# Union Ridge Solar

Exhibit P

Ecological Assessment

Part 7

**Case No. 20-1757-EL-BGN**

# APPENDIX E

Project Area Photographs

**Photo 1:** Typical agricultural land use within the project area, facing south. Location of DP-2.

**Photo 2:** Typical grassy swale within an agricultural setting, facing west. Location of DP-6.

**Photo 3:** Typical grassy swale within an agricultural setting, facing west. Location of DP-11.

**Photo 4:** Typical surface inlet associated with drainage tiling throughout the project area. Agricultural production within the project area, facing southwest.

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**Union Ridge Solar Project**

**Site Photographs**
**Licking County, Ohio**

SEPTEMBER 2020

**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 5:** Photo taken within Wetland A, facing north.

**Photo 6:** Photo taken within Wetland A, facing east.

**Photo 7:** Photo taken within Wetland A, facing south.

**Photo 8:** Photo taken within Wetland A, facing west.


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**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 9:** Photo taken within Wetland B, facing north.

**Photo 10:** Photo taken within Wetland B, facing north.

**Photo 11:** Photo taken within Wetland B, facing south.

**Photo 12:** Photo taken within Wetland B, facing west.

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**File Name: EVD009.0001**

**Photo 13:** Photo taken within Wetland C, facing north.

**Photo 14:** Photo taken within Wetland C, facing east.

**Photo 15:** Photo taken within Wetland C, facing south.

**Photo 16:** Photo taken within Wetland C, facing west.

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**Licking County, Ohio**

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**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 17:** Photo taken within PSS portion of Wetland D, facing north.

**Photo 18:** Photo taken within PSS portion of Wetland D, facing east.

**Photo 19:** Photo taken within PSS portion of Wetland D, facing south.

**Photo 20:** Photo taken within PSS portion of Wetland D, facing west.

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**File Name: EVD009.0001**

**Photo 21:** Photo taken within PEM portion of Wetland D, facing north.

**Photo 22:** Photo taken within PEM portion of Wetland D, facing east.

**Photo 23:** Photo taken within PEM portion of Wetland D, facing south.

**Photo 24:** Photo taken within PEM portion of Wetland D, facing west.

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**Licking County, Ohio**

SEPTEMBER 2020

**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 25:** Photo taken within PEM portion of Wetland E, facing north.

**Photo 26:** Photo taken within PEM portion of Wetland E, facing east.

**Photo 27:** Photo taken within PEM portion of Wetland E, facing south.

**Photo 28:** Photo taken within PEM portion of Wetland E, facing west.

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**Licking County, Ohio**

SEPTEMBER 2020

**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 29:** Photo taken within PSS portion of Wetland E, facing north.

**Photo 30:** Photo taken within PSS portion of Wetland E, facing east.

**Photo 31:** Photo taken within PSS portion of Wetland E, facing south.

**Photo 32:** Photo taken within PSS portion of Wetland E, facing west.


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**Photo 33:** Photo taken within PFO portion of Wetland F, facing north.

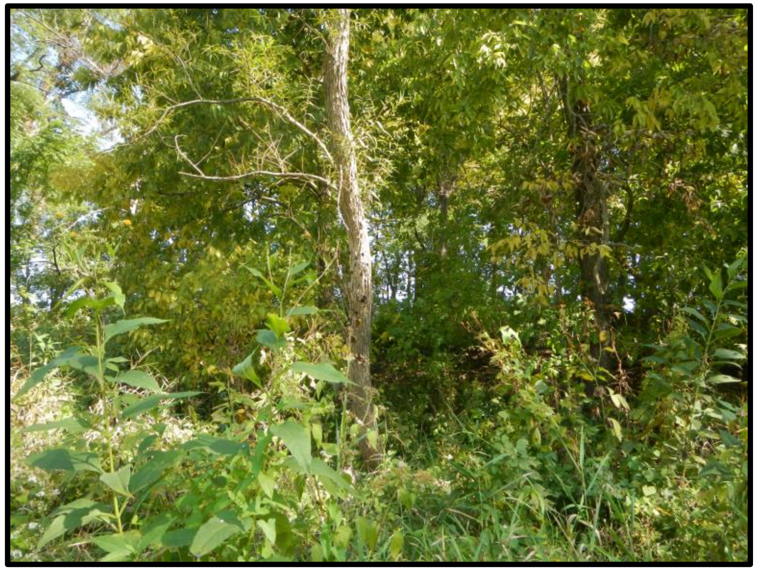

**Photo 34:** Photo taken within PFO portion of Wetland F, facing east.

**Photo 35:** Photo taken within PFO portion of Wetland F, facing south.

**Photo 36:** Photo taken within PFO portion of Wetland F, facing west.

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**Licking County, Ohio**

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**File Name: EVD009.0001**

**Photo 37:** Photo taken within PEM portion of Wetland F, facing north.

**Photo 38:** Photo taken within PEM portion of Wetland F, facing east.

**Photo 39:** Photo taken within PEM portion of Wetland F, facing south.

**Photo 40:** Photo taken within PEM portion of Wetland F, facing west.

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**Licking County, Ohio**

SEPTEMBER 2020

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**File Name: EVD009.0001**

**Photo 41:** Photo taken within PEM portion of Wetland G, facing north.

**Photo 42:** Photo taken within PEM portion of Wetland G, facing east.

**Photo 43:** Photo taken within PEM portion of Wetland G, facing south.

**Photo 44:** Photo taken within PEM portion of Wetland G, facing west.

**Photo 45:** Photo taken within PFO portion of Wetland G, facing north.

**Photo 46:** Photo taken within PFO portion of Wetland G, facing east.

**Photo 47:** Photo taken within PFO portion of Wetland G, facing south.

**Photo 48:** Photo taken within PFO portion of Wetland G, facing west.

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**Union Ridge Solar Project**

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**Licking County, Ohio**

SEPTEMBER 2020

**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 49:** Photo taken within Wetland H, facing north.

**Photo 50:** Photo taken within Wetland H, facing east.

**Photo 51:** Photo taken within Wetland H, facing south.

**Photo 52:** Photo taken within Wetland H, facing west.

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**Union Ridge Solar Project**

**Site Photographs**
**Licking County, Ohio**

DECEMBER 2020

**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 53:** Photo taken within Wetland I, facing north.

**Photo 54:** Photo taken within Wetland I, facing east.

**Photo 55:** Photo taken within Wetland I, facing south.

**Photo 56:** Photo taken within Wetland I, facing west.

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**Union Ridge Solar Project**

**Site Photographs**
**Licking County, Ohio**

DECEMBER 2020

**Project Number: EVD009**
**File Name: EVD009.0001**

**Photo 57:** Upstream view of Stream 1, facing northwest.

**Photo 58:** Downstream view of Stream 1, facing southeast.

**Photo 59:** Stream 1, substrate.

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**Photo 60:** Upstream view of Stream 2, facing north.

**Photo 61:** Downstream view of Stream 2, facing south.

**Photo 62:** Stream 2, substrate.

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**Union Ridge Solar Project**

**Site Photographs**
**Licking County, Ohio**

SEPTEMBER 2020

**Project Number: EVD009**
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**Photo 63:** Upstream view of Stream 3, facing northwest.

**Photo 64:** Downstream view of Stream 3, facing southeast.

**Photo 65:** Stream 3, substrate.


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**Photo 66:** Upstream view of Stream 4, facing west.

**Photo 67:** Downstream view of Stream 4, facing east.

**Photo 68:** Stream 4, substrate.

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**Photo 69:** Upstream view of Stream 5, facing north.

**Photo 70:** Downstream view of Stream 5, facing south.

**Photo 71:** Stream 5, substrate.

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**Photo 72:** Upstream view of the South Fork Licking River, facing north.

**Photo 73:** Downstream view of the South Fork Licking River, facing south.

**Photo 74:** South Fork Licking River, substrate.

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**Project Number: EVD009**
**File Name: EVD009.0001**

# ATTACHMENT D

Impact Tables

**Union Ridge Solar Project**
**Licking County, Ohio**
**Table 4: Surface Water Impact Summary**

| Resource ID | Coordinates | | USGS 8-Digit HUC | USACE District | Hydrologic Connection+ | Cowardin Classification+ | Habitat Assessment | Proposed Impact | Area of Impact (acres) [2] | | Volume of Impact (cubic yards) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Latitude | Longitude | | | | | | | Temporary | Permanent | Temporary | Permanent |
| Wetland B | 39.986992 | -82.636778 | 05040006 | Huntington | Jurisdictional | Palustrine Emergent | ORAM score: 14 Category 1 | Fill/Grading | 0.000 | 0.00006 | 0.00 | 0.10 |
| Wetland D | 39.986140 | -82.648634 | 05040006 | Huntington | Jurisdictional | Palustrine Emergent | ORAM score: 21 Category 1 | Fill/Grading | 0.003 | 0.006 | 4.84 | 9.68 |
| Stream 2 | 39.984462 | -82.648792 | 05040006 | Huntington | Jurisdictional | Riverine | HHEI score: 54 | Fill/Grading | 0.001 | 0.003 | 1.61 | 4.84 |
| | | | | | | | | **Total** | **0.004** | **0.009** | **6.45** | **14.62** |

**+ = Determined by Hull; subject to review by USACE verification**
*** = Determined by Hull; subject to review by Ohio EPA verification**
**[1] = ORAM scores that fall within a 1-2 grey zone, or 2-3 grey zone have been assigned to a category of 1, 2 or 3 per guidance outline in the ORAM manual.**
**[2] = Area of wetland impact is the area of wetland boundary located within the proposed limits of disturbance.**

**Acronyms:**
**N/A = Not Applicable**
**USGS = United States Geologic Survey**
**USACE = United States Army Corps of Engineers**
**HUC = Hydrologic Unit Code**
**ORAM = OH Rapid Assessment Method**

# ATTACHMENT E

Inadvertent Release of Drilling Fluid Contingency Plan

# HORIZONTAL DIRECTIONAL DRILLING INADVERTENT RETURN RESPONSE AND CONTINGENCY PLAN

FOR THE:
**UNION RIDGE SOLAR PROJECT**
**LICKING COUNTY, OHIO**

PREPARED FOR:
**ENVIRONMENTAL DESIGN & RESEARCH, LANDSCAPE ARCHITECTURE, ENGINEERING, & ENVIRONMENTAL SERVICES, D.P.C**
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**FEBRUARY 2021**

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**TABLE OF CONTENTS**

# 1.0 INTRODUCTION

This Horizontal Directional Drilling (HDD) Inadvertent Return (IR) Response and Contingency Plan (Plan) provides procedures to address an IR of drilling fluid used in HDD crossings for the Union Ridge Solar Project (Project) being developed in Licking County, Ohio. The Plan was prepared for the Project to satisfy Section 4906-4-08(B)(2)(b)(ii) of the Ohio Administrative Code, which requires an application for an electric generation facility to include, as part of its description of mitigation procedures to minimize construction impacts, "a detailed frac out contingency plan for stream and wetland crossings that are expected to be completed via" HDD.

The vast majority of the buried lines for the project will be installed by open-ditch trenching. While the placement of utility lines in an open trench is the most economical and practicable means of installation, trenching may not be feasible or allowed in situations that require avoidance of sensitive environmental or cultural resources and other obstacles on the surface or near surface. In such situations, the project is expected to employ HDD to install the line below the resource or obstacle.

HDD is a proven technique for the installation of subsurface utility lines with minimal surface disturbance. It is a trenchless, steerable method that has been successfully used in the United States since the 1960s. HDD has been successfully utilized to limit surface disturbance for decades, and modern technology and best management practices have been developed by industry and regulatory authorities over decades of experience.

However, HDD does present some potential environmental risk, primarily in the form of IRs. IRs typically occur when pressurized drilling fluid follows a path of least resistance outside of the borehole annulus through natural or manmade voids in subsurface materials such as soil and rock. When IRs occur in sensitive areas such as streams and wetlands, environmental impact may result. Adequate pre-drill investigation and planning, and operational process controls can reduce the risk of IR occurrence. Likewise, adequate IR contingency planning, preparation and rapid response can limit the spatial and temporal impact if an IR does occur. The Plan provides the framework for reducing the risk of IR during construction of the project and planning, preparation and response for one should it occur.

## 2.0 DESCRIPTION OF HORIZONTAL DIRECTIONAL DRILLING

The HDD method requires establishing staging areas at both ends of the proposed crossing, typically known as the entry and exit points, or workspaces. The process commences with the drilling of a pilot hole along a predetermined path beneath the area to be crossed. The drilling head is tracked and guided by a telemetry system that controls its depth and lateral position to ensure that the borehole is installed in the pre-determined route. IRs most commonly occur during the installation of the pilot hole primarily due to the small aperture of the hole and relative lack of space for the drilling fluid and soil cuttings to be returned to the entry point. However, because the pilot hole has a relatively small diameter compared to the diameter of the borehole necessary to accept the utility line, far less drilling fluid is required, thus reducing the overall risk of a problematic IR. The pilot hole is also critically important to ensure that the final borehole meets design specifications thereby limiting overall subsurface activity.

Once the pilot hole has been completed, the borehole is enlarged with one or more passes of a reamer until the diameter of the borehole is adequate to complete the installation of the utility line. Installation typically includes feeding the line into the borehole from the entry point while pulling the line through the exit point. This process limits the forces exerted on the subsurface and prevents unwanted conditions, such as borehole collapse, which would require additional reaming and/or drilling.

### 2.1 Drilling Fluid Role

Drilling fluid is a critical component of HDD, without which avoidance of sensitive receptors would not be possible. Drilling fluid has several important roles in HDD operations:

- Clearing Soil and Rock Cuttings – Excavated soil and rock are suspended in the drilling fluid and transported back to the entry or exit points via fluid flow. It is crucial to achieve adequate viscosity and pressure to maintain circulation of cuttings to prevent blockages that can lead to pressure spikes.

- Friction Reduction – Drilling fluid lubricates, cools, and cleans the cutting head to ensure efficient drilling.

- Borehole Stabilization – Drilling fluid mixes with subsurface materials to form a "wall cake" against the walls of the boring. The wall cake can be thought of as a grout that seals fissures or voids through which drilling fluid could be lost, possibly resulting in an IR. The wall cake also adds strength to the borehole walls, and along with the drilling fluid filling the bore, prevents collapse of the bore.

- Drilling Power – Drilling fluid is used to transmit hydraulic power from the surface to operate the cutting bit in the borehole.

The drilling fluid is mixed and prepared at the surface and then introduced through a pipe to the cutting head in the borehole. The fluid is then circulated through the borehole annulus back to the entry or exit point, where it is collected into the drilling fluid recycling system. The recycling system, through a series of mechanical operations, separates the drilling fluid from soil and rock cuttings and adjusts water content to ensure proper viscosity, before the fluid is recycled back into circulation. Excess drilling fluid will either be stored for recycling and reused or transported off-site for disposal.

## 2.2 Drilling Fluid Composition

Fresh water is the main component of drilling fluid. Bentonite clay (sodium montmorillonite) is added to the fresh water to increase viscosity, which affords the drilling fluid its beneficial properties. Bentonite clay is a naturally occurring clay typically mined in a very pure form in Wyoming; however, bentonite is somewhat ubiquitous in the environment. It is non-toxic and can be found as an ingredient in many skin care products and dietary supplements, is a common soil supplement used in farming, and is frequently used to seal freshwater ponds and earthen dams. Bentonite is not a hazardous material as defined by the United States Environmental Protection Agency (USEPA) Emergency Planning and Community Right-to-Know Act (EPCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Bentonite is non-toxic; however, due to regulation, it is classified as a non-hazardous waste when used in an industrial process such as HDD. Bentonite is not toxic to the aquatic environment; however, if introduced to a stream, wetland, lake or other water body in a large quantity, it can be temporarily disruptive, particularly to benthic organisms.

Depending on the subsurface conditions encountered during an HDD operation, certain drilling fluid additives, such as loss circulation materials (LCM), may be added to the drilling fluid mixture. LCMs may be used during inadvertent return events and/or in certain cases when drilling fluid circulation is diminished or completely lost. If naturally-occurring preferential flow paths (faults, fractures, voids, large pores etc.) intersect the HDD path, LCMs may be used to seal around the borehole and prevent drilling fluid from escaping into the formation and allow for the reestablishment of drilling fluid circulation. Many types of LCMs available for use during HDD operations are inert and environmentally benign.

Only those drilling fluid additives and LCMs that are not petroleum-based, meet NSF/ANSI Standard 60 (NSF 60) or food additive standards, and are consistent with materials used in the drinking water distribution industry will be available for use by the company performing the HDD for the project (HDD Contractor). NSF 60 establishes health and safety criteria for the chemical treatment of drinking water. Most drilling fluid additives used in the HDD industry are NSF 60 compliant, as these products are also used in other rotary drilling applications such as water well drilling and completion. Other drilling fluid additives may not have NSF compliant requirements but will meet U.S. food additive standards.

# 3.0 HDD FEASIBILITY ANALYSIS

## 3.1 Necessity of HDD

The first step in determining HDD feasibility is identifying the need for an HDD. As stated previously, open cut trenching is the most economical and efficient method for installing subsurface utility lines. HDD is utilized when an environmental, infrastructure, or cultural asset must be avoided, or when open cut trenching is otherwise not possible or practicable. Each HDD crossing identified for the Project will be reviewed, including an assessment of alternate methods.

## 3.2 Physical Characteristics of Crossing Locations

After determining the necessity of employing HDD at a proposed crossing, the suitability and accessibility of each location based on topographic and physical characteristics will be evaluated. This part of the feasibility analysis will determine whether each proposed crossing can accommodate the HDD work, necessary equipment, contractors, and permit-required controls. Determining the difference in elevation between entry and exit locations is crucial in planning the minimum recommended depth of cover required for each HDD. The results of this evaluation will be used to determine if additional evaluations are necessary, such as geotechnical investigations.

Public and private utility investigations, including One-Call notifications, at each crossing will be conducted and document that the HDD alignment and depth will not interfere with any pre-existing utilities. The bore alignments and profiles will be designed to maintain adequate lateral and vertical separation from all existing underground utilities and pipelines.

# 4.0 INADVERTENT RETURN PREVENTION AND MINIMIZATION

The application of HDD methods for avoiding sensitive environmental, infrastructure, and cultural assets during utility line installation has been proven effective over decades of practice. The feasibility analysis summarized in the previous section will be the first measure of prevention by reducing the probability of an IR through an understanding of subsurface conditions to the extent practicable, identifying and avoiding proximate sensitive receptors, and identifying construction design controls. The following section details operational controls that will be employed during HDD operations to further reduce the probability of IR occurrence, and the scale of an IR should one occur.

## 4.1 Drilling Fluid Management and Control

Maintaining drilling fluid circulation from the cutting head through the borehole annulus and back to the entry or exit point is the primary operational control used to reduce both the probability of IR occurrence and the scale of an IR should one occur. The HDD Contractor will have overall control of the HDD operation and will be responsible for maintaining drilling fluid circulation.

### 4.1.1 Drilling Fluid Composition

The drilling fluid will be mixed in accordance with the manufacturer's recommendations and physical characteristics of the crossing. The most effective composition for a given soil/rock condition will be established, monitored, and maintained throughout the drilling process. The HDD Contractor will ensure that the drilling fluid composition is adequate for each application during the duration of HDD activities.

### 4.1.2 Drilling Fluid Management Equipment

The HDD Contractor will ensure regular inspection and maintenance of all drilling fluid handling equipment including, but not limited to hoses, pumps, valves, tanks, recycling equipment, cutting heads, reamers, etc. All equipment will be clean and functioning properly to ensure uninterrupted operation. The HDD Contractor will ensure that all equipment is sized properly to accommodate the actual volume and flow rate of drilling fluid and provide capacity for increased volume or flow rate of returns throughout HDD operations.

### 4.1.3 Process Monitoring Instrumentation

The HDD Contractor will be prepared and able to measure borehole annular pressure, drilling fluid discharge rate, the drill string axial and torsional loads and the lateral and vertical position of the drilling bit or reamer bit.

#### 4.1.4 Loss of Drilling Fluid Circulation

Loss of drilling fluid circulation is defined as a reduction in the volume of drilling fluid returning to the entry or exit point through the borehole annulus, relative to the volume of drilling fluid that is being transmitted into the borehole from the cutting head. This condition can result from several issues, which may include blockages at the cutting head, blockages in the borehole annulus, and loss of drilling fluids to the formation through natural or manmade voids. A loss of circulation concurrent with an increase in annular pressure typically indicates a blockage in the circulation system. A loss of circulation absent an increase in annular pressure or concurrent with a decrease in annular pressure may indicate a loss of drilling fluid to a formation, which increases the probability of an IR. Increased annular pressure due to a blockage in the circulation system, or due to non-ideal drilling fluid composition, can also increase the probability of losing drilling fluid to the formation. The HDD Contractor will use all available methods, some of which are provided below, to reduce the probability of drilling fluid loss:

- maintain clean and unobstructed drilling fluid handling equipment;
- maintain clean and unobstructed borehole annual space;
- closely monitor and adjust annular pressure to ensure that the minimum necessary pressure is used for HDD operations;
- reduce "plunger effect" by ensuring clean cutting heads and reamers, and minimizing the speed of drill string advancement and retraction; and
- monitor and adjust drilling fluid viscosity as necessary to maintain minimum required annular pressure, but still allowing circulation back to the HDD entry point.

If a loss of drilling fluid occurs, the HDD Contractor will use all appropriate methods to regain full drilling fluid circulation to prevent an IR, such as:

- decrease pump pressure;
- decrease penetration rate;
- retract the drill string sufficiently to restore circulation ("swab" the hole);
- introduce additional drilling fluid flow along the borehole using "weeper" subs; and
- utilize bentonite plugs, grout, and/or LCM to seal voids and eliminate loss of drilling fluid to the formation. Ensure that seals are effective before continuing HDD operations.

### 4.2 HDD Monitoring and Inspection Protocols

HDD activities will be closely and continually monitored by the HDD Contractor as necessary to meet the objectives of this plan. Monitoring and inspection procedures will include, but are not limited to:

- Visual and pedestrian field inspection along the HDD route, to the extent allowable by the terrain, including monitoring drainage features and surface waters for evidence of an IR. The HDD route will be inspected prior to the beginning of an HDD, and any condition that impedes the ability to conduct the visual inspections of any portion of the bore route will be identified and a site-specific modification to the inspection routine at that location will be developed.

- Monitoring of the HDD fluid composition, drilling pressures, and return flows.

- Monitoring of drill status information regarding drill conditions, pressures, returns, and progress during the course of drilling activities.

Upon the discovery of a sustained loss of drilling fluid circulation and/or a sustained drop in annular pressure, the HDD Contractor will notify the on-site project representative, reduce downhole pressure and conduct a detailed inspection of the HDD equipment and performance, and inspect the HDD route and surrounding area for evidence of an IR. If an IR is not observed, and based on a consultation with the project representative, the HDD contractor may elect to continue drilling. In these cases, the corrective action may include altering the viscosity of the drilling mud, adding an approved LCM, or slightly altering the drill path profile to avoid unsuitable subsurface materials. If an IR is identified or suspected, HDD operations will immediately cease and response actions will be initiated, as described in Section 5.

## 5.0 RESPONSE TO INADVERTENT RETURNS

These response protocols have been developed with full consideration of the potential risk posed by IRs to the aquatic environment. While upland IRs are generally not associated with environmental risk due to the lack of drilling fluid toxicity, upland IRs can impact the aquatic environment if the drilling fluid is transported to surface water via runoff through natural or man-made drainage features. The HDD contractor will strictly adhere to this Plan and the overall goal of IR prevention and mitigation through rapid response, containment, and recovery.

Releases of drilling fluid in upland areas typically can be contained to prevent further migration and are cleaned up during and following completion of the crossing. Inadvertent returns into watercourses, however, can present greater risks and clean-up challenges. In large quantities or in sensitive environments, bentonite slurry may pose a threat particularly to benthic macroinvertebrates (e.g., aquatic larval insects). The threat to aquatic life is typically acute, although the long term impact of IRs on aquatic life appears to be negligible. Prompt and thorough removal of bentonite deposits in streams, coupled with normal stream hydrology and sediment dynamics, should disperse the bentonite to levels where aquatic faunal communities can recover quickly. The rapidity of the response to an IR is dependent on several elements:

- prompt detection and communication of the IR;
- training and adequate number of response staff;
- access to needed materials and equipment that are present in sufficient quantity and ready for use; and
- clear and timely direction regarding measures to be taken by the HDD Contractor (e.g., suspending drill operations), and where IR response materials, equipment, and labor should be deployed, depending on the location of the IR and the sensitive resource potentially affected.

### <u>5.1 Response Protocol for IR in Uplands</u>

Upland areas are generally located above and away from surface waters. Releases to upland areas are most likely to occur within the LOD near the HDD entry and/or exit points; however, IRs are also possible in upland areas outside the LOD. The primary focus of the response action is to stop and contain the IR to prevent further surface migration, especially to surface water receptors. If an upland IR is identified, the protocol described in this section will be followed.

**Upland IR Within the Limit of Disturbance**

Upland IRs typically occur at the HDD entry and exit points within the limit of disturbance (LOD) as defined in the approved erosion and sediment control plan. These IRs, referred to as “punch out” returns, generally occur at shallow depths where overburden soils are weak. Response actions will focus on containing the release and preventing migration outside the LOD. If the punch out return is fully contained within the LOD, and surface water features and water supplies are not threatened, HDD operations may continue.

In the event of an upland IR within the LOD, the HDD Contractor will notify the project representative, determine the approximate volume of the IR, and oversee and document the containment and recovery operations. If at any time the IR threatens to migrate beyond the LOD, the IR exceeds the erosion and sedimentation controls, or the rate of return exceeds the capacity of response operations, HDD operations will be suspended until such time that the IR is completely contained. Released drilling fluid can be recovered and reused in HDD operations. Excess drilling fluid, if disposed, will be managed as waste in accordance with applicable regulations. After the IR is contained and recovered, the area will be restored in accordance with applicable requirements.

**Upland IR Outside the Limits of Disturbance**

While uncommon, upland IRs can occur outside the LOD when drilling fluid is pushed through natural or manmade voids to the surface. These IRs are sometimes preceded by ground swelling and groundwater seepage and can occur anywhere along the HDD alignment. Diligent inspections are necessary to identify evidence of an upland IR so response protocols can be initiated quickly.

Upland IRs do not generally pose significant risk to the environment if they are contained and prevented from migrating to surface water via natural and man-made drainage features. If an upland IR occurs outside the LOD, the following response protocols will be followed:

- HDD operations will immediately cease which will immediately reduce borehole annular pressure. Resumption of HDD operations will be contingent upon approval of the project representative, and, if required, applicable regulatory agencies.
- The HDD Contractor will obtain the coordinate location and estimated volume of the release and determine whether surface water, natural or man-made drainage features, or any other sensitive receptors are impacted or threatened.
- The project representative will confirm access rights to enter the affected property for containment and recovery operations. If access is not granted, the project representative will notify and work with applicable regulatory agencies to gain access.
- The HDD Contractor will initiate containment and collection of the drilling fluid.
    - Contain the IR to the smallest area possible with physical barriers such as hay bales, sandbags, silt fencing, silt socks, all of which will be installed in accordance with best management practices as defined in the approved erosion and sedimentation control plan. Small excavated pits, dikes and diversion ditches may also be used.

- If recovery equipment is not immediately available due to the location of the IR, especially if precipitation is expected, plastic sheeting will be used to cover the IR to minimize contact with stormwater.
- The IR will be recovered to the maximum extent practicable. All necessary erosion and sediment control protocols will be utilized during recovery operations.
- All recovered material will be managed as a residual waste in accordance with applicable regulations, including the retention of all disposal documentation.
- The impacted area will be restored to pre-existing conditions, including re-establishment of vegetation. All necessary erosion and sediment control protocols will be utilized until site restoration is complete.

## 5.2 Response Protocol for IR in Surface Water

HDD techniques are often employed to cross streams and wetlands without physically impacting the watercourse. Due to the typical morphology of streams (association with bedrock fractures), IRs can occur within a surface stream. Likewise, natural and man-made drainage features, wetlands, springs, and riparian zones can also be susceptible to IRs that migrate through the subsurface, or from upland areas. Wetlands generally occur in depositional environments, and consequently wetland biological systems are highly resilient to acute inputs of sediments. The biological systems of riparian zones and springs are also much less susceptible to damage from IRs than streams, and the lack of moving water reduces the extent to which drilling fluid can be transported. However, rapid containment and recovery of IRs in these areas is critical to reducing the possibility of environmental impact to adjacent streams or other sensitive areas. For these reasons, if an IR threatens a surface water feature, the focus of the response will be stopping the release of drilling fluid, containing the fluid to the smallest possible area, and quickly removing as much drilling fluid as possible.

Aquatic life is typically concentrated in stream riffles (shallow areas of fast-moving water between natural stream pools). Aquatic macroinvertebrates live in the oxygen-rich stream riffles and are especially susceptible to increased sedimentation associated with IRs. Accordingly, response actions will be designed to prevent sediment accumulation in stream riffles to the extent possible. While aquatic biological systems are sensitive, streams are effective at clearing excess sediment. Accordingly, response actions also will be tempered to prevent additional harm. Response actions such as power washing and artificial flushing, while effective at removing drilling fluid, may cause additional or even greater harm than the IR, and so will be avoided. In the event of a surface water IR, a person with experience with or professional certification relevant to stream dynamics, morphology and aquatic ecology will approve and oversee in-stream response actions.

Specific permits may be required prior to entering a surface water body to conduct IR assessment, containment, and recovery operations. The HDD Contractor will not place or allow the placement of equipment or materials in the water course without direct approval of the project representative. The project representative will coordinate with applicable federal, state and local regulatory agencies to ensure that any necessary permits are in place prior to conducting containment and recovery operations in surface water.

With consideration given to specific permit requirements, the following general response protocols will be followed in the event of an IR to surface water:

- HDD operations will immediately cease, and the HDD Contractor will immediately reduce borehole annular pressure to the extent practicable. Resumption of HDD operations will be contingent upon approval of the project representative and applicable regulatory agencies.
- The HDD Contractor will immediately notify the project representative and provide the coordinate location and estimated volume of the release.
- The Ohio EPA Spill Hotline will be notified within 30 minutes of the discovery of an IR at 1-800-282-9378.
- The Ohio Department of Natural Resources – Division of Wildlife will be notified within 30 minutes of the discovery of an IR in surface waters known to contain endangered species at 614-265-6346.
- An attempt to contact all property owners that may be affected by the IR will be made.
- The project representative will confirm access rights to enter the affected property for containment and recovery operations. If access is not granted, the project representative will notify and work with applicable regulatory agencies and property owner(s) to gain access.
- The project representative and HDD Contractor will work with internal resources, consultants and federal, state, and local regulatory agencies in an expeditious manner to prepare, submit, and gain approval of any permits as might be required prior to entering a water course for containment and recovery operations.
- The HDD Contractor will determine the need for containment and clean-up personnel, including whether third-party contractors and equipment are necessary.
- Once access to enter the surface water feature has been granted by the property owner, and/or via permit approval, the HDD Contractor will initiate, oversee, and document containment and recovery operations. A qualified professional will oversee all corrective actions associated with a surface water IR:
    - Contain the IR as close to the release point as possible using sediment control devices such as silt fencing, silt curtains, mulch tubes, hay bales, and sandbags.
    - Immediately begin recovering drilling fluid as close to the release point as possible using vacuum trucks, pumps, and manual methods, as applicable.

- Install sediment control devices downstream of the release point. Avoid installing sediment control devices immediately downstream of riffles, as the resulting accumulation of sediment can harm these sensitive areas at the following locations:
    - Immediately downstream of the release point.
    - Upstream of riffles.
    - Downstream side of existing natural pools.
- Once sediment control features are installed, sediment will begin to accumulate in the natural stream pools, which will allow efficient recovery. Natural pools typically offer more convenient access for recovery operations.
- A qualified professional will determine the need for additional actions.
- All recovered material will be managed as a waste in accordance with applicable regulations, including document retention.

- If necessary, the project representative will design and implement a monitoring program consistent with permit requirements, regulatory agency requirements, and the scale of the IR and response actions.

## 5.3 Containment and Recovery Materials and Equipment

The HDD Contractor will ensure that adequate IR containment and recovery equipment and materials are located at the HDD location prior to the initiation of HDD activities. Prior to the start of HDD operations and at the beginning of each workday, the HDD Contractor will verify the inventory and condition of equipment and materials as part of the daily pre-drill checklist. This equipment will be on standby and ready for use for the entirety of the drilling process. The materials and equipment may include:

- Compost filter sock
- Silt fence, hay bales, sandbags, and wood stakes for installation
- Hand tools (shovels, rakes, brooms, buckets, etc.)
- Centrifugal, trash, and sump pumps with associated hoses
- Pump water filter bags
- Vacuum truck
- Mini backhoe/loader (rubber tire or wide track to minimize surface disturbance)
- Equipment mats and timbers
- Aqua barriers/floating turbidity curtains and mounting hardware
- Plastic sheeting (6 mil minimum)

After an IR response, all equipment will be cleaned, inspected, repaired and/or replaced, and be fit for use before HDD operations can resume. Likewise, consumable materials (silt fence, hay bales, etc.) will be properly disposed and replaced before resuming HDD operations.

# 6.0 HDD CONTINGENCY PLAN

## 6.1 Contingency Plan for a Failed HDD

In the event that corrective measures are not sufficient to maintain the integrity of an HDD borehole, the HDD Contractor will abandon the borehole and in consultation with the project representative consider alternate crossing locations and/or techniques. If necessary, the project representative will consult with applicable regulatory agencies to determine if an HDD failure has occurred and evaluate alternate, site-specific remedies.

In the event of borehole failure, the borehole will be properly abandoned, and a decision will be made regarding whether to re-attempt the HDD crossing, or use another crossing method, as described below:

- grout will be used to seal the bore hole;
- the top 5 feet will be filled with topsoil; and
- the location will be graded to the original contour and re-vegetated.

The above abandonment procedures will be discussed with all appropriate permitting and regulatory agencies prior to implementation.

## 6.2 Alternative Crossing Locations and Methods

If the HDD bore cannot be completed at the proposed location, the HDD crossing may be re-attempted at an alternate location. Before a determination is made on an alternate crossing location, an effort will be made to identify and assess the reason for the HDD failure. This may be critical for the selection of the alternate crossing. Considerations of alternative locations include, but are not limited to:

- horizontal relocation of the drill hole,
- changing of the drill profile (depth of bore),
- changing drill procedures (slurry viscosity/pressure/flow velocity, bit rotation/velocity, etc.), and
- geotechnical considerations.

If the entry and exit points must be relocated, consideration will be given to:

- proximity to surface water, wetlands, sensitive habitats, cultural resources, existing utilities;
- surrounding topography,
- entry and exit angles for the HDD path, and

- permitting considerations.

These and other factors will be considered and discussed with appropriate regulatory agencies to secure any necessary approvals. Alternate crossing methods, such as open cut, may also be evaluated.