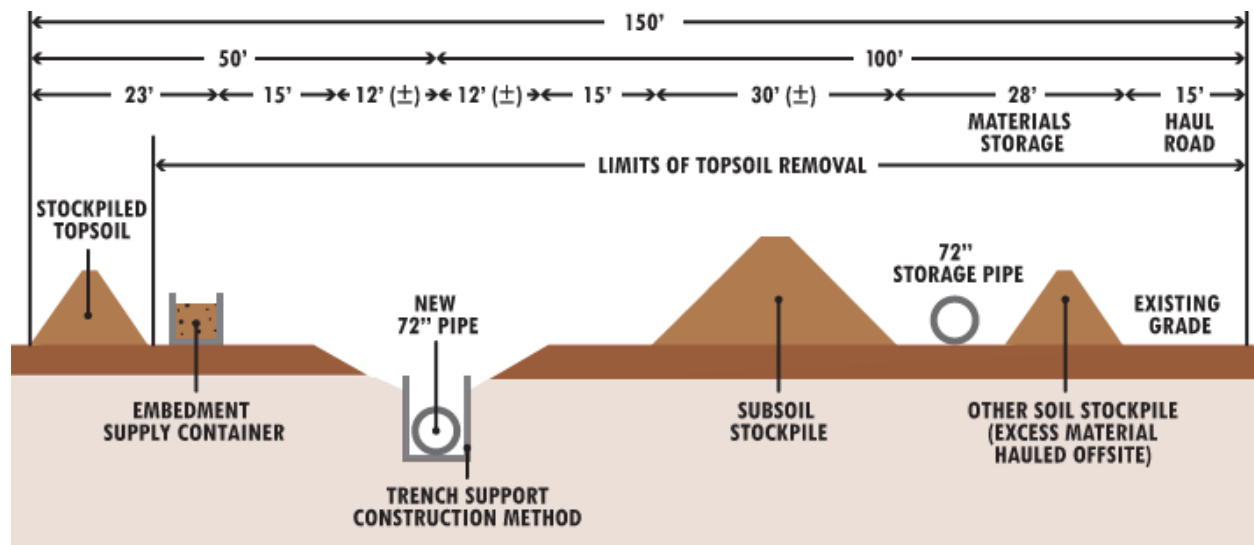
construction materials. Avoidance of sensitive areas requires rerouting the entire 150-foot easement.

Rerouting of the pipeline outside of the ENDAWS 150-foot easement could result in a reduction of temporary impacts to environmentally sensitive areas, reduce the number of potential trenchless crossings for avoidance of sensitive areas, and lower total capital construction costs.

### 3.1 Trench Installation Considerations

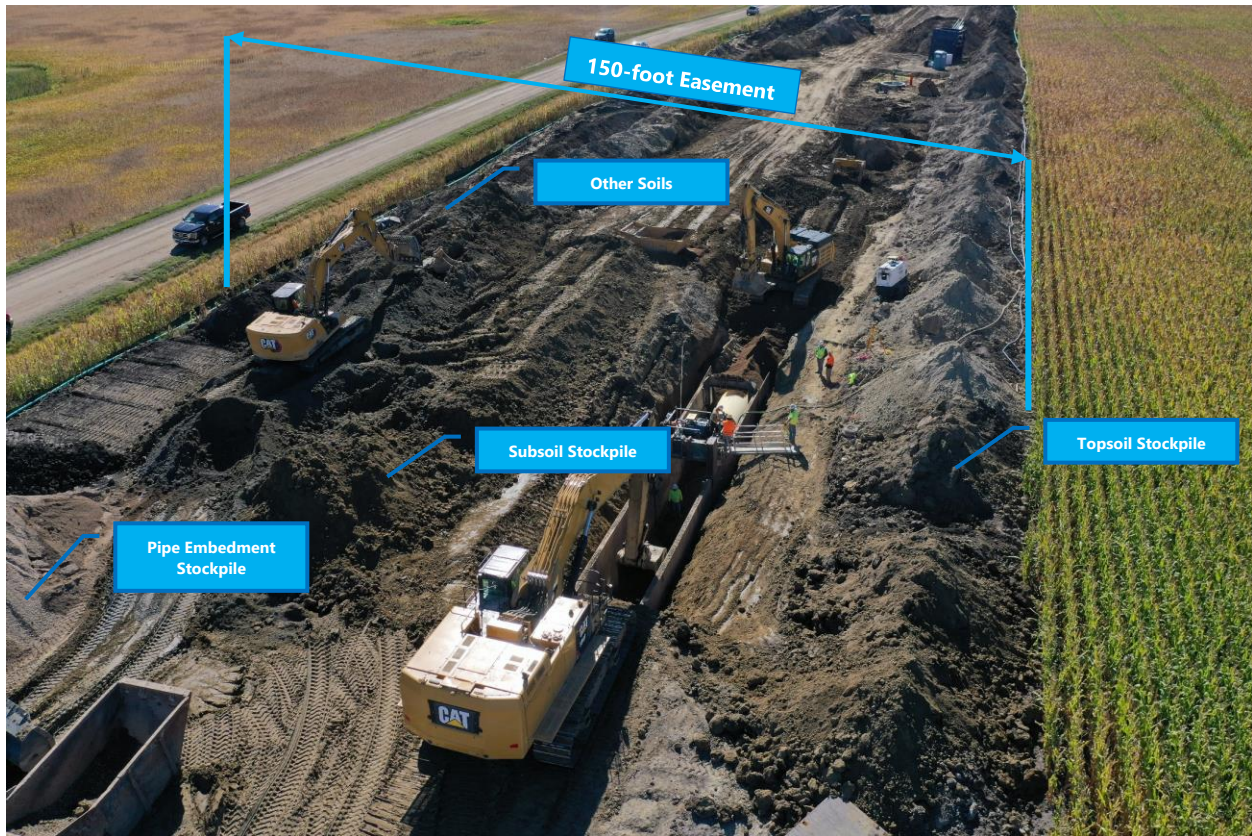
Over the past two years, GDCD has constructed multiple segments of the RRVWSP pipeline. Confirmed from the design and construction of these segments is that the minimum construction impact area to install a 72-inch steel water pipeline is a 150-foot-wide easement. This minimum size easement is necessary to facilitate the orderly and efficient access to the project alignment, storage of excavated soils, stockpiling of the required pipe embedment aggregate, and storage of the pipe to be installed.

**Figure 2** below shows a schematic of the typical 150-foot easement space utilization during the placement of the 72-inch steel water pipe. **Figure 3** is an aerial photo of the 150-foot easement during construction of a segment of the RRVWSP 72-inch pipeline. As clearly illustrated by **Figure 2** and **Figure 3** the management of excavated materials, aggregates, and construction access dictate that the entirety of the 150-foot easement width be utilized for construction.



**Figure 2 Trench Pipe Installation Schematic** (not to scale)

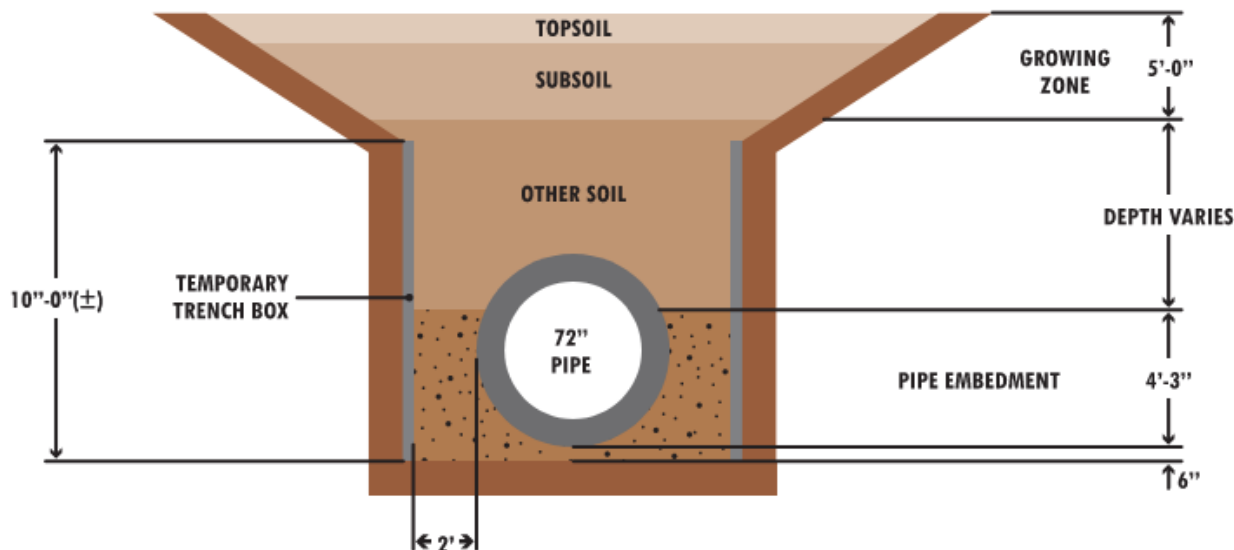




**Figure 3 RRVWSP Actual Construction** (not to scale)

The excavated material from trench excavation for a 72-inch water delivery pipe is substantial. As shown by **Figure 4** the minimum trench depth for a 72-inch pipe is 15 feet resulting in over eight (8) cubic yards per foot of pipe of material to be excavated from the trench. Included in this excavation is over four (4) cubic yards of excess excavated material that needs to be hauled offsite. For each 50-foot-long stick of pipe results in 200 yards, or up to eight truckloads, of excess material to be removed.





**Figure 4 Typical 72-inch Pipe Trench** (not to scale)

In summary, the installation of the proposed ENDAWS Segment 1 72-inch pipeline necessitates a minimum of a 150-foot-wide easement to accommodate the construction access, excavated soils, and construction materials. Allowing rerouting of the pipeline to areas outside of the 150-foot easement has the potential to reduce environmental impacts and lower total capital construction costs.

### **3.2 Trenchless Installation Considerations**

Due to the size of the pipeline, there are limited methods of trenchless crossing construction available for the avoidance of wetlands. Based on previous evaluations during the ENDAWS Assessment Level Design and implementation of the RRVWSP possible trenchless methods are limited to Jack and Bore or Earth Pressure Balance Machine (EPBM).

There are additional trenchless construction methods that have been ruled out of the ENDAWS and RRVWSP pipeline construction due to practical and economic considerations. Examples of these methods include tunnel boring machine, pipe-ramming, open shield with an excavator arm, and hand mining. A detailed analysis of these construction methods is outside of the scope of this technical memorandum.

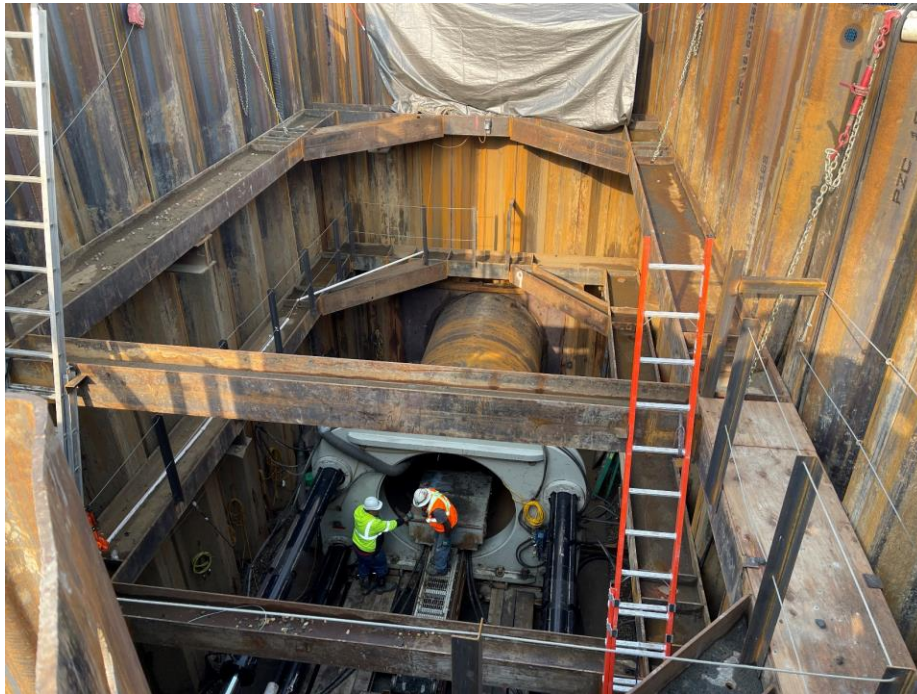
While Jack and Bore is potential possible for the ENDAWS construction, one the major drawback of this method is the limited ability to remove ground water from the face of the bore. Due to the size of the ENDAWS pipe, and the minimum depth of the pipe the construction activities will generally be in groundwater.

For that reason, it is assumed that most trenchless crossings will need to utilize an EPBM. This technology can complete a trenchless crossing without the need to dewater at the face of the tunnel, and the required shafts can be installed to limit groundwater infiltration.

**Figure 5** and **Figure 6** below are photos from trenchless crossing installations on the RRVWSP project from 2021 showing the launching shaft for a EPBM crossing.



**Figure 5 RRVWSP 72-inch Trenchless Crossing Launching Shaft**



**Figure 6 RRVWSP 72-inch Trenchless Crossing Inside of Launching Shaft**

### 3.3 Construction Cost Considerations

**Table 2** and **Table 3** present estimated construction costs for trenchless crossing and trenched pipe installation for the ENDAWS Segment 1 project. The unit price costs presented in these tables have been derived from RRVWSP construction projects costs from 2021 and 2022. As shown by these tables, trenchless installations are approximately six times more expensive than trenched installations.

**Table 2 Unit Price Construction Costs for Trenchless Installation**

Item	Unit	Unit Cost
Launching Shaft	EA	\$250,000
Receiving Shaft	EA	\$125,000
96" Steel Casing and 72" Carrier Pipe	Per Foot	\$5,000

Notes:

Costs are based on bids received in 2021 and 2022 for the installation of RRVWSP water pipe.

**Table 3 Unit Price Construction Cost Trenched Installation**

Item	Unit	Unit Cost
72" Steel Water Pipe	Per Foot	\$800

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Item	Unit	Unit Cost
SPGM and Subsoil Management	Per Foot	\$20
Easement Restoration	Per Foot	\$25

Notes:

Costs are based on bids received in 2021 and 2022 for the installation of RRVWSP 72-inch water pipe.

Following are two examples of construction cost comparison for locations where the proposed ENDAWS easement intersects with USFWS Wetland Basins. These locations are designated as USFWS-0005 and USFWS-0010 in the attached Mapbook and in the above **Table 1**.

**Table 4** and **Table 5** below summarize the construction costs for avoiding a 200-foot long USFWS Wetland Basin shown in **Figure 8** and the attached Mapbook (USFWS-0000). The estimated construction costs to avoid the USFWS Wetland Basin with a trenchless crossing is approximately \$1,300,000, and the estimated construction costs to temporarily impact the USFWS Wetland Basin with a trenched pipe is approximately \$170,000.

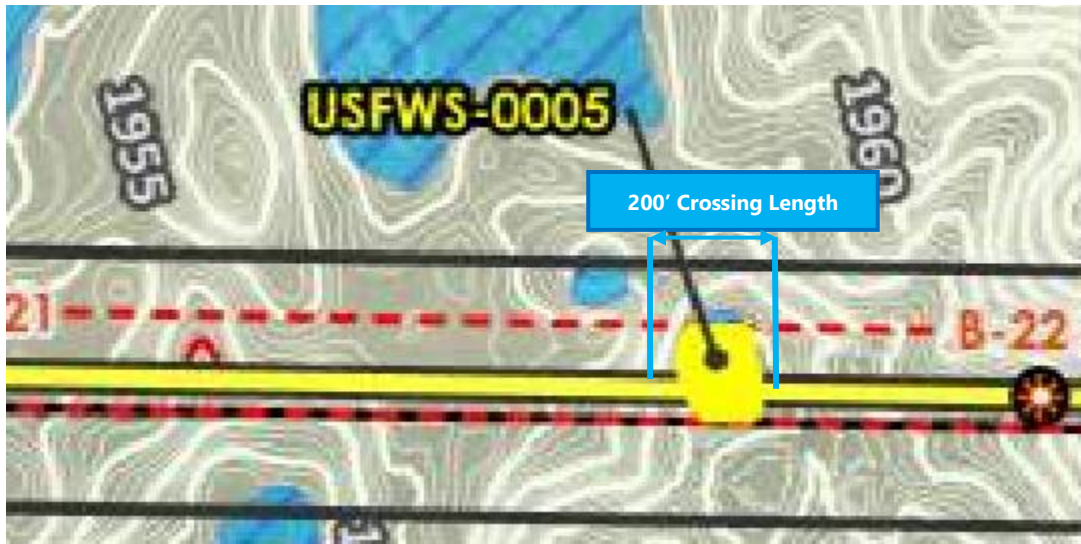
**Table 4 USFW-0005 Avoidance Trenchless Costs Comparison**

Item	Unit	Unit Cost	Quantity	Total Cost
Launching Shaft	EA	\$250,000	1	\$250,000
Receiving Shaft	EA	\$125,000	1	\$125,000
96" Steel Casing and 72" Carrier Pipe	Per Foot	\$5,000	200	\$1,000,000
<b>Total</b>				<b>\$1,250,125</b>

**Table 5 USFW-0005 Temporary Impact Trenched Installation Cost Comparison**

Item	Unit	Unit Cost	Quantity	Total Cost
72" Steel Water Pipe	Per Foot	\$800	200	\$160,000
SPGM and Subsoil Management	Per Foot	\$20	200	\$4,000
Easement Restoration	Per Foot	\$25	200	\$5,000
<b>Total</b>				<b>\$169,000</b>





**Figure 7 Example Crossing for USFWS-0005** (Not to Scale)

**Table 6** and **Table 7** below summarize the construction costs for avoiding a 700-foot long USFWS Wetland Basin shown in **Figure 8** and the attached Mapbook (USFWS-0010). The estimated construction costs to avoid the USFWS Wetland Basin with a trenchless crossing is approximately \$3,800,000, and the estimated construction costs to temporarily impact the USFWS Wetland Basin with a trenched pipe is approximately \$600,000.

**Table 6 USFW-0010 Avoidance Trenchless Costs Comparison**

Item	Unit	Unit Cost	Quantity	Total Cost
Launching Shaft	EA	\$250,000	1	\$250,000
Receiving Shaft	EA	\$125,000	1	\$125,000
96" Steel Casing and 72" Carrier Pipe	Per Foot	\$5,000	700	\$3,500,000
<b>Total</b>				<b>\$3,750,125</b>

**Table 7 USFW-0010 Temporary Impact Trenched Installation Cost Comparison**

Item	Unit	Unit Cost	Quantity	Total Cost
72" Steel Water Pipe	Per Foot	\$800	700	\$560,000
SPGM and Subsoil Management	Per Foot	\$20	700	\$14,000
Easement Restoration	Per Foot	\$25	700	\$17,500
<b>Total</b>				<b>\$591,500</b>



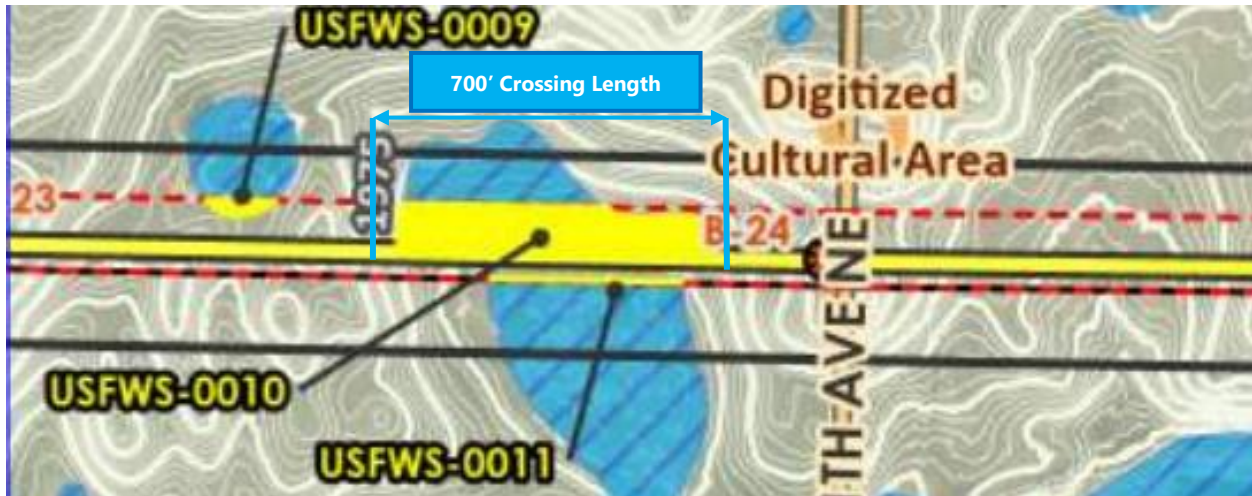


Figure 8 Example Crossing for USFWS-0010 (Not to Scale)

### 3.4 Construction Access Considerations

Construction access for the installation of the ENDAWS Segment 1 pipe will consist of using existing north/south roads to bring equipment and materials to the 150-foot-wide easement. The majority of construction access will be inside of the 150-foot wide easement. There are 25 USFWS Wetland Basins that fully, or in combination with an adjacent basin fully, intersect the proposed easement area. In these instances the project will need to utilize combination of the following practices to allow for construction access:

1. Temporary access/construction easements adjacent to the proposed 150-foot permanent easement,
2. Temporary impact to USFWS Wetland Basins to allow trenched pipe installation and construction access that includes restorations, or
3. Temporary impact to USFWS Wetland Basins using mats or other engineered method of crossing the basin without significant impact.

Following are the USFWS Wetland Basins that completely intersect with the proposed 150-foot easement. See the attached Mapbook for the a graphical representation of the location.

USFWS-0001, USFWS 0003,	USFWS-0029, USFWS-0031,	USFWS-0043, USFWS-0044,
USFWS-0004, USFWS-0005,	USFWS-0032, USFWS-0034,	USFWS-0048, USFWS-0049,
USFWS-0007, USFWS-0010,	USFWS-0035, USFWS-0036,	USFWS-0052, USFWS-0053,
USFWS-0012, USFWS-0015,	USFWS-0037, USFWS-0038,	USFWS-0054, USFWS-0055.
USFWS-0017, USFWS-0027,	USFWS-0040, USFWS-0042,	

### 3.5 Suitable Plant Growth Material Management

Proper management of suitable plant growth material (SPGM) during the construction of the ENDAWS pipeline is critical to returning the easement area back to agricultural production, or restoration to a natural area. The following is a summary of the RRVWSP Pipeline construction requirements for SPGM that have been included in the project specification and construction requirements. GDCD continues to modify the SPGM management requirements based on lessons learned each construction season. The ENDAWS final design and construction specification will include the following requirements:

- Contractor and Engineer field staff will receive annual training sessions from the Program's Professional Soil Scientist. This training will include classroom and field workshops so that the Engineer's and Contractor's field staff can visually identify topsoil, subsoil, and other soil.
- The Professional Soil Scientist will make periodic site visits during SGPM stripping and restoration activities, make suggestions for improving the operations, and provide written reports for each visit to GDCD.
- Final design and construction specifications will require that the Contractor segregate and protect the following soil types:
  - Topsoil (1st Horizon SPGM)
  - Subsoil (2nd Horizon SPGM)
  - Other Soil (Unsuitable as SPGM)
- Mixing of Topsoil/Subsoil with the Other Soil will not be allowed by the construction specifications. Engineering Field staff document the stockpile management.
- During restoration, the Subsoil is replaced into the trench and the entire easement is "shattered" to mitigate for compaction of the root zone area. Past RRVWSP projects have shattered 18" – 24" deep in the subsoil to loosen the material from compaction during construction activities.
- After shattering of the Subsoil, discing, or raking occurs to remove clods, and then the Topsoil is replaced over the entire easement area.
- After the placement of the Topsoil, the entire easement is disced or raked to remove clods prior to restoration seeding.

## 4 FINAL DESIGN CONSIDERATIONS

The following sections summarize the considerations and construction specification requirements that will be included in the final design documents for avoidance and temporary impacts to USFWS Wetland Basins and other similar sensitive areas.

### 4.1 Avoidance of Impacts using Trenchless Crossings

In general, when the ENDAWS Segment 1 pipeline intersects known USFWS easements, trenchless crossings will be utilized to avoid impacts to USFWS Wetland Basins when:

1. The delineated basin typically holds water continuously,
2. A temporary impact area of greater than 1.5 acres, and
3. Locations identified where restoration may not be practical.

Project construction specifications will require that all sensitive areas be delineated in the field prior to ground disturbance. In the location of trenchless crossings, the sensitive area will be marked with an orange construction fence across the entire easement width to remind the Contractor that access along the easement is not allowed.

### 4.2 Temporary Impacts for Trenched Installation

For location where the ENDAWS Segment 1 pipeline intersects known USFWS easements and a temporary impact is allowable, the construction specifications will include the following requirements for environmentally sensitive areas (USFWS Wetland Basins, USACE wetlands etc.) that are to be temporarily impacted:

- With regards to dewatering of USFWS Wetland Basins to be temporarily impacted, provisions will be included that the Contractor will use filter and tanks such that surface water removed and discharge to adjacent basins is not sediment laden.
- With regards to dewatering of the trench during construction, provisions will be included that the Contractor will use filter and tanks such that water removed from the trench excavation is free of sediments prior to discharging into adjacent sloughs or low-area. No sediment laden water will be discharge to USFWS Wetland Basins.
- Construction plans will include trench details and requirements that a water stop be installed in the pipe-zone on each side of all temporary impacts to USFWS Wetland Basins. The trench water stop will consist of control density fill, compacted cohesive clay material excavated from the trench zone, or bentonite amended other soils.

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- Prior to the start of ground disturbing construction activities
  - The Engineer will complete preconstruction drone aerial videos documenting the condition of the alignment.
  - The project Professional Soil Scientist will conduct a SPGM training session with the Contractor and Engineers field staff.
- The Engineer will mark the Sensitive Areas in the field prior the start of any construction activities and designate if this area can be temporarily impacted or must be avoided.
- Areas that are to be avoid by the Contractor, including construction access, will be delineated with orange construction fencing. The Contractor and Engineer will periodically inspect the fencing to confirm it is still in-place.
- When the Contractor is actively working during a temporary impact of a USFWS Wetland Basin, the project Professional Soil Scientist will be onsite to observe the SPGM being removed from the easement area and the Subsoil being removed from the trench. The Professional Soil Scientist will make recommendations during the activities for the replacement of the subsoil to mimic the pre-construction hydrologic soil conditions.
- Sensitive areas where temporary impacts are allowed will be topographically surveyed prior to removing the SPGM.
- Contractor will segregate the Topsoil and Subsoil from the sensitive area such that this SPGM material is replaced back into the wetland. Engineer will confirm compliance with this requirement.
- After the replacement of the Topsoil and Subsoil, following the program SPGM handling procedures, the Engineer will confirm that pre-impact grades have been restored by completing a after construction topographic survey. This survey will be compared to the pre-construction survey and any changes in drainage will be corrected.
- Final restoration of temporarily impacted wetland areas will use a native seed mix only after the Engineer has confirmed that the pre-construction grades have been restored.
- Contractor will be responsible for the establishment of restoration of sensitive areas until 70-percent native vegetative cover has been achieved. Contractor will be responsible for weed control during the establishment period, or up to 2-years, whichever is longer.