DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Waterways Engineering and Wetlands

DOCUMENT NUMBER: 310-2100-###

TITLE: Trenchless Technology Technical Guidance Document

EFFECTIVE DATE: Month, Day, Year

AUTHORITY: This document is established in accordance with Section 1917-A of The Administrative Code of 1929, Act of April 9, 1929, P.L. 177, *as amended*,71 P.S. § 510-17; The Clean Streams Law, Act of June 22, 1937, P.L. 1987, *as amended*, 35 P.S. §§ 691.1- 691.1001; Dam Safety and Encroachments Act, Act of November 26, 1978, P.L. 1375, *as amended*, 32 P.S. §§ 693.1- 693.27; Flood Plain Management Act, Act of October 4, 1978, P.L. 851, No. 166, *as amended*, 32 P.S. § § 679.101- 679.604; Oil and Gas Act of 2012, Act of February 14, 2012, P.L.87, No.13, 58 Pa. C.S. §§ 3201-3274; the Pennsylvania Safe Drinking Water Act, Act of May 1, 1984, P.L. 206, *as amended*, 35 P.S. §§ 721.1- 721.17; the Solid Waste Management Act, Act of July 7, 1980, P.L. 380, *as amended*, 35 P.S. §§ 6018.101-6018.1003; and the regulations promulgated under these statutes, including 25 Pa. Code Chapters 78, 78a, 91, 92a, 93, 95, 96, 102, 105, 106, 109, 250, 287, 288, 289, 293 295, 297 and 299.

POLICY: Provides guidance on the Department of Environmental Protection's (DEP) requirements for usage of any Trenchless Technology.

PURPOSE: This guidance document outlines the steps and options to be considered and, as appropriate, implemented by the regulated community when a project proponent proposes to use trenchless technology, which includes, but is not limited to, horizontal directional drilling (HDD), on any portion of a project, including pipelines.

APPLICABILITY: This guidance document is intended for any project proposing to utilize HDD or other Trenchless Technology. The guidance has been written in a manner so that the level of analysis needed for a project should be commensurate with the level of environmental risk (please refer to Appendix A). The guidance includes but may not be limited to:

- Analysis/Considerations to be submitted by project proponent during permitting process to demonstrate Suitability and Feasibility
- Prevention, Preparedness and Contingency (PPC) Measures to be taken when Trenchless Technology is proposed to address issues should they arise during construction. (e.g. Inadvertent Return & Water Supply & Voids/Subsidence)

DISCLAIMER: The guidance and procedures outlined in this document are intended to supplement existing requirements. Nothing in the guidance or procedures shall affect regulatory requirements. The guidance or procedures herein are not an adjudication or a regulation. There is no intent on the part of the PADEP to give the rules in these policies that weight or deference. This document establishes the framework within which PADEP will exercise its administrative discretion in the future. PADEP reserves the discretion to deviate from this policy statement if circumstances warrant. This guidance does not require new permits.

It is important to note that the PADEP does not have a substantial role in siting of projects, such as pipelines. PADEP strongly recommends that the user review if other agencies regulate pipeline siting or other obligations not regulated by PADEP (e.g., Pennsylvania Utilities Commission) and coordinate early with all pertinent agencies. The siting (or project location) is often selected by the project proponent and, if federally regulated, reviewed by that federal agency (e.g., the Federal Energy Regulatory Commission). The PADEP is bound by the authorities listed in Section 1 (C) "Authority". Nowhere in the State Regulations is PADEP provided the power to move a proposed project.

The issuance of this guidance is not meant to sway project proponents from utilizing Trenchless Technology, nor should it be used, or viewed, in that manner. The issuance of this guidance is not meant to indicate that PADEP exclusively views Trenchless Technology (e.g., HDD) as the least environmentally impactful. Each use of Trenchless Technology will be reviewed to determine what option is the least environmentally impactful.

PADEP recognizes that all projects do not pose the same level of risk. This guidance may not be necessary for small projects that pose little to no risk to resources nor have any potential impacts to the

environment. It is the sole responsibility of the project proponent to diligently evaluate all risks associated with a project.

This guidance document may help guide project proponents in documenting and addressing all potential risk to resources or any potential impacts to the environment. Please see Appendix A to help evaluate risk.

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Acronyms

ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Corps	United States Army Corps of Engineers
CSL	Clean Streams Law
DEM	Digital Elevation Models
DSEA	Dam Safety and Encroachments Act
EI	Environmental Inspector
EPCRA	Emergency Planning and Community Right-to-Know Act
EV	Exceptional Value
GPS	Global Positioning System
HAB	Horizontal Auger Boring
HDD	Horizontal Directional Drilling
HQ	High Quality
IR	Inadvertent Return
ISBN	International Standard Book Number
LIDAR	Light Detection and Ranging
LOD	Limits of Disturbance

Acronyms

MCD	Minor Civil Division
MCL	Maximum Contaminant Level
MPN	Most Probable Number
MSDS	Material Safety Data Sheets
NRCS	Natural Resources Conservation Service
NSF	National Science Foundation
NWI	National Wetlands Inventory
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PaGEODE	Pennsylvania Geologic Data Exploration
PaGWIS	Pennsylvania Groundwater Information System
PASDA	Pennsylvania Spatial Data Access
PE	Professional Engineer
PEMA	Pennsylvania Emergency Management Agency
PFBC	Pennsylvania Fish and Boat Commission
PG	Professional Geologist
PHMC	Pennsylvania Historical Museum Commission
PHMSA	Pipeline and Hazardous Materials Safety Administration
PNDI	Pennsylvania Natural Diversity Inventory
PNHP	Pennsylvania Natural Heritage Program
PPC	Prevention, Preparedness, and Contingency
PRC	Pipeline Research Committee
PWS	Public Water Supplier's Service Area(s)
ROW	Right of Way
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SWA	Source Water Assessment
TGD	Technical Guidance Document
TT	Trenchless Technology
USDA	United States Department of Agriculture
UESI	Utility Engineering and Surveying Institute
USEPA	United States Environmental Protection Agency
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Program
WSS	Web Soils Survey

SECTION 1. PREAMBLE

A. Foreword/Executive Summary

Pennsylvania Department of Environmental Protection (PADEP) has created a Trenchless Technology (TT) Technical Guidance Document (TGD) outlining policies, procedures, and best practices for the prevention of adverse environmental impacts from construction in Pennsylvania utilizing trenchless technology, as defined in Section B (Definitions), which includes horizontal directional drilling (HDD). This guidance has been prepared to give project proponents information to help prevent environmental issues and to provide a roadmap to improve compliance. Project proponents are encouraged to read the Disclaimer section of this document. It is important to note, this is recommended guidance that does not require a new permit.

This TGD outlines the steps and options to be considered when a project proponent proposes the use of a trenchless technology construction method as part of their project, which may include a pipeline, utility construction or other similar projects. The level of analysis needed for a project will be commensurate with the level of environmental risk. It is the project proponent's responsibility to perform the due diligence, but PADEP may request this information. Some of the guidance provided herein may not be appropriate for the scope of a proposed project. Each project that proposes Trenchless Technology (e.g. HDD) should be prepared in consideration of project-specific issues, impacts, and public and agency comments.

This TGD includes, but is not limited to, a recommended Suitability/Feasibility Analysis which includes evaluation of aquatic resource impacts of trenchless technology construction in advance of and throughout the permitting process. Guidelines for supplemental measures to be incorporated into Prevention, Preparedness, and Contingency (PPC) Plans are also outlined in the event they should be needed either during and/or after construction.

The Site Suitability Analysis includes, but is not limited, to an evaluation of site topography, soil type, geology, hydrogeology, public-private-industrial water supplies, known oil-gas wells, mining sites, and contamination sites. A simple process is laid out for bores and a more detailed process is outlined for HDDs and other TT which includes a desktop assessment of existing environmental considerations and a two-tiered field assessment.

The Feasibility Analysis includes the assessment for use of trenchless technology construction as the least environmentally impacting alternative. Economics and constructability are also included in the decision matrix considerations.

For larger and more complex projects, this TGD recommends that during the Site Suitability and Feasibility Analysis local stakeholders (e.g., local municipalities, county officials, emergency managers, watershed groups, non-governmental organizations, and other concerned citizens who have expressed interest) are consulted. The TGD also includes design considerations when proposing trenchless technology and construction considerations when executing TT as well as a plan submittal checklist and suggested attachments. In addition, the

TGD outlines the need for an inspection and monitoring program and most importantly the need for Emergency Response Planning.

Design and Permitting guidance include identification, detailed design and confirmation of the preferred construction method. Plan contents and attachments required for permitting are also identified. The construction and compliance guidance include personnel training, recommended pre-construction activities, preparation of an HDD drilling fluids management plan when applicable, inspection and monitoring, and emergency response planning.

B. Definitions

- **Alternative**- any alternative to the proposed action, including alternative locations, routings or designs to avoid or minimize adverse environmental impacts. An alternative is practicable if it is available and capable of being carried out after taking into consideration construction cost, existing technology and logistics. (adapted from 25 Pa. Code Chapter §105.13 and §105.18a).
- **Artesian Groundwater** – An aquifer under hydrostatic pressure that is great enough to cause water to rise in a well or bore high enough so that it flows out on the land surface. (Adapted from Driscoll, 1986)
- **Aquatic Resources** - For the purposes of this document, the term aquatic resources refers to Regulated waters of this Commonwealth, as defined in §105.1, which includes watercourses, streams or bodies of water (e.g., all wetlands) and their floodways wholly or partly within or forming part of the boundary of this Commonwealth (25 Pa. Code Chapter §105.1)
- **Bore**- Techniques consistent with Horizontal Auger Boring (HAB), a technique for forming a bore from a drive pit to a reception pit by means of a rotating cutterhead. The casings are jacked forward sequentially in a cyclic process while the auger is turned. The spoils are moved back to the drive shaft by the rotation of the helically wound auger flights in the steel casing. The equipment may have limited guidance and steering capability (ASCE, 2017).
- **Borehole Investigation**- an investigation where a hole is drilled into the earth to explore below surface conditions (adapted from Merriam-Webster definition, accessed June 2019).
- **Cross bore** - A cross bore is the intersection of an existing underground utility or underground structure by a second utility installed using trenchless technology. This results in an intersection of the utilities, compromising the integrity of either or both utility or underground structure.
- **Cone of Depression** - The depression, roughly conical in shape, produced in the water table by pumping water from a well.
- **Drilling Fluid** - A mixture of water, a viscosifier (typically bentonite), polymers, air, or other fluid that is pumped to the drill bit or reamer to facilitate cutting, transport drilled spoil, stabilize the borehole, cool and clean cutters, and reduce friction between the product pipe and the wall of the hole (Muindi et al., 2014).

- **Dry Hole** - drilling term, a condition that occurs when the drilling tools advance beyond the drilling mud. Typically caused by trying to advance the borehole too quickly (DTD, 2009).
- **Environmental Risk** - Risk is defined as the chance or probability of an event that exposes something or someone to a specific level of danger and peril. For every event, there is a cost. These costs can be monetary, affect schedule, affect finished product, or the environment. Risks associated with Trenchless Technology can involve various factors, including ground settlement, ground heaving, subsidence, opening of voids, sinkholes, movement of sensitive buildings, inadvertent returns, impacts to water supplies, the environment, changed ground conditions, broken down-hole tooling, damage to third party property, and damage to other utilities and structures (adapted from (Doherty, 2019). Please refer to Appendix A.
- **Feasibility** – Capable of being used or dealt with successfully.
- **Geologic Hazard** (i.e., Hazardous Geologic Conditions) - Any part of the proposed project located where known geologic conditions may provide hazards to the project or surrounding environment or have the potential to cause or contribute to pollution when disturbed, including, but not limited to land sliding, steep slopes, karst/sinkhole formation, coal seams, acid producing rock, radioactive or arsenic bearing formations, surface mines (existing, abandoned and/or reclaimed), deep mines (active, abandoned where the earth disturbance activities have the potential to encounter a mine void), mine spoil dump area, abandoned mine drainage, or abandoned mine drainage treatment systems. (Adapted from PaDEP, *ESCGP-3 Permit and Standard Conditions*)
- **Horizontal Directional Drilling** – A trenchless construction methodology for installing pipelines, conduits or cable utilizing drilling fluid, often pressurized, and consisting of a directionally controlled (e.g., steerable) pilot hole drilled along a predetermined path extending from grade at one end of a drilled segment to grade at the opposite end; enlarging the pilot hole to a size which will accommodate a pipeline; and pulling a pipeline/conduit into the enlarged hole. The method is accomplished using a horizontal drilling rig (Adapted from Hair, 2015).
- **Hydraulic Fracture -** A soil discontinuity produced or enlarged by borehole annular pressure, the process of annular pressure inducing a fracture or opening up an existing fracture in the formation during the drilling process. (Adapted from Canadian Association of Petroleum Producers Publications)
- **Inadvertent Return** – An unauthorized discharge of drilling fluids and associated drilled spoils to the surface of the ground or surface waters, including wetlands, associated with HDD or other trenchless construction methodologies (Source: Adapted from PADEP Standard Operating Procedures (SOPs) Regarding Inspection and Compliance of Trenchless Construction Methodologies Associated with PADEP Permits).
- **Karst Areas** – Areas that are underlain by bedrock that is carbonate rock containing discontinuities that were enlarged by dissolution and may allow water to flow.

- **Large and Complex Projects-** A project that by its nature is larger and/or more complex from a technical standpoint than a standard project. Since this document is regarding Trenchless Technology, the focus is based on subsurface conditions and other related factors. (Source: adapted from PADEP Permit Review Process and Permit Decision Guarantee, Document No.: 021-2100-001).
- **Limit of Disturbance (LOD) –** The boundary within which it is anticipated that earthmoving, including installation of BMPs, will take place (adapted from 2012 E&S Manual, Document No.: 363-2134-008)
- **Municipality –** A county, city, borough, town, township, school district, institution or authority or another public body created by or pursuant to State law. For purposes of this definition, town includes an incorporated town (25 Pa. Code Chapter §102.1)
- **NSF/ANSI 60 -** National Science Foundation/American National Standards Institute published a set of standards and health effects criteria in 1988 for water treatment chemicals which were developed by a team of scientists, industry experts and key industry stakeholders (Source: http://www.nsf.org/services/by-industry/water-wastewater/water-treatment-chemicals/nsf-ansi-can-standard-60
- **Pennsylvania Spatial Data Access (PASDA)** - Pennsylvania's official public access open-geospatial data portal.
- **Potable Water** – A water source that is used by humans after conventional treatment for drinking, culinary and other purposes such as inclusion in food products. (25 Pa. Code Chapter §96.1, Definitions)
- **Preparedness, Prevention and Contingency Plan (PPC Plan)** - A written plan that identifies an emergency response program, material and waste inventory, spill and leak prevention and response, inspection program, housekeeping program, security and external factors, and that is developed and implemented at the construction site to control potential discharges of pollutants other than sediment into waters of this Commonwealth. The PPC plan must include a site-specific contingency plan that describes the measures to be taken to control, contain and collect any discharge of drilling fluids and minimize impacts to waters of the Commonwealth. The PPC plan must be present onsite during drilling operations and shall be made available to the Department upon request. [§§102.5(l) and 78a.68a(b)]
- **Public Water Supplier's (PWS) Service Area -** public water supplier's service area attribute definition: Active service boundary areas for Pennsylvania public water supplies, excluding non-transient non-community and transient noncommunity systems.
- **Right-of-Way (ROW)** - For highways, pipelines, and utility lines, it is the boundary line within which the applicant/operator has a legal right to do earthwork, and following construction, maintain and operate (adapted from 2012 E&S Manual, Document No.: 363-2134-008).
- **Trenchless Technology** – A type of subsurface construction work that requires few trenches or no trenches which includes any trenchless construction methodology, including without limitation, horizontal directional drilling, guided auger bore, cradle

bore, conventional auger bore, jack bore/hammer bore, guided bores, and proprietary trenchless technology [Adapted from EHB Docket No. 2017-009-L].

- **Source Water Assessment (SWA)** – An evaluation documented in writing of the contamination potential of a drinking water source used by a public water system which includes identifying the contributing area to the water source, an inventory of potential contaminant sources and a determination of the susceptibility of the water source to contamination (Ch. 109.1 Definitions).
- **Stop-Work Authority** - the authority to stop site-specific activities that violate the environmental permits or conditions. Stop-work authority is given to all key personnel, including Environmental Inspectors.
- **Suitability** – The quality of being right or appropriate for a purpose or situation.
- **Surface Water Intake Protection Area** – The surface and subsurface area surrounding a surface water intake supplying a public water system through which contaminants are reasonably likely to move toward and reach the water source (abridged, Ch. 109.1 Definitions).
- **Surface Water Intake Protection Program** – A comprehensive program designed to protect each surface water source used by a public water system from contamination (Ch. 109.1 Definitions).
- **Unconsolidated Material -** sediment that is loosely arranged or unstratified, or whose particles are not cemented together, found either at the surface or at depth (USGS)
- **Unconventional well** (or well) - A bore hole drilled or being drilled for the purpose of, or to be used for, the production of natural gas from an unconventional formation (Ch. 78a.1 Definitions).
- **Water Supply** - A private or public supply of water for human consumption or use, or for agricultural, commercial, industrial or other legitimate beneficial use. This may include wells, springs, and surface water intake (adapted from Ch. 78a.1 Definitions).
- **Water Systems -** categories listed below are served by a public water supply and are regulated by the Pennsylvania Bureau of Safe Drinking Water (Ch. 109.1).
    - **Community Water System** - A public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents (Ch 109.1 Definitions).
    - **Public Water System** - A system which provides water to the public for human consumption which has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. The term includes collection, treatment, storage and distribution facilities under control of the operator of the system and used in connection with the system. The term includes collection or pretreatment storage facilities not under control of the operator which are used in connection with the system. The term also includes a system which provides water for bottling or bulk hauling for human consumption. Water for human consumption includes water that is used for

drinking, bathing and showering, cooking, dishwashing or maintaining oral hygiene (Ch 109.1 Definitions).

- **Non-Transient Non-Community Water System (e.g., a school)** - A noncommunity water system that regularly serves at least 25 of the same persons over 6 months per year (Ch 109.1 Definitions).
- **Transient Non-Community Water System (e.g., a camp)** - A public water system which is not a community, non-transient noncommunity, bottled or vended water system, nor a retail water facility or a bulk water hauling system (Ch 109.1 Definitions).

- **Wellhead Protection Area (WHPA)** – the surface and subsurface area surrounding a public water supply well, wellfield, spring or infiltration gallery through which contaminants are reasonably likely to move toward and reach the water source, as more fully defined in Ch 109.1.
- **Zone of Influence** – The land area above the cone of depression of a well which contributes groundwater to the production well.

SECTION 2. SUITABILITY, FEASIBILITY, AND ENVIRONMENTAL CONSIDERATIONS

Note to Reader: *Prior to beginning any analysis associated with this Technical Guidance Document (TGD), project proponents are encouraged to review Appendix A. Project proponents are also encouraged to read the Disclaimer section of this document. It is important to note, this is recommended guidance that does not require a new permit.*

A Site Suitability/Feasibility Analysis is recommended as an initial step in determining the applicability of a trenchless technology. The Site Suitability Analysis can rely primarily on electronic resources and other available data (i.e. a desktop review), including the data resources listed in **Appendix B**. The analysis would identify and document potential impacts, including environmental impacts, of the proposed project.

The Site Suitability Analysis outlines the need for a desktop assessment of existing environmental considerations (for all drilling proposals) and a two-tiered assessment which, based on the size and complexity of the project, may include site geotechnical, geologic, and/or geophysical investigations to further investigate potential for adverse environmental impacts. The two-tiered assessment is laid out in **Appendix C**, Bore & HDD Flowchart. The process for bores is simpler while a more detailed process is outlined for HDDs and other Trenchless Technology methods.

The Feasibility Analysis would provide conclusions and recommended construction methods for the various types of crossing (i.e. road, stream, wetland, and groundwater/reservoir). The recommended Feasibility Analysis would include a decision matrix for use of Trenchless Technology construction as the ***least environmentally impacting alternative***.

Economic and constructability issues are also included in the decision matrix considerations and addressed through two-tiered field assessment.

Any considered alternatives to minimize potential adverse environmental impacts should be identified in the Site Suitability/Feasibility Analysis. For more information on Alternatives Analysis guidance, go to *Chapter 105 Alternatives Analysis Technical Guidance Document (Document # TBD)*

For large and complex projects, it is recommended that the project proponent incorporate a summary of the results from their Site Suitability/Feasibility Analysis into their public participation process, so stakeholders can have an opportunity to become familiar with the project. For more information, go to PADEP's Public Participation Policy in the Permit Review Process (Doc. No. 012-0900-003).

A. Proposed Alternative

The applicant is responsible for providing a detailed analysis of the proposed action, including alternative locations, routings or designs to avoid and minimize adverse environmental impacts §105.13(e)(1)(viii). This is the proposed alternative chosen by the project proponent which they anticipate being practicable if it is available, capable of being carried out, and best accomplishes

the purpose and need of the proposed action after taking into consideration construction cost, existing technology and logistics (Adapted from Ch.105). If the proposed alternative is still practicable based on the site suitability, feasibility, and environmental analysis it becomes the preferred alternative which is discussed in Section 3, Design and Permitting.

B. Site Suitability Analysis

The site suitability analysis should look at physical, technical and geologic constraints for all aspects of the project. The project should, at a minimum, account for all aspects of construction and project implementation. This includes, but is not limited to, the pilot hole, reaming and pull back stages of construction, enough area for construction, siting areas, pipe stringing areas, discharge areas for hydrostatic testing, and space needed for hole flushing. This analysis should also include, but is not limited to, an evaluation of site topography, soil type, geology, hydrogeology, public-private-industrial water supplies, known oil-gas wells, mining sites, and contamination sites. A data resources list is provided in **Appendix B** to assist in obtaining this information. **Appendix B** is not a complete list of resources. A simple process is laid out in this TGD for bores; and a more detailed process is outlined for HDDs and other Trenchless Technology which includes a desktop assessment of existing environmental considerations and a two-tiered field assessment. The two-tiered assessment is laid out in **Appendix C**, Bore & HDD Flowchart. The following items are topics this TGD recommends a project proponent evaluate, as necessary. Project proponents should be prepared to support their evaluations with documentation and why, if any, items were not evaluated. An incomplete investigation and analysis of information necessary for the adequate review of the project may impede the permit review process.

1. Existing Surface Conditions - Analyze the natural and artificial existing features in proximity to the project prior to project activity including the following:

    a) **Topography,** including but not limited to areas within the right-of-way and areas draining from upslope.

    An important aspect of topography that should be considered by project proponents is significant elevation differences. This is an environmental risk metric that looks at the difference in elevation between the entry and exit points of an HDD. The risk is magnified by many factors including, but not limited to groundwater elevation, hole diameter, angle of profile through the portion of the bore that is completed at an elevation higher than the water table, entry point positioned on the high side based on site conditions which increases annular pressure, and other subsurface conditions. The TGD recommends project proponents pay special attention to crossings with elevation differential between entry and exit points. For example, 100 ft elevation differential between entry/exit points may be a reasonable benchmark of elevation difference. With that said, 100 ft elevation differential can be overcome, and the industry has completed them successfully with even larger elevation differentials. Please also refer to: http://www.pasda.psu.edu/ as a possible source.

b) **Waters of the Commonwealth**, Analyze and examine potential impacts to the following: rivers, streams, creeks, rivulets, impoundments, ditches, water courses, storm sewers, lakes, dammed water, ponds, springs, wetlands and all other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth (Adapted from the Clean Streams Law and Dam Safety and Encroachments Act).

Available digital resources can be used in conducting a first-cut desktop assessment of Waters of the Commonwealth. The approximate locations of many watercourses, their PA-designated and existing uses, and their attainment status can be identified from data available at PASDA Please refer to the references in **Appendix B** and refer to: http://www.pasda.psu.edu/ (approximate stream locations also can be obtained from the USGS National Hydrography Dataset).

For some wetlands, the National Wetlands Inventory (NWI) mapping by USFWS can be used, but only as a partial resource because it is based on high-altitude aerial photography and omits many actual, regulated wetlands. NWI mapping should not be relied upon as the only source in identifying possible wetlands.

More reliable than the NWI database, is the PA Wetland Mapping Database. This dataset was developed to support land-cover mapping and modeling initiatives in the Commonwealth of Pennsylvania. High-resolution wetlands dataset for Pennsylvania. Primary wetlands classes were mapped, plus water: Emergent, Scrub\Shrub, Forested and Water. The primary sources used to derive this modeled wetlands layer were 2006-2008 leaf-off LiDAR data, 2005-2008 leaf-off ortho imagery, 2013 high-resolution land-cover data, and moderate-resolution predictive wetlands maps incorporating topography, hydrological flow potential, and climate data. This dataset is considered current based on the 2013 land-cover map. Wetlands classes were mapped using a rule-based expert system embedded within an object-based framework. Object-based image analysis techniques (OBIA) work by grouping pixels into meaningful objects based on their spectral and spatial properties. Using this technique, a rule-based expert system was designed to effectively mimic the process of manual image analysis by incorporating the elements of image interpretation (color/tone, texture, pattern, location, size, and shape) into the classification process. A series of morphological procedures were used to ensure that the end product was both accurate and cartographically coherent. This dataset was developed to support land-cover mapping and modeling initiatives in Pennsylvania. The PA Wetland Mapping Database can be accessed:
http://www.pasda.psu.edu/uci/SearchResults.aspx?Keyword=Modeled+Wetlands

Information derived from the Web Soil Survey (WSS) should be used to supplement NWI mapping. The WSS identifies soil drainage classes – those soils that are classified as "poorly drained" or "very poorly drained" generally are hydric and should be identified as wetlands in any desktop analysis. Those WSS soil-derived "wetlands" should then be combined with any additional wetlands identified in NWI mapping and together be used as a proxy/screening for likely wetlands on a project site.

While there are many resources for what is considered a desktop review, for permit approval, a complete demarcation of the floodplains and regulated waters of this Commonwealth will be required. The wetlands should be identified and delineated in accordance with the Department's Wetland Delineation Policy in § 105.451 (relating to identification and delineation of wetlands - statement of policy).

The Department adopts and incorporates by reference the 1987 Corps of Engineers Wetland Delineation Manual (Technical Report Y-87-1) along with the guidance provided by the United States Army Corps of Engineers, Major General Arthur E. Williams' memorandum dated 6 March 1992, Clarification and Interpretation of the 1987 Manual and any subsequent changes as the methodology to be used for identifying and delineating wetlands in this Commonwealth. The 1987 Corps Wetland Delineation Manual, Publication No. ADA 176734 is available from the National Technical Information Service (NTIS), Springfield, VA 21161, or telephone: (703) 487-4650. Copies of the Supplemental Guidance issued by the Corps concerning use of the 1987 Manual, (that is, the October 7, 1991, Questions and Answers, and the March 6, 1992, Clarification and Interpretation Memorandum) as well as the Administration's Wetlands Plan of August 24, 1993, may be obtained by contacting the regulatory branch of a local Corps District, or the EPA Wetlands Hotline at (800) 832-7828. For more information, contact Pennsylvania Department of Environmental Protection, Bureau of Dams, Waterways and Wetlands, Post Office Box 8554, Harrisburg, Pennsylvania 17105-8554, telephone (717) 787-6827.

c) **Manmade Features**, including but not limited to, highway/rail embankments, flood protection levees, airport runways, and landfills, other utilities. When planning to drill beneath a flood protection levee or floodwall, or within 500 feet of a dam, contact PADEP's Bureau of Waterways Engineering and Wetlands at (717) 787-3411. Please request to speak with the Dam Safety Division Chief (for dams) or the Project Inspection Division Chief (for flood protection structures). Coordination with the Bureau is essential to prevent damage to structures or their underlying foundations. Please also refer to: http://www.pasda.psu.edu/

d) **Cultural, Historical, and Archaeological features**. Project proponents should consult data and resources with the Pennsylvania Historical and

Museum Commission (PHMC). Please refer to: https://www.phmc.pa.gov/Preservation/Cultural-Resources-GIS/Pages/default.aspx

e) **Land Use Aspects.** Both historic and current land uses, should be reviewed for the project area(s), by accessing current and historic aerial imagery from USGS Earth Explorer https://earthexplorer.usgs.gov, Google Earth, and other land use cover data at http://www.pasda.psu.edu/.

f) **Geopolitical Boundaries**, including, property tax map and parcel boundaries should be reviewed for the project area, data is available at http://www.pasda.psu.edu/

g) **Floodplains** for their project area(s), which can be reviewed at https://msc.fema.gov/portal/home or http://www.pasda.psu.edu/

2. Subsurface Conditions – Analyze the existing conditions below the surface in proximity to the project prior to project activity. A data resources list is provided in **Appendix B** to assist in obtaining this information. Project proponents should investigate for geologic hazards within the area of the proposed project and/or the proposed use of Trenchless Technology (e.g., HDD). If the project proponent determines any potential geologic hazards exist, they should plan for avoidance and/or mitigation of the hazard. Hazards may include, but are not limited to; karst, coal seams, coal refuse, landslides, geologic contacts/fracture zones, artesian groundwater. The following information that should be reviewed, at a minimum to accomplish this task:

a) **Geologic Conditions**, including, but not limited to, geologic mapping, formation identification, known fractures and/or faults in the area, known strike and/or dip mapping, Light Detection and Ranging (LIDAR), Digital Elevation Models (DEMs), Aerial photos, and other data that may capture and help characterize geological conditions, including hydrogeological issues (e.g., artesian conditions). Project proponents are encouraged to perform a fracture-trace analysis if the proposed drill path is through highly-deformed bedrock and is near water wells or exceptional value aquatic resources. Project proponents are encouraged to utilize the best available data, including the Pennsylvania Department of Conservation and Natural Resources (PADCNR) Geology of PA page, which can be accessed here: https://www.dcnr.pa.gov/Geology/Pages/default.aspx and United States Geologic Survey (USGS) mapping, which can be accessed here: https://ngmdb.usgs.gov/mapview

b) **Soil Interfaces and Geologic Contacts**, such as depth to soil/bedrock interface, which may be identified through use of a soil survey data, such as the NRCS Web Soil Survey. Web Soil Survey data can be accessed at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Web Soil Survey may not provide accurate depth to soil/bedrock interface depending on site

location and data available. Geotechnical test borings should be used to confirm any desktop research data concerning soil/bedrock interface depth

c) **Groundwater**. This TGD recommends the use of data from the following two resources relating to groundwater:

i. Groundwater data. A brief guide to Pennsylvania's unique groundwater is available through the Pennsylvania State University's College of Agricultural Science's, Penn State Extension. The Penn State Extension is a modern educational organization dedicated to delivering science-based information to people, businesses, and communities. The brief guide helps project proponents understand where PA ground water comes from, how it's used, and potential risks this vital resources faces. The information can be found here: https://extension.psu.edu/a-quick-guide-to-groundwater-in-pennsylvania

ii. PA DCNRs Groundwater Information System (PaGWIS). PaGWIS holds hundreds of thousands of water well records and more than 2,000 spring records, with more than 8,000 new records added each year. While useful, PaGWIS is an incomplete source to use in the identification and mapping of PA water well records. Well locations are often inaccurate, and an abundance of older wells are not mapped. Therefore, PaGWIS should not be relied upon exclusively for identifying water wells. Project proponents are encouraged to identify and locate all public and private water supplies as described in this document. PA water well and spring data may be accessed at: https://www.dcnr.pa.gov/Conservation/Water/Groundwater/PAGroundwaterInformationSystem/Pages/default.aspx

iii. USGS Groundwater Site Inventory (GWSI). Another source of data would be the GWSI. GWSI consists of roughly 80,000 wells and springs), the USGS database provides precise locations of wells (usually within 1 second or less) compared to the often-inaccurate location of PaGWIS wells. Plus, many wells in GWSI have water-quality attributes. To view available USGS publication for a given area of Pennsylvania visit United States Geologic Survey (USGS) mapping, which can be accessed here: https://waterdata.usgs.gov/nwis/gw

d) **Potential Contamination of Soil and/or Groundwater**, including storage tanks. Project proponent should prepare and review a characterization of any former or active contamination sites. It is expected that project proponents coordinate with the PADEPs Environmental Cleanup and Brownfield program (https://www.dep.pa.gov/Business/Land/SiteRemediation/Pages/default.aspx) and through the United States Environmental Protection Agency's (USEPA) Brownfield Program. The EPA's Brownfields Program provides grants and technical assistance to communities, states, tribes and others to assess, safely clean up and sustainably reuse contaminated properties. The EPA's Brownfield

Program can be accessed through the following web address: https://www.epa.gov/brownfields/brownfield-overview-and-definition.

Project proponents are encouraged to evaluate all available data resources, including but not limited to, PASDA, PADEPs Activity and Use Limitations Registry (http://www.depgis.state.pa.us/pa-aul/),and PADEP's Environmental Site Assessment Search Tool (https://www.depgis.state.pa.us/esaSearch/). The activity and use limitations registry is a user-friendly map-based website that allows users to identify within the commonwealth where any type of Activity and Use Limitation had been imposed and of which DEP has been informed. PADEP's Environmental Site Assessment Search Tool allows consultants conducting Phase I environmental site assessments and interested members of the public access to information maintained by PADEP concerning permitting, licensing, inspection, compliance, discharges of pollution, regulated storage tanks, site remediation, and enforcement. Consultation with PADEP's Environmental Site Assessment Search Tool is a means of identifying activities of potential environmental concern. It is not a substitute for an environmental assessment conducted by a qualified professional. In addition, the EPA's Superfund program, which is responsible for cleaning up some of the nation's most contaminated land, provides access to a website allowing users to search for superfund sites by State, EPA Region, City, County, Zip Code, or site name. The EPA's superfund program can be accessed through the following web address: https://www.epa.gov/superfund/search-superfund-sites-where-you-live

e) **Residual and/or Municipal Waste**. This TGD recommends coordinating with PADEP's Bureau of Waste Management manages the statewide hazardous, municipal, and residual waste programs. The office also oversees implementation of municipal waste planning and recycling, waste transportation, and the Covered Device Recycling Act. Information is available at the following web address: https://www.dep.pa.gov/Business/Land/Waste/Pages/default.aspx and GIS layers are available for download on PASDA.

f) **Geologic Hazards and Subsurface Voids** (e.g., karst), caves, subsidence features, such as sinkholes, and any closed depressions located in carbonate bedrock, fractured metamorphic, and igneous bedrock areas, faults, and geologic contacts should be identified. Pennsylvania has a great diversity of bedrock that is at or near the surface and portions of Pennsylvania have some unique geological conditions that may require special attention. To assist with the characterization and review, PA's DCNR provides an interactive web-mapping application called Pennsylvania Geologic Data Exploration (PaGEODE) which allows users access to publications and to download and extract GIS data about PA's geology. PaGEODE can be accessed through the following web address: https://www.gis.dcnr.state.pa.us/geology/index.html

The DCNR also provides information about geological hazards, such as sinkholes, which can also be mapped on PaGEODE as well. DCNRs information about sinkholes is accessible through the following webpage: https://www.dcnr.pa.gov/Geology/GeologicHazards/Sinkholes/Pages/default.aspx

Pennsylvania Geological Survey staff have also compiled 19 different groups of rock types and published them (i.e., statewide Map 63). DCNR's webpage (https://www.dcnr.pa.gov/Geology/GeologyOfPA/CountyRockMaps/Pages/default.aspx) provides maps and a description of rock-type by County within PA. Each county map has been scaled to fit on letter-size paper. The rock-type data were extracted from Map 63 and are represented by numbers and colors on top of a shaded-relief base map. Major highways and municipalities aid with location. These regional maps allow users to see broad trends and patterns. They should not be used for detailed analysis or site-specific applications.

USGS also provides information about geologic hazards, and to view available USGS publication for a given area of Pennsylvania visit United States Geologic Survey (USGS) mapping, which can be accessed here: https://ngmdb.usgs.gov/mapview

g) **Existing Utilities**, whether active or abandoned, such as gas, fiber-optic cables, electric, phone, pipelines, water, or sewer lines should be identified. The best way to accomplish this task is to contact PA's One Call. More information about PA's One Call is accessible through the following webpage: https://www.pa1call.org/PA811/Public/. In addition to Pa's One Call, project proponents are encouraged to seek out locally available information through the local municipality. Project proponents should not just rely on One Call and local municipality knowledge but should also attempt to conduct detailed field reconnaissance to observe and identify any signs of existing utilities.

i. Cross bores. An important point regarding existing utilities is cross bores. A cross bore is the intersection of an existing underground utility or underground structure by a second utility installed using trenchless technology. This results in an intersection of the utilities, compromising the integrity of either or both utility or underground structure. Cross bores can lead to immediate or delayed issues and potential environmental impacts. Cross bore awareness must be emphasized to minimize the risk for injury, loss of life and property damage from utility cross bores in an effective and efficient manner. While there is literature available on cross bores outside of this guidance, it is worth mentioning in this report due to the potential impacts to safety and the environment.

ii. Excavation Damage. The biggest risk to pipeline integrity is excavation damage. While it is understood that this TGD is to consider all uses of

trenchless technologies, the fact remains that gas and liquid pipelines crisscross the Commonwealth and the potential for damaging these lines remains the highest risk to pipelines. Each damage to a gas or hazardous liquid pipeline facility has the potential to both migrate and ignite. The safety and environmental implications from ignitions or explosions can be catastrophic. Hazardous liquid pipelines can contain a variety of liquid products with varying properties. Some of these products can cause environmental devastation. Product migration should be modeled to understand these potentials. Pipelines are installed by both HDD and conventional trenching and are crossed or paralleled by HDD and trenchless activities throughout the Commonwealth. The installation of any infrastructure via trenchless technology could potentially lead to pipeline failures.

Permit applications should attempt to note and identify all nearby utilities and confirm that excavations will either not impact adjacent assets or plan such work with the other owner(s) to appropriately conduct work.

h) **Unconsolidated Material**. According to the U.S. Geological Survey, unconsolidated material is "sediment that is loosely arranged or unstratified, or whose particles are not cemented together, found either at the surface or at depth" (https://mrdata.usgs.gov/geology/state/sgmc-lith.php?code=1)

Initially, this TGD recommends that a desktop review be completed for the project area utilizing the U.S. Department of Agriculture's Web Soil Survey (WSS). WSS provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. USDA's WSS can be accessed at the following web address:
https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

Moreover, the PA Geologic Survey has several open file reports covering surficial geology of the glaciated regions within PA. Users can go to PaGEODE's map viewer to find data on "Surficial" Geology of PA. This information can be accessed at:
http://www.gis.dcnr.state.pa.us/geology/index.html

USGS also provides information about surficial geology of glaciated or coastal plain regions of Pennsylvania, and to view available USGS publication for a given area of Pennsylvania visit United States Geologic Survey (USGS) mapping, which can be accessed here:
https://ngmdb.usgs.gov/mapview

Following the initial desktop review, project proponents are expected to

characterize field conditions through the gathering of site-specific information. Depending on the size and complexity of the project this can include borings and other subsurface field exploration as identified in Section 3.

i) **Surface and Deep Mines**. This TGD recommends coordinating with PADEP's Bureau of Mining Programs. Some of the potential mining facilities that could be affected include shafts, boreholes, slopes, portal sites, beltlines, refuse areas, preparation plants, waterlines, water wells, and powerlines. Any overlap between the use of Trenchless Technology and these facilities should result in the notification and coordination with the PADEP Bureau of Mining Programs and the operator with respect to planned activities. The Bureau of Mining Programs administers the environmental regulatory program for all coal and noncoal mining activities in Pennsylvania. The following webpage provides information about the Bureau, including contact information and available data for the State of Pennsylvania.
https://www.dep.pa.gov/Business/Land/Mining/BureauofMiningPrograms/Pages/default.aspx.

In addition to coordinating with the Bureau of Mining Programs, this TGD also recommends utilizing the Pennsylvania Mine Map Atlas at http://www.minemaps.psu.edu/. The PA Mine Map Atlas database contains information relevant to past and present underground mining within the Commonwealth of Pennsylvania, including, but not limited to, maps, indices, locations of mines, and other pertinent data contained in various collections held or obtained by the PADEP's Office of Active and Abandoned Mine Operations. The PA Mine Map Atlas allows users to search by county and municipality, street address and zip code, or by latitude and longitude.

USGS also provides information about Pennsylvania coal and non-coal mining activity. To view available USGS publication for a given area of Pennsylvania visit United States Geologic Survey (USGS) mapping, which can be accessed here: https://ngmdb.usgs.gov/mapview
Pennsylvania has a long history of wildcat mining where not all historic mines may be mapped. Local site review may be required in some areas.

j) **Oil and Gas Wells**, whether active or abandoned. This TGD recommends using PADEP's Oil and Gas Mapping website through the PASDA database. Access to PADEP's Oil and Gas Mapping website is available here: http://www.depgis.state.pa.us/PaOilAndGasMapping/. This interactive website shows the location of both conventional and unconventional oil and gas wells, including producing and non-producing wells, based on information from permit applications, authorization requests and operator submitted reports. The user can request this data set to display the information based on the permit number, combinations of operator that submitted the report, the county in which the well is located or the Municipality in which the well is located. The user also can use map functionality to locate a specific address, county, latitude and

longitude, municipality or zip code. Additionally, the user can also link to the PADEP Oil & Gas Reporting Website to review production and waste reporting as provided by the operators.

Certain parts of Pennsylvania may have oil and gas wells which were abandoned before plugging became industry practice. If operating in oil producing areas, check local resources to determine if any suspected abandoned wells which were not plugged to current standards may exist.

This TGD also recommends coordinating directly with the following two PADEP Programs, contact information is accessible on their webpages:

1. PADEP's Oil and Gas Programs (https://www.dep.pa.gov/Business/Energy/OilandGasPrograms/Pages/default.aspx)
2. Office of Oil and Gas Management (https://www.dep.pa.gov/Business/Energy/OilandGasPrograms/OilandGasMgmt/Pages/default.aspx)

The USGS also has reports on Pennsylvania oil and gas wells. To view available USGS publication for a given area of Pennsylvania visit United States Geologic Survey (USGS) mapping, which can be accessed here: https://ngmdb.usgs.gov/mapview

k) **Any Other Site-Specific Impediments**, such as old landfills, acid producing rock, old tree stumps or roots, animal burrows, and any natural or manmade impediment. It is expected that the project proponent will conduct all due diligence required to characterize their project area. One such example that is common in PA, and which this TGD would like to point out, is Acid-Producing Rock. The Bureau of Topographic and Geologic Surveys, the DCNR, and the Pennsylvania State University provide a useful map, titled, "Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals" as a starting point for characterizing and reviewing areas with acid producing rock in PA. The map can be accessed at the following webpage: http://www3.geosc.psu.edu/~jlm80/PAacidRockMap.pdf

l) **Locate Public Water Supplies**, including surface water intakes, that may be impacted in the event of an unauthorized sediment or other pollutant release, please reference Table 3-1 for additional details. The definition of water supply and Public Water System can be found in 25 Pa Code Chapter 78a.1, "Unconventional Wells" and the section of regulations dealing with the "Protection of Water Supplies" can be found in 25 Pa Code Chapter 78a.51, "protection of water supplies". 109.1, "Safe Drinking Water" and the section of regulations dealing with the Protection of waters of this Commonwealth can be found in 25 Pa Code Chapter 91 §§ 91.31 – 91.34 "Managements of Other Wastes". As part of a project proponent's due diligence, the following data and information should be reviewed and characterized:

i. eMap PA Public Water Supplier List. This TGD recommends utilizing PADEP's eMap GIS website (http://www.depgis.state.pa.us/emappa/). PADEP's eMap is a GIS based website and mapping tool that focuses on the display of environmentally relevant data to Commonwealth Agencies, contractors and the public. In addition to PADEP-permitted facilities, there are over 50 map layers relating to administrative and political boundaries, culture and demographics, geology, mining, streams and water resources, and transportation networks. The eMap mapping tool enables the user to identify sensitive data and non-sensitive data attributes located near a proposed project without showing the water source locations or coordinates. Instructions for Determining Public Water Supply Source Locations or coordinates using eMapPA in **Appendix D**.

ii. Public Information Act for Locations. The location of public water supplies may be considered sensitive and protected, therefore information not obtainable through eMAP may require direct coordination with local water supply companies or PADEPs Bureau of Safe Drinking Water. The Bureau of Safe Drinking Water is charged with managing the federally delegated drinking water program and implements both the federal and state Safe Drinking Water Act and associated regulations. The Bureau of Safe Drinking Water may be contacted at RA-epwater@pa.gov. More information is available at the following webpage: (https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/pages/default.aspx)

iii. Wellhead Protection Areas. Almost half of Pennsylvania's residents rely on ground water as a source of drinking water. Section 1428 of the Federal Safe Drinking Water Act (SDWA) requires States to submit plans to EPA that describe how they will protect ground-water sources used by public water systems from contamination.

As required under the SDWA, PADEP has developed a Wellhead Protection Program (WHPP) to protect ground-water sources used by public water systems from contamination that may have an adverse effect on public health. Participation in the program is voluntary and builds upon the basic requirements for water purveyors to obtain the best available source and to take the appropriate actions to protect the source, thereby ensuring a continual and safe water supply. For more information on the WHPP, please contact the appropriate Regional PADEP office(s). More information and a list of offices can be found on the following webpage: https://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/srceprot/source/WHPPOVER.htm

iv. Surface Water Intake Protection. The 1986 amendments to the federal SOWA required States to develop wellhead protection (WHP) programs to protect GW sources used by PWSs from contamination. Recognizing the success of WHP efforts and considering it as the cornerstone of source water protection, Congress expanded the source water protection concept to surface-water sources with the 1996 SDWA re-authorization that required States to conduct source water assessments of all sources used by PWSs as the skeletal framework for voluntarily developing local source water protection programs. Surface Water Intake Protection Areas and Surface Water Intake Protection Programs are the surface-water analogs to wellhead protection.

v. PWSs and Other Water Resources. Another important tool a project proponent can utilize in reviewing and identifying public water resources is PASDA (Keywords: Public Water Supplier's Service Areas, or PWS, and Water Resources). PASDA includes discharge, groundwater withdrawal, interconnection, storage, surface water withdrawal, water allocation. Users can access PASDA here: https://www.pasda.psu.edu/

vi. Public Information Act for WHPAs. WHPAs may be considered sensitive and protected, therefore information not obtained through PADEP WHPP may require direct coordination with local water supply companies or PADEPs Bureau of Safe Drinking Water. The Bureau of Safe Drinking Water is charged with managing the federally delegated drinking water program and implements both the federal and state Safe Drinking Water Act and associated regulations. The Bureau of Safe Drinking Water may be contacted at RA-epwater@pa.gov. More information is available at the following webpage: (https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/pages/default.aspx)

m) **Locate Private Water Supplies**. In PA, property owners are not required to register their private water supply wells and there is no single location where this information can be obtained. In addition, many older homes have wells that predate any paper or digital databases. Therefore, a plan to conduct any Trenchless Technology needs to also incorporate a plan for locating water supplies. This TGD provides guidance and recommendations below to accomplish this task.

The definition of water supply can be found in 25 Pa Code §78a.1. The section of regulations dealing with the "Protection of Water Supplies" can be found in 25 Pa Code §78a.51 and 25 Pa Code Chapter 91 §§ 91.31 – 91.34. It is incumbent upon the project proponent to evaluate all resources to determine location of all private water supplies. In doing so, they will need to document

how they will be locating and identifying private water supplies based off the following:

i. Horizontal Offset, or the distance from alignment measured from the pipeline, or utility line, centerline, giving the project proponent the area that would be expected to investigate for the existence of private water supply wells. After careful consideration of multiple factors, this TGD recommends identifying private wells within a minimum of 450 feet in non-karst terrain, and a minimum of 1000 feet in karst terrain/areas (i.e., limestone and dolomite bedrock). The TGD expects any project proponent to use their best professional judgement when choosing to exclude parcels and water supplies that are crossed by intersecting geologic structures (e.g. faults, fractures), but outside of the stipulated radius. The TGD expects any project proponent to evaluate when it should expand this horizontal offset due to local geological conditions.

ii. Well Recon Listing. Within the established distance requirements, the project proponent will prepare a Well Recon Listing to identify wells. This TGD recommends that all PWS are identified and mapped. In doing so, it is important to note that tax parcels outside of a PWS may have a private well, or wells utilized for industrial, agricultural, irrigation, geothermal or other non-potable use. In addition, there may be, and often are, private water wells within areas mapped as PWS. Project proponents are encouraged to start by referring to PaGWIS, using all available data packages, but must recognize the limitations of the data in PaGWIS (Please see the Data Resource List in **Appendix B**). It is anticipated that the available information (particularly from PaGWIS) may be extremely limited, therefore, additional investigation will be needed to accomplish this task.

This TGD recommends researching current tax parcel information and assume each parcel has a well location until documented facts prove otherwise. Additional sources of information that may be utilized to accomplish this task include, mapping from local utility companies (e.g., water and sewer) and public records maintained by the municipality or county (e.g. local sewage enforcement officers, county and municipal health departments). Note: There may be private water wells within areas mapped as public water service areas. Please refer to: https://www.health.pa.gov/About/Pages/County%20and%20Municipal%20Health%20Departments.aspx

iii. Tax Parcel Mailing List. The project proponent should compile mailing, or contact, lists for all properties at a minimum of 450 feet (1,000 feet in karst) from the pipeline, or utility line, centerline. Many parcels outside of a PWS and some inside of a PWS may have a private well, it is imperative to include all tax parcels on the mailing list and assume

each parcel in or outside of a PWS has a well until facts prove otherwise. Local conditions may require further due diligence and the use of best professional judgement and documentation should be used to support any reasoning for not needing, or needing, to extend beyond 450 feet (1,000 feet in karst).

iv. Well Construction Details. Table 2.1 below lists the information that this TGD recommends gathering. Information denoted with an asterisk "*" are considered the most critical. This information may be available from municipality records and/or, the independent well drillers (i.e. the contractor) that installed the well(s), and/ or well owner/operator interviews (see Section 3B.6)

v. Identify Any Other Sources of Water. To examine all resources, this TGD recommends that the project proponent identify water supplies within the determined (e.g., 450 to 1000 feet) corridor radius. At a minimum, this TGD recommends identifying all groundwater sources, such as seeps or springs, and all surface water sources, such as ponds and creeks.

Table 2.1 Recommended Data to Gather on Well Construction Details
1. GPS Coordinates of Wellhead *
2. Date Well Constructed *
3. Depth of Well *
4. Depth to Bedrock*
5. Depth to Bottom of Casing *
6. Method of Well Construction, including:
a. Primary/Secondary Filter Pack
b. Type of Annular Seal
c. Grout Seal Interval (top and bottom)
d. Type of Surface Seal
e. Protective Casing
7. Method of Well Installation
8. Casing Diameter
9. Casing Material
10. Water Bearing Zones
11. Static Water Level
12. Use of Well
13. Blown Yield
14. Primary Aquifer
Note: items marked with an asterisk (*) are most critical, all others are recommended.

3. Field Exploration – During the desktop review of the site-specific suitability analysis, areas requiring additional investigation for information (e.g., field verification) should have been identified. Those areas identified will determine the level of analysis and effort deemed necessary during this step in the guidance. The extent of the field exploration step will be based on the size and scope of the proposed Trenchless Technology method being used. This TGD recommends the following investigations:

    a) **Geotechnical Investigation** should be conducted, as necessary, based on the evaluation of risk (see **Appendix A**) of the Trenchless Technology used, but especially for HDD. A complete geotechnical investigation report should be prepared and sealed by a Pennsylvania-licensed professional engineer (PE). The geotechnical investigation and associated report should include a borehole investigation. The borehole should match, or exceed, the depth of the Trenchless Technology being employed (i.e., depth of profile) to correlate to the drilling profile. The number of borings should be determined by what is needed to adequately characterize the subsurface formation. This TGD recommends that test borings are generally drilled at intervals not greater than 300-feet and no more than 100 feet from the proposed drill path. In some situations, shorter intervals may be necessary to adequately define subsurface conditions. The geotechnical investigation, and subsequent borehole investigation, should be conducted by a licensed geologist, or a licensed professional engineer, with knowledge of the local geology. Any information gathered should be logged with oversight by a licensed geologist. After information is gathered all boreholes should be pressure grouted closed from the bottom up. It is advisable that a third-party inspector be used to assure proper grouting as incorrectly grouted borehole could become a pathway for inadvertent returns. Table 2.2 provides considerations of data to be collected, analyzed, and discussed for any geotechnical report prepared.

    b) **Geophysical Investigation** should also be conducted, if applicable, based on the evaluation of risk (see **Appendix A**). Geophysical methods, that are non-intrusive exploratory methods, may be employed to augment exploratory borings and assist in characterizing the subsurface conditions and, to the maximum extent possible, to a depth that matches or exceeds the depth of the Trenchless Technology being employed (i.e., depth to profile). This can be effective when large gaps between completed borings exist, environmental or land restrictions prevent the ability to gather geotechnical borings and/or when trying to identify the top of bedrock in challenging geologic conditions, including karst, especially in limestone and dolomite bedrocks, or other fractured bedrock. However, because of the need for physical samples for testing and correlation of geophysical methods, borings are not expected to be entirely replaced with geophysical methods. Where possible, any geophysical investigation should be physically correlated with a geotechnical investigation. This TGD recommends that any engineering effort should consult with a subject matter expert to determine the appropriate geophysical method, including an

explanation of why that method was chosen. This TGD recommends that a minimum of one method be required to aid in the identification of, including but not limited to, karst or potentially open voids, high moisture areas, soft zones, fractures, faults, and geologic contacts, if they are identified to be a risk, based on the geologic review.

Table 2.2 Drilling Procedures and Recommended Data
1. Drilling Procedures
a. Soil
b. Rock
2. Field Classification of Soil and Rock†
3. Laboratory Determination of Soil and Rock Properties†
4. Determine Strike and/or Dip (i.e., Core Fracture/Bedding Orientation)
5. Groundwater Level Data - recommend data collection at 0hr and 24hr
6. Downhole logging, including, but not limited to, high-resolution televiewer and 3-arm caliper.
Note: Please see Appendix G for an example of a standard boring log †This includes Strength Properties (e.g., Overburden soils and bedrock), Deformation properties, and Soil mass loosening). Please reference the following documents as guides for classification: **a)** Unified Soil Classification System see https://www.usbr.gov/tsc/techreferences/mands/geologyfieldmanual-vol1/chap03.pdf and **b)** for rock core classification, https://www.dot.ny.gov/divisions/engineering/technical-services/technical-services-repository/GEM-23b.pdf

This effort, when necessary (refer to **Appendix A**), should include one or more of the following methods listed in Table 2.3 on the next page. If one of the methods below was not chosen to identify challenging geologic conditions, including karst terrain, a licensed professional engineer/geologist may be consulted regarding applicability of geophysical investigation.

c) **Hydrogeologic Investigation**. When necessary (refer to **Appendix A**), examine both vertical and horizontal flow. Refer to Groundwater Monitoring Guidance in Land Recycling Program Technical Guidance Manual. (261-0300-101) January 19, 2019.

ci) **Licensed Professionals.** This TGD recommends that all geotechnical and geophysical investigations, when necessary, be conducted by a licensed professional as described below:

i. Geologic interpretations should be reviewed and stamped by a PA licensed Professional Geologist who is knowledgeable in local geology.

ii. Geotechnical engineering reviews should be stamped by a PA licensed Professional Engineer who is knowledgeable in the subject matter.

Table 2.3 Recommended Geophysical Methods
1. Electromagnetic Surveys
2. Electric Resistivity Tomography
3. Seismic Surveys
4. Ground penetrating Radar
5. Gravity
6. Other pertinent technology that is recognized by the scientific community. †
Note: † Supporting documentation should be available to explain why a method was chosen.

All individual drilling segments of a project need to be individually signed and sealed by the professional that made the interpretation of the data for that segment. An overarching signature for an entire large and complex project is not acceptable. For any investigative work conducted in this step of the process, all technical references should be documented. The project proponent should make every attempt to find and reference the most current industry standards.

C. Feasibility Analysis

Once a project proponent has proposed their preferred alternative and have completed a site suitability analysis, they are expected to complete a feasibility analysis. A site-specific feasibility analysis should be conducted to evaluate the level of difficulty and/or constructability of any Trenchless Technology method being utilized. The analysis should, at a minimum, identify areas of potential risk and geologic concern. This TGD also recommends that the feasibility analysis include a decision matrix explaining the reasoning behind selecting Trenchless Technology as the least environmentally impacting alternative and the most practical solution for the site-specific conditions.

To accurately determine the least environmentally impacting alternative, the site-specific feasibility analysis should not rely upon desktop resources for identifying wetlands, streams, and other aquatic resources. Rather, a field delineation of all waters of the Commonwealth, including wetlands, must be conducted as the basis for the site-specific feasibility analysis. A Preliminary Jurisdictional Determination from the Army Corps of Engineers is recommended.

This section has been formatted in the chronological order that a project proponent should follow when conducting a feasibility analysis for any Trenchless Technology employed.

This TGD recommends that project proponent(s) consider, at a minimum, the following:

1. The project proponent should conduct an overall and site-specific analysis with the

goal of ensuring the highest probability of success when using trenchless technology. A site-specific analysis should be completed for each trenchless technology profile. For all trenchless technologies with risk potential but still deemed feasible, the project proponent will need to specify all actions taken to reduce or control the release or inadvertent returns of drilling fluids and/or groundwater to the surface of the ground, aquatic resources, or to water supplies at each site during operations.

2. The project proponent should investigate and evaluate all the physical, technical and geologic constraints for all aspects of drilling activities associated with trenchless technology, including HDD. An evaluation of any potential supply or discharge of hydrostatic testing water needs to also be considered at this stage.

3. Project proponents should document and evaluate at least one alternative method to each use of trenchless technology that does not utilize fluids under pressure.

D. Environmental Considerations and Analysis

The project proponents should prepare an Environmental Analysis that addresses all features covered under 25 PA Code Chapter 105, including but not limited to:

- Type (e.g., forested wetland) and Size of Wetland
- Threatened and Endangered Species
- Wild and Stocked Trout Streams
- Exceptional Value (EV) wetlands
- EV and High Quality (HQ) streams
- Regimen and ecology of the watercourse or body of water
- Water quality
- Stream flow
- Fish and wildlife
- Aquatic habitat
- Instream and downstream uses
- Other significant environmental factors

Project proponents should utilize the Pennsylvania Natural Heritage Program (PNHP). PNHP is an international network of natural heritage programs that gather and provide information on the location and status of important ecological resources (plants, vertebrates, invertebrates, natural communities and geologic features). For environmental review purposes, users must access PNHPs Pennsylvania Natural Diversity Inventory (PNDI). For more information on the PNHP, go to http://www.naturalheritage.state.pa.us/ . In addition to PNDI, other resources include PASDA and the U.S. Fish and Wildlife Geospatial Services https://www.fws.gov/gis/data/national/ and the data resources available in **Appendix B.**

E. Conclusion

In this section, the TGD recommends that the project proponent discuss and support, through documentation and scientific reasoning, which trenchless technology was chosen and why it was considered the most practicable alternative. The project proponent is expected to provide an explanation for each use of a trenchless technology. This section should be supported by, and reasoned from, the above analyses (Site Suitability, Feasibility, and Environmental). This section should also discuss and support why trenchless technology (e.g., HDD) was selected versus open trench or another technology.

SECTION 3. DESIGN AND PERMITTING

Note to Reader: *Prior to beginning any analysis associated with this Technical Guidance Document (TGD), project proponents are encouraged to review Appendix A. Project proponents are also encouraged to read the Disclaimer section of this document. It is important to note, this is recommended guidance that does not require a new permit.*

The site suitability, feasibility and environmental analyses results, including the field investigations (e.g., geotechnical, geological, and/or geophysical), should be included in the design and permitting documents. If a trenchless technology method (e.g., HDD) is sought and determined to be suitable and feasible, supplemental field investigations should be conducted to determine the requirements of the proposed trenchless technology construction, including appropriate drill entry and exit locations.

For larger and more complex projects, workspace for a trenchless technology crossing will typically require clearing and grading, depending on the entry and exit sites selected for the drilling. Since the drill entry location accommodates the drill rig and supporting equipment, the entry side location should be designed to provide satisfactory access as well as stable ground conditions to support heavy equipment.

This TGD also recommends that the project proponent consider site access which is driven by the need for (1) supplying a water source during the installation of the trenchless method (e.g., HDD), (2) monitoring of the drill path, and (3) mitigating during containment and clean-up operations in the event of an inadvertent return. Another important aspect when designing and permitting the site access is to consider the inherent discharge (e.g., dewatering structure) associated with many trenchless technology methods that utilize drilling fluids. The TGD recommends that project proponents examine all considerations for site access regarding their chosen trenchless technology method during the design and permitting step.

The design of the drill path should also be based upon site-specific subsurface information gathered for the crossing area and/or pipeline route during the site-specific suitability and feasibility analysis. The final path design should also consider physical and access limitations at entry-exit sites, as well as geotechnical, environmental, and hydrological information.

The design of the drill path and selection of pipe should also consider the radius of the curves in the drill path, and the exit and entry angle. For adequate allowance to install the pipe, a recommended “rule of thumb” from industry is to ream the bore hole to approximately 1.5 times the outside pipe diameter (including coating and insulation of the pipe to be installed). Industry “rule of thumb” for reamed hole diameter tends to be 12” greater than the pipe diameter for pipelines 24” and larger.

Subsurface soil and bedrock conditions evaluated during the site-specific suitability and feasibility analysis along the pipeline alignment, should have identified potential problem areas which may prevent successful trenchless technology pipeline installation. These may include, for example, the possible occurrence of cobbles and boulders in till soils, presence of soils and rocks with fissures that could provide paths for fluid migration to the surface, high plastic clay soils and shale

bedrock formations with potential for swelling, jointed/fractured bedrock units, and/or karst areas. Any potential problem area identified should be avoided whenever possible during the design and permitting stage. When they are not avoided, supporting documentation and justification, should be provided as to why they were not avoided.

All preliminary trenchless technology design assumptions should be confirmed, prior to final design and submittal for permitting and construction. Based upon the proposed pipeline final design route and anticipated crossings, a final review of all necessary federal, state, and local regulations and requirements should be completed prior to submittal for permits and approvals.

A. Preferred Alternative

Upon analyzing the proposed alternative for suitability, feasibility and environmental analyses, the project proponent can determine their preferred alternative. This section should include a discussion of the preferred alternative based on the information identified during suitability, feasibility and environmental analyses and make clear any changes made from the proposed alternative and why those changes were made. Reference to data gathered during the site suitability and feasibility analyses should be made to support the reasoning behind the selected preferred alternative.

B. Design

Using the information gathered and analyzed in Section 2 of this TGD, this section will discuss the detailed design components of the selected Trenchless Technology method, if they are deemed suitable and feasible. This can be an iterative process since some design is necessary to determine feasibility. This TGD recommends that the project proponent consider the following items during the design phase.

1. Site Constraints and Topographic Considerations

   a) Project proponents should identify any aboveground disturbances or clearings that will be needed between the drilling entry and exit workspaces during construction.

   b) In addition, minimum setbacks from entry/exit points should be included (e.g., setbacks from streams, wetlands, buildings, roads).

   c) The project proponent should provide a justification of the drill path chosen, including a minimum drill path depth below streams and wetlands and design geometry considerations.

2. Inadvertent Returns (IRs)

   Project proponents are expected to be proactive when planning for a project, including how to avoid and address IRs. In accordance with the requirements of 25 Pa Code 78a.68, project proponents must notify the PADEP prior to beginning any trenchless technology activity – Ch. 78a.68a(c), they must also monitor for pressure loss and loss of circulation – Ch. 78a.68a(g) and notify the PADEP of drilling fluid discharge or loss of drilling fluid circulation – Ch. 78a.68a(i). In addition, project proponents should

prepare a PPC plan that addresses IRs and describes how they will be prevented, planned for, and dealt with when they happen. At a minimum, the PPC plan must include a risk assessment for IRs and loss of circulation.

3. Hole Flush

Another area a project proponent should be concerned with, and must consider, is hole flush considerations. Specifically, the TGD recommends that the volume of fluid that could be potentially held in the dry hole section should be estimated and the project proponent should ensure adequate containment measures are in place. This is critical on any Trenchless Technology with significant elevation differential between the entry and exit points. Hole flush considerations should ensure that all fluids can be contained within the workspace

4. Hole Stability

Another important consideration that project proponents should be aware of during the design phase is hole stability. Project proponents should consider fluid composition, fluid rate, drilling rate and downhole pressure, among other variables, in managing hole stability. While this TGD recognizes that this variable cannot easily be accounted for in calculation method design, this TGD recommends using both theoretical calculation methods combined with engineering judgement based on previous trenchless technology experience (e.g., HDD). Project proponents should evaluate hole stability in their design.

5. Failure Mode Contingency Planning

Risk cannot be eliminated and, therefore, must be managed. Project proponents should develop a contingency plan, as part of their PPC plan, in the event the drill and/or borehole is unsuccessful. Project proponents should be able to describe all the different approaches attempted to succeed with the drill and/or borehole prior to seeking open trench or reroute and redesign. This includes, but is not limited to, the following:

a) Project proponents should document all the alternative entry and/or exit points considered and attempted, all the alternative entry and/or exit angles attempted, and any alternative profile depths attempted. If local adjustments cannot be developed, then a more thorough modification may be needed. Project proponents should be able to support any modification. These alternative approaches should be considered as part of a PPC plan and all alternative approaches should be discussed in detail including permitting impacts of each alternative. Prior to any modification, coordination and notification with the PADEP should occur.

b) In addition, project proponents should consider every available Alternate Crossing Measures

c) Finally, if a drill and/or borehole is unsuccessful and it has been determined to abandon the drill hole, the project proponent should identify and follow necessary steps which should be discussed in detail in the PPC plan. One aspect of drill hole abandonment is identifying the type of grout to be used which

should be listed in the PPC plan (see **Appendix E**) and include specifications from a recognized industry standard.

6. Water Supplies.

During the design phase, project proponents should consider all water supplies, including surface and groundwater. Project proponents should provide details on notification to all users and managers of water supplies, including detailed design plans. It is recommended that notifications and requests for permission to sample and test water supplies take place before starting site work in the Limits of Disturbance (LOD) or Right-of-Way (ROW) (e.g., vegetation clearing). It is not recommended that project proponents wait to engage the public until just prior to drilling. An example notification letter and well construction questionnaire is provided in **Appendix F** to assist in notifications and obtaining well construction information and permission to access wells. The following is a list of information this TGD recommends a project proponent gather when identifying water supplies.

a) Private Groundwater Wells, including a consideration of the zone of influence. If the zone of influence isn't known, or able to be determined, this TGD recommends using the distances listed in Table 3.1.

b) Public Water Supply Wells and Intakes, including a consideration of the zone of influence. If the zone of influence isn't known, or able to be determined, this TGD recommends using the distances listed in Table 3.1.

c) Mapping Municipal Sewer and Private Sewage Disposal Systems

d) Public Water Supplies, Wellhead Protection Areas, and Surface Water Intake Protection Areas

e) Analysis of Risks to Water Supplies

f) Public and Private Water Supply Owner Consultations and Notifications. This TGD recommends using a combination of some, or all, of the following four methods to succeed at determining the location and construction details of public and private water supplies.

- Broadcast (online, via municipality, and local paper)
- Certified Mailer
- Phone Recon
- Site Recon

g) Project proponents should update their designs and sampling methods of private and public water supplies based on the well construction details collected in Table 2.1 and industry standard sampling methods (referenced in **Appendix B**).

h) Project proponents should be able to provide a water supply well sampling protocol including what constituents will be sampled, the distance sampled from the proposed centerline of the project corridor including reasoning based on geologic findings, a mode of sharing test data, including an explanation of results, number of reports/summaries planned to be shared with landowners. If

the project proponent decides to share this information with the property owner, this TGD recommends that any results shared include an explanation of what the data means (e.g., numbers/exceedances).

i) Project proponents should develop a plan for situations where water sources have existing contamination and/or high background levels. The TGD provides an example letter in **Appendix H** to assist in conveying water quality results and notification of EPA maximum contaminant level (MCL) exceedances, if observed.

Table 3.1 Pre-Construction Water Supply Identification and Sampling
1. Identify the location of the following*:
a) Private water supply within a minimum of 450-ft, and in karst, a minimum of 1000-ft, of Trenchless centerline alignment.
b) All public supply wells within a minimum of 0.5-miles
c) All surface water intakes located a minimum of 1-mile downstream
d) Any water supply deemed a potential concern due to geologic structures
2. Scope of sampling - water quality and quantity
3. Sampling Methodology
a) Purge water supply as close to the source as possible.
b) Sample when field chemistry parameters stabilize (e.g., 3 well volumes or purged for 10-15 min, as applicable[1]) *
c) Record pumped volume*
d) Record rate of pumping*
e) Record duration of pumping*
f) Perform 30-minute specific capacity testing[2]
Note: items marked with an asterisk (*) are most critical [2] Perform specific capacity testing after water quality testing is complete so as not to introduce a potential source of bacterial via capacity testing instrumentation" Sources: [1] https://www.arcc.osmre.gov/about/techDisciplines/hydrology/docs/techGuidance/2012/tsd-wggb-Well_Purging.pdf

Table 3.1 and 3.2 provide the sampling parameters recommended by this TGD. Table 3.1 provides a list of recommended actions a project proponent should accomplish and prepare as part of the sampling parameters. **Note:** Pre-construction refers to a time period prior to land altering, clearing and other types of site work in the LOD or ROW. Table 3.2 provides a list of all the recommended constituents that should be sampled. Following the sampling

period, the project proponent should notify the landowner(s) of the results.

Table 3.2 Laboratory Analysis		
Field Chemistry[1]		
1. Temperature	5. Conductivity	
2. pH	6. Oxidation Reduction Potential	
3. Total Dissolved Solids	7. Dissolved Oxygen	
4. Turbidity		
Microbiological - (Reported in Most-Probable-Number [MPN] colonies, not absence or presence)		
1. Total Coliform		
2. E. Coli		
3. Fecal Coliform		
Inorganic[2]		
1. Nitrate	5. Alkalinity	
2. Chloride	6. Hardness	
3. Bromide	7. Sulfate	
4. Total Dissolved Solids	8. Total Suspended Solids	
Trace Metals		
1. Barium	6. Calcium	10. Iron
2. Magnesium	7. Manganese	11. Potassium
3. Sodium	8. Strontium	12. Arsenic
4. Zinc	9. Aluminum	13. Lithium
5. Selenium		
Organic		
1. Methane		
2. Ethane		
3. Propane		
4. Total Petroleum Hydrocarbons		
Sources: 1. https://www.epa.gov/sites/production/files/2015-06/documents/gw_sampling_guide.pdf 2. http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=1419068&DocName=RECOMMENDED%20BASIC%20OIL%20AND%20GAS%20PRE-DRILL%20PARAMETERS.PDF%20%20%20%3Cspan%20style%3D%22color%3Ablue%3B%22%3E%3C%2Fspan%3E%203%2F15%2F2020		

The last step in the sampling protocol is to complete sampling both during and after construction. The protocol for completing sampling, during and post-construction, are similar to the Pre-construction protocol outlined in Table 3.1 and the list of constituents to be sampled which is provided in Table 3.2. Following the post-construction sampling period, the project proponent should,

again, notify the landowner(s) of the results.

Project proponents who wish to see example water sample plans may do so by searching on PADEP's Pennsylvania Pipeline Portal webpage. Example water sample plans that may be used as a template include, a *"Well and Spring Monitoring Plan"*, and a *"Water Supply Assessment, Preparedness, Prevention and Contingency Plan"*. Both documents are publicly available on PADEP's Pennsylvania Pipeline Portal webpage and are available through weblinks in **Appendix B.**

7. Waters of the Commonwealth.
Another important aspect of the design phase is for the project proponent to field delineate Waters of the Commonwealth, especially at all resource crossings. The following is a list of items this TGD recommends.

a) Streams and Wetlands which should be field delineated/confirmed during the 25 PA Code Chapter 105 permitting process.

b) Quantitative or Qualitative Risk Analysis

c) Pre and Post Function and Value Assessment for Wetlands – as required for Ch. 105 permitting.

d) Sampling parameters for streams and wetlands with significant spills. This should be done during and following trenchless construction. There should be a description of methodology and analysis.

C. Confirmation

With design phase nearly complete and additional data gathered and analyzed, this TGD recommends the project proponent explain why the preferred alternative (Section 3) is still the most practicable choice. This explanation should describe why it is the most practicable choice, but it is also possible that at this stage the data suggest that the preferred alternative is not the most practicable choice. The conclusion should support the preferred alternative or explain why a different alternative should be chosen.

D. Permitting

Once the feasibility analysis has been completed, a project proponent is ready to prepare and submit the appropriate permits. **Appendix I** contains a checklist for project proponents to complete as part of their due diligence. Many of the items on the checklist and in this TGD are equally examined during the preparation of a permit application submittal. The checklist should be submitted with the permit application, while all other items should be available upon request. Below are some examples of the items a project proponent should include with their permit application submittal.

a) Site-Specific Crossing Plans – as included in permit(s) submittal

b) Safety Data Sheets (SDS) – (formerly known as MSDS) includes information

such as the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. SDS sheets should be included for each chemical used.

c) Reporting Forms– this includes all necessary forms (e.g., incident response forms)

d) Checklists– Please see **Appendix I** for checklist(s)

e) Prevention Preparedness Contingency (PPC) Plans – See Section 4 for more information and **Appendix E**.

SECTION 4. CONSTRUCTION AND COMPLIANCE

Note to Reader: *Prior to beginning any analysis associated with this Technical Guidance Document (TGD), project proponents are encouraged to review Appendix A. Project proponents are also encouraged to read the Disclaimer section of this document. It is important to note, this is recommended guidance that does not require a new permit.*

Section 4 includes information and guidance recommended by this TGD for construction and compliance of any Trenchless Technology utilized.

A. Preparedness, Prevention, and Contingency (PPC) Plan

A Preparedness, Prevention, and Contingency (PPC) Plan can have various elements. The overarching PPC Plan generally addresses spill prevention, countermeasures, and response in general. Additional guidance can be found at https://www.dep.pa.gov/Business/Water/Waterways/Documents/400-2200-001.pdf.

Once HDD and other trenchless technology is proposed with a project, additional assessment, prevention, preparedness and contingency measures may be necessary which may include potential impacts related to:

- Inadvertent Returns (IR Plan)
- Public and private water supplies (Water Supply Plan)
- Underground Mining and Karst Terrain (Void Mitigation Plan)

Each of these categories can have a separate plan (as noted above) or can be addressed in one comprehensive plan at the discretion of the project proponent.

Pursuant to the Chapter 102 regulations (§102.5(l)) and Chapter 78a regulations (§78a.68a - for *Horizontal directional drilling for oil and gas pipelines*), a PPC Plan is required prior to beginning any Trenchless Technology activity. An example template PPC plan is provided in **Appendix E**. The PPC Plan "*must include a site-specific contingency plan that describes the measures to be taken to control, contain and collect any discharge of drilling fluids and minimize impacts to waters of the Commonwealth*" (§78a.68a(b)).

To help address this regulatory requirement, the PPC Plan should address Inadvertent Returns (IRs) surfacing in any of the following locations:

- Within approved workspaces/Limits of Disturbance (LOD)
- Outside of designated construction work areas (beyond the LOD)
- Within areas with challenges for vehicular access
- Within environmentally sensitive areas such as wetlands and watercourses

Equipment, materials, and personnel required to contain an IR should be listed in the IR Plan of the PPC Plan and be available at each entry point and exit point for all Trenchless

Technology utilized. The equipment and materials should be appropriate for the scale of the project and include, but not be limited to, pumps, hay bales, hoses, and constructed containment facilities. If any equipment or materials fail, standby resources should be available in the event they are needed. All the equipment and materials should be maintained on-site or be immediately available to the site. A list of professional contractors that may be able to assist in responding and cleaning up an IR (e.g., vacuum trucks), should be available in the IR Plan.

If an IR isn't contained, the IR Plan should include a restoration plan to bring impacted areas to pre-existing conditions. It should also include a protocol for restoration of wetlands and waterbodies. The restoration of wetlands and waterbodies will vary according to the extent of disturbance and requirements by the appropriate agencies, therefore, appropriate agency contact information should be included. Finally, the IR Plan should provide procedures required to secure landowner permission and any necessary environmental and resource clearances.

The PPC plan should also include an emergency response contingency plan that describes measures to be taken in the event of the following operational drilling problems: equipment malfunction, pilot hole deviations, high annular pressures or deviations or loss of returns, high torque while reaming, pipe stuck during pull back, and abandonment. Alternative crossing measures should also be part of the contingency planning.

Lastly, the PPC plan should include protocols for compliance documentation. It should be maintained for all visual and pedestrian monitoring, Trenchless Technology (e.g., HDD) instrument logs, drilling fluid composition including any laboratory testing of drilling fluid/source water. In addition, all intended reuse of drilling fluids should be clearly documented. The PPC plan should also address a protocol for responding to a subsidence, including points of contact and immediate steps considering public health and safety and the environment. The PPC plan should also include a notification list of appropriate contacts and authorizations. Please refer to **Appendix E** for a PPC plan template.

B. Personnel, Responsibilities, and Trainings

A site-specific environmental and operational training plan should be prepared, approved by the owner, and reviewed with all construction personnel prior to the start of any drilling operations. This environmental and operational training program should address all applicable environmental impact avoidance and minimization measures, including the information contained in the PPC plan and all permit conditions.

Resumes of key personnel containing their experience, planned duties, roles and responsibilities should be included for each key employee along with training documentation in their site-specific safety training plan. Trenchless Technology should include an appropriate inspection and monitoring program and documentation should be made available upon request. During construction there should be regular management oversight from both the project proponent and lead contractor. For proper compliance by all personnel (e.g., drillers and engineers), certain co-lead contractors, sub-contractors, and other contractors may need to be added as co-permittees once the Ch. 102 permits are issued. The project proponent is responsible for verifying the need of adding any co-permittees with all appropriate agencies.

The defined roles and responsibilities for key personnel, including onsite crews and support staff should be available in the PPC plan, maintained and available on-site, and maintained and/or updated as needed. This list should include the contact information (e.g., cell phone numbers) for all individuals, including a back-up contact, when possible to obtain, in the event the primary contact is not available. The following personnel are examples of those individuals that may need to be included:

- Professional Geologist(s)
- Professional Engineers
- Drilling Managers
- Drilling fluid Managers
- Environmental Inspectors
- Incident Response entities
- Others, as needed

Project proponent must identify all elements of training required for the specific project. The type and amount of training will depend on the size and scope of the project. All training, including verification (i.e., signatures) of individuals who have been trained, should be maintained and available. Examples of training that may be required includes, but is not limited to:

- The locations of resources being crossed (e.g., wetland or stream delineation)
- The local site layout, including ingress and egress
- When to call 811 and identify potential interferences
- Local sensitivities
- Potential water resources, wellhead protection issues, and surface water intake protection issues
- Permits and other obligations (including special conditions)
- Construction techniques proposed
- Potential challenges and risks that the onsite crew must manage
- Plans and procedures that the onsite crew will use for the project, (e.g., the PPC Plan)
- Contacts and resources, both onsite and those on standby
- Specific notifications as required and/or described in the PPC plan. Notification should emphasize that every attempt be made to reach a live person on the phone, where possible. DEP regional offices have a 24-hour emergency number to report incidents during off hours.
- When to call Pennsylvania Emergency Management Agency (PEMA)

- When conditions warrant a public health and safety issue and protocols to follow
- Who to contact in the case of a subsidence and protocols to follow

All training must be scheduled so that all appropriate personnel receive training. In some cases, the training may vary based on responsibilities. In those cases, the project proponent should document the training that occurred and the individuals who successfully completed the training (e.g., helmet stickers and signed documentation). When new staff are brought on, the project proponent should ensure they receive appropriate training before the new staff may begin work on the project or access the project site (e.g., walk on the ROW).

All onsite construction staff, including all contractors and sub-contractors, especially those responsible for being aware of the permits and design for implementation should receive all appropriate training prior to beginning work on the project or accessing the project site (e.g., walk on the ROW). Other staff that may access the site less frequently, but may still need to attend trainings includes:

- Offsite staff (e.g., professional and/or administrative) who may be called in for technical assistance or for other factors.
- Offsite staff who may be involved in decision making for onsite work.

To reduce risk and to reduce potential compliance problems, project proponents should adopt a policy where no individuals can begin work or access the project site unless they have documentation showing all trainings have been completed. In the scenario where an individual will only access the project site once, or infrequently, the project proponent must identify these individuals as untrained and provide a responsible escort who has completed all trainings.

It is incumbent on the project proponent and lead contractor to verify that the training objectives have been met and have available documentation showing that the training objectives have been met. Training records should be available for inspection immediately upon request.

C. Preconstruction Activities

The following are recommendations by this TGD that a project proponent should consider prior to beginning any construction activities, including but not limited to clearing vegetation prior to any site mobilization.

Project proponents should identify all appropriate agencies and acquire all necessary licenses, permits or other authorizations. Project proponents are responsible for obtaining all permitting and licensing from all appropriate agencies and entities. Project proponents should ensure that all contractors and subcontractors possess appropriate licenses and that they receive copies of required permits. Project proponents should maintain updated copies of all licenses of all individuals conducting work under those licenses. All permits and licenses should be readily available upon request.

Prior to construction, the project proponent is expected to identify, as part of its due diligence all potential impacts as defined in the site suitability and feasibility assessments. The project proponent should develop all required plans and incorporate those plans into the scope of the project.

Prior to the start of construction, project proponents should integrate site-specific conditions and identified issues in permits, or from licenses, into all site plans. They are expected to do their due diligence and incorporate the following items, including but not limited to:

- Geology or geophysics
- Local land use
- Water supply or disposal issues
- Critical resources
- Soil conditions or constraints

Another important aspect recommended by this TGD is that a project proponent analyze and consider implementation planning. This TGD recommends that all project proponents and lead contractors work together to implement the approved permit and design plans, including any potential permit amendments, into an achievable project. This includes identifying differences, issues and other considerations which may require adjustments to plans. This also includes identifying any resources that should be on-site for planning and response purposes and identifying resources that should be on standby if needed for technical, planning and response purposes. They should document which resources are available and how such resources may be activated in the case that they are needed. The project proponent should discuss with the contractor(s) the constructability and necessary modifications of the design for the project locations identified in the permits. They should also verify due diligence performed in the previous sections of this document (e.g., site suitability and feasibility) and adjust as necessary. All these steps should be taken prior to scheduling a preconstruction meeting with regulatory agencies.

There are several types or levels of meetings that should occur prior to construction. This TGD recommends that training on all permit conditions and expectations of permitting and regulatory agencies are communicated to all staff. This TGD recommends, to the maximum extent practicable, that the project managers, site superintendents, Environmental Inspectors (EIs), Professional Geologists (PG), Trenchless Technology (e.g., HDD) experts and inspectors, all professional engineers, drillers and driller support staff meet to discuss and go over all permit conditions and expectations of permitting and regulatory agencies and to clarify any misunderstandings several days before construction begins. In addition, this TGD recommends that "stop work" authority is defined at this meeting to help establish clear roles and responsibilities. Documentation of this meeting, including signatures of all participants and attendees, should be kept and made and available upon request.

On the day drilling begins, a "tailgate" meeting should be conducted by the project proponent and appropriate members of their drilling team. This meeting should include sufficient representation from parties responsible for design and construction. Depending on the size and scope of the drilling activity, this may include, at the discretion of the project proponent,

the Project Manager, EI, PG, Trenchless Technology (e.g., HDD) inspector, PE, driller operators, or other driller and contractor support staff associated with the drilling activities. These tailgate meetings should occur prior to the start of drilling for every drill rig and its associated operations. The tailgate meetings are in addition to the preconstruction meetings and give all key personnel a chance to meet and discuss site-specific issues and concerns. These tailgate meetings should enforce applicable policies and information covered during the preconstruction trainings and include, at the discretion of the project proponent, the following:

- Review PPC Plan, chain of command and identify team members.
- If a high-risk Trenchless Technology (e.g., HDD) is proposed, geologist(s) who performed the geologic evaluations should review findings with driller, project manager and EI.
- Discuss and identify contractor(s) as co-permittees and, as such responsible parties to the conditions of the permit.
- A plan for access to all areas of the project site for inspection by regulators.
- The roles and responsibilities for every personnel on site
- Any additional documentation needed.
- The role of the EIs, the Conservation District, and/or PADEP.
- Review of Ch. 102 E&S Plan and ESCGP (if applicable), including physical location of plans and permits on-site as well as individual responsible for proper implementation of the E&S Plan and ESCGP
- Review of Ch 105 Permit(s), if applicable, including physical location of permits on site.
- Any site-specific HDD drawings
- Any additional site-specific permits

This TGD also recommends that project proponents exercise courtesy and complete project-specific outreach 14 days before the start of HDD activities. This can be combined with the project proponent's normal public relations activities and may also include outreach related to clearing and site preparation. Earlier outreach should be considered for the larger and more complex projects. (see Section 1(B) Definitions for “large and complex” projects). These voluntary outreach efforts would be most ideal if they included municipal agencies, landowners, conservation districts and applicable regulating agencies.

D. Drilling Fluid Management

A drilling fluids management plan should be prepared for each crossing utilizing Trenchless Technology (e.g., HDD) which includes the source of drilling water, anticipated water use, volume, and any required sampling and laboratory analysis of the water source. Any drilling fluid additives besides bentonite and water should be pre-approved, non-hazardous, and non-petrochemical based.

The primary purpose of the drilling fluids management plan is to establish inspection and monitoring procedures to address potential impacts associated with Inadvertent Returns (IRs) of the drilling fluid and any hydraulic spills from the drilling or pumping equipment.

Drilling Fluid and Additives used in many Trenchless Technologies (e.g., HDD) should not be used in a manner that causes pollution or a threat of pollution to waters of the Commonwealth. All Trenchless Technology activities (e.g., HDD) related to Oil and Gas operations must be done in accordance with, or should be consistent with, PA Title 25, 78a.68a *Horizontal directional drilling for oil and gas pipelines.* Drilling additives, specifically for HDD, are addressed in Section 78a.68a(f) which states:

> *"Drilling fluid additives other than bentonite and water shall be approved by the Department prior to use. All approved horizontal directional drilling fluid additives will be listed on the Department's web site. Use of a preapproved horizontal directional drilling fluid additive does not require separate Department approval."*

HDD Additives which are certified for conformance with ANSI/NSF Standard 60 (Drinking Water Treatment Chemicals – Health Effects) with a product function of drilling fluid are deemed acceptable to PADEP when used in the manner indicated in the certification of the additive. All conditions included as part of the additive's certification should be followed.

Most approved products with the NSF/ANSI Standard 60 have product functions other than "drilling fluid" such as, for example, "well sealant", "well drilling aid", "well cleaning aid", and "pipe cleaning aid". There are also products with multiple product functions. It is acceptable for a product to have more than one product function, however, if the product function of "drilling fluid" is not listed, the product is not allowable for use with HDD operations unless reviewed and approved by the PADEP and added to its website.

A list of certified drilling fluids with NSF/ANSI Standard 60 (Drinking Water Treatment Chemicals – Health Effects) with a product function of drilling fluid is maintained by NSF on its website:
http://info.nsf.org/Certified/PwsChemicals/Listings.asp?ProductFunction=Drilling+Fluid&.

Use of drilling additives certified for conformance with ANSI/NSF Standard 60 with a product function of drilling fluid does not relieve operators from the requirement to obtain the necessary permits to conduct HDD operations. Use of certified additives does not relieve the operator of liability should an inadvertent return or other pollution of the waters of the Commonwealth occur as a result of drilling operations.

Any products not currently listed on the NSF/ANSI Standard 60 with a product function of "drilling fluid" may be submitted to PADEP for review. To request a review of an unlisted product, please submit a Safety Data Sheet (SDS) for the product to RA-epOilandGas@pa.gov. For PADEP to conduct a proper review, the SDS should list the product's common name and Chemical Abstracts Service Registry Number.

Part of the management of drilling fluids includes understanding the drilling fluid physical properties and uses. The principal functions of drilling fluid in any method utilizing Trenchless Technology (e.g., HDD) during pipeline installation are listed below. Project proponents should have staff, or contractors, who are familiar with the items listed below and are prepared to provide documentation that these items have been considered as part of their due diligence in managing drilling fluids and their understanding the drilling fluid physical properties.

1. Transportation of Spoil – Drilled spoil, consisting of excavated soil or rock cuttings, is suspended in the fluid and carried to the surface via a fluid stream flowing through the drill annulus between the bore hole and the drill rig.
2. Cleaning and Cooling of Cutters – Build-up of drilled spoils on bit or reamer cutters is removed by high velocity fluid streams directed at the cutters. Cutters are also cooled by the fluid.
3. Reduction of Friction – Friction between the pipe and the bore wall is reduced by the lubricating properties of the drilling fluid.
4. Bore Stabilization – Stabilization of the drilled hole is accomplished by the drilling fluid building up a "wall cake" which seals pores and holds soil particles in place. This is a critical element in HDD pipeline installation.
5. Transmission of Hydraulic Power – Power required to turn a bit and mechanically drill a hole is transmitted to a downhole motor by the drilling fluid.
6. Hydraulic Excavation – Soil is excavated by erosion from high velocity fluid streams directed from jet nozzles on bits or reaming tools.
7. Soil Modification – Mixing of the drilling fluid with the soil along the drilled path facilitates installation of a pipeline by reducing the shear strength of the soil to a near fluid condition. The resulting soil mixture can then be displaced as a pipeline is pulled into this formation.

The major component of drilling fluid used in Trenchless Technology (e.g., HDD) during pipeline installation is freshwater. To increase the hydraulic properties of the water, it is generally necessary to modify it by adding a viscosifier. The viscosifier used almost exclusively in HDD drilling fluids is naturally occurring bentonite clay, which is principally sodium montmorillonite. It is not a listed hazardous material/substance as defined by the U.S. Environmental Protection Agency's (USEPA) Emergency Planning and Community Right-to-Know Act (EPCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulatory criteria. If the product becomes a waste following drilling operations, it should not meet the criteria of a hazardous waste, as defined by the USEPA.

In addition to understanding and considering the aspects and uses of drilling fluid physical properties and in managing drilling fluids, project proponents must consider the disposal of all drilling fluids. Drill cuttings could become contaminated with regulated materials which could, in some instances, cause drilling fluids or cuttings to be classified as a hazardous or special waste. If drilling fluids or cuttings are contaminated, follow appropriate disposal

requirements. Project proponents should be prepared to provide documentation showing that location(s) have been identified for the disposal of all drilling fluids and associated parts (e.g., cuttings). As part of their due diligence in managing drilling fluids, project proponents should identify a primary disposal location and a back-up disposal location, and a documented protocol should be developed and readily available upon request.

When using drilling fluid additives other than bentonite and water, drillers must characterize the drilling fluid (drill cuttings and drill fluids) prior to disposal/reuse onsite or offsite by determining constituents of material to be disposed. Once determined, the driller may apply on-site if the drilling liquid and cuttings meets the Department's co-product determination requirements 25 PA Code §287.8:
https://www.pacode.com/secure/data/025/chapter287/s287.8.html.
The definition of co-product can be found in 25 PA Code § 287.1:
https://www.pacode.com/secure/data/025/chapter287/s287.1.html.

If analytical determination by an independent, Department-accredited laboratory does not justify a co-product determination as described above, the drill cuttings and fluid must be disposed of in a landfill as required by Department Waste Management Program Rules and Regulations.

E. Inadvertent Return Minimization Methodologies

To ensure that all Trenchless Technology (e.g., HDD) operations are conducted in accordance with permit conditions, established requirements, and standard industry practice, EIs should monitor all pipeline construction activities, with increased attention provided to all Trenchless Technology (e.g., HDD) installations.

Part of the preconstruction trainings and tailgate meetings, all contractors and individuals associated with the project should understand that all personnel, including the EIs and PGs, have "stop-work" authority. Stop-work authority is the authority to stop site-specific activities that violate the environmental permits or conditions.

The most effective way to minimize environmental impact associated with Trenchless Technology (e.g., HDD) installations and specifically with drilling fluids is to maintain drilling fluid recirculation. This TGD recommends that project proponents take preventative measures to minimize the likelihood and adverse environmental impact of IRs by controlling and monitoring drilling fluid. Protocols should be discussed, and prepared, and responsible persons should be assigned to monitoring fluids during drilling operations. Monitoring of drilling mud volumes, pressures, and pump rates/returns will assist in determining if significant drill mud loss occurs signaling potential hydraulic fracture or formational fluid loss which could indicate, or lead to, a possible inadvertent return. The following steps should be considered with respect to drilling fluid control, if other potential solutions are warranted based on site-specific conditions, project proponents should be able to provide documented justification:

1. Instrumentation – monitor the annular pressure of returns during the pilot hole phase of any Trenchless Technology (e.g., HDD), utilizing drilling fluids, by using an annular pressure monitor, or provide justification for an alternative monitoring methods and/or

best drilling practices to ensure that the drilled and reamed holes do not become plugged with drill cuttings leading to hydraulic fracture and IR. At all times provide and maintain instrumentation which accurately locates the pilot hole, measures drill string axial and torsional loads, and measures drilling fluid discharge rate. A log of all recorded readings should be maintained.

2. Fluid circulation – Recirculation of drilling fluid to the bore pit enough to clear the annular space is important in maintaining operations. solids control and fluid cleaning equipment of a configuration and capacity that can process drilling fluids to the bore pit that produce drilling fluids suitable for reuse. Fluid circulation can fall under one of three categories: (1) Full/Normal Circulations, (2) Partial Loss of Circulation, and (3) Total/Full Loss of Circulation.

3. Loss of Circulation – Employ best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than the entry and exit points should be minimized. If annular circulation is lost or significantly diminished, one or more of the following steps should be considered to restore circulation:

   a) Size the hole frequently by advancing and retracting the drill string in order to keep the annulus clean and unobstructed.

   b) Minimize annular pressures by minimizing fluid density consistent with hole cleaning and stabilization requirements.

   c) Adjust viscosity as necessary to reduce annular pressures consistent with hole cleaning and stabilization requirements.

   d) Adjust gel strength as necessary to reduce annular pressures.

   e) Prevent "plunger effect" from occurring by:

      - Controlling the balling of material on bits, reaming tools, and pipe
      - Controlling penetration rates and travel speeds

   f) Seal a zone of lost circulation using a high viscosity bentonite plug, loss control materials, or grouting. Suspend drilling activities as long as necessary to allow plugs, loss control materials, or grout to cure.

   g) Following suspension of drilling fluid flow, re-establish circulation slowly before advancing.

   h) A loss of circulation must be reported to the Department in accordance with 25 Pa Code §78a.68a (i), as appropriate, and 25 Pa Code §91.33.

F. Hydrologic (Groundwater) Considerations

During drilling operations, the TT contractor should monitor the annulus pressure of returns during the TT pilot hole phase of TT using an annular pressure monitor. If the pressure spikes significantly and unexpectedly and all other drilling parameters are otherwise unchanged, or if the pressure drops, an inspection of the TT alignment and adjacent areas for returns should be conducted. The surfacing of groundwater over the TT profile as a result of TT activities, other

than returning water to the entry or exit pit, could be indicative of an ongoing or impending IR. When groundwater surfacing is identified, it should be photographed and characterized (i.e., location, size, limits, flow rate, clarity, etc.). The inspection and early detection of any surfacing of groundwater over the trenchless construction profile will allow the trenchless construction contractor to stop or adjust the trenchless construction profile to reduce the potential for secondary impacts or an IR. If it is determined that the surfacing of groundwater over the trenchless construction profile, other than returning water to the entry or exit pit, is related to its construction activities, the groundwater discharge may be treated as an IR.

During the pilot hole or reaming phase of an TT, a sudden increase in drilling fluid returns, the appearance of clear water mixed with drilling fluids, or clear water only returning to the TT entry point or exit point indicates that the TT has progressed into or intercepted a zone of groundwater with a hydrostatic pressure greater than the annular pressure of the TT phase in progress. If this occurs, the PG should document the current phase of the TT, the location and elevation of the tool, and consult with experts regarding the known presence, or unknown potential for the TT to have intercepted a mine pool, just entered a void, encountered a water bearing zone at higher elevation, or encountered a water bearing zone under artesian pressure. The Team should collect samples of the water to test for acid mine pool constituents.

If the volume of produced water is minimal or does not exceed the volumes being used for the trenchless construction phase in progress, then this water should be pumped with the returning fluids and cuttings and recycled into the trenchless construction process. If the volume of produced water exceeds the water demand for continued drilling, the contractor should capture and haul away all produced water for treatment until the test results show that the water can be safely discharged at a suitable location at the trenchless construction location. The Team should obtain any required authorizations for on-site discharge of excess produced waters. If the volume of produced water exceeds the water demand for continued drilling, when weather permits, the necessary portion of the bore hole should be grouted and allowed an appropriate period for curing before proceeding with further trenchless construction activities.

If the produced groundwater returns persist after pipe pullback, the contractor should develop and implement a plan to establish a seal to stop groundwater flows and/or mine pool discharge as to avoid impacts to environment and public and private water supplies.

G. Inspection, Monitoring, Compliance and Emergency Response

This TGD considers one of the most important aspects of the construction phase to be inspection, compliance, monitoring and emergency response planning. The following are recommendations this TGD makes to ensure the expectations for appropriate inspection, compliance, monitoring and emergency response planning are met.

1. Inspection Protocols: As a first step, prior to the start of, and during, construction project proponents, in conjunction with EIs and other pertinent staff, should identify what inspections are necessary or required to ensure compliance. Project proponents should develop inspection, compliance, monitoring, and emergency response protocols.

   All parties should review the PPC plan to make sure that all conditions and expectations of

the PPC plan are met in a meaningful way. All conditions of the various permits are appropriately addressed. As needed, the project proponent should follow up with the PADEP, and any other relevant agency, imposing conditions on the project to clarify compliance requirements. The expectation of this TGD is that the project proponent examine all avenues in planning for inspections.

The next step should be to assign roles and provide or create some form of verification or checklists and systems of the inspections. This includes frequent (daily or weekly) project alignment walks to monitor for any ongoing or potential impacts to the environment, regular equipment (e.g., drill rigs) and mud system inspections. Drill rig operators and other pertinent staff should inspect their equipment daily. There should be daily tailgate meetings to discuss any potential issues and introduce new staff (e.g., new EIs). Project proponents should ensure that all permits and the associated conditions are on site and updated. This TGD recommends that any adjustments made are verified, included in future staff training, and used to adjust procedures to minimize future issues.

Inspection protocols should include the development of inspection reports and checklists that include critical compliance parameters. The inspection protocol should include instructions on how to complete the inspection reports and checklists to maintain standardization. The protocol should identify the frequency of all inspections, either daily, weekly, or another defined expectation. Once complete, there should be a clearly defined location for storage of inspection reports and checklists and/or a person identified by the project proponent that will collect them. After collection or submittal, the project proponent should identify an individual that will be responsible for oversight and review of all inspection reports and checklists, including addressing issues raised. Decisions on issues raised in the inspection reports and checklists need to be addressed by the project proponent with onsite contractors and staff as well as management and the EI(s). Once the project is up and running, a protocol should be established to adjust the inspection reports and checklists to meet the project realities.

2. Monitoring protocols: This TGD recommends that project proponents take preventative measures to minimize the likelihood and adverse environmental impact of IRs. The persistent monitoring of the Trenchless Technology alignment for the occurrence of IRs is an integral component in allowing the quick and effective response which would minimize adverse environmental impacts. The intensity of this monitoring should vary depending upon the following drilling fluid operational conditions:

   - Full circulation
   - Loss of circulation
   - Inadvertent returns, including prior inadvertent returns

   Ch. 78a.68a(g) requires monitoring for pressure and loss of drilling fluid returns. Bodies of water and watercourses over and adjacent to horizontal directional drilling activities should also be monitored for any signs of drilling fluid discharges. Monitoring should be in accordance with the PPC plan. For those projects not regulated under 78a, this requirement represents current best practices for other projects.

3. Compliance: Daily tailgate meetings should take place that include the drill operators, contractors, and EIs, where updates and adjustments are discussed. These tailgate meetings may coincide with the typical safety meetings commonly held by contractors at the start of their day.

   The developed protocol should include a clearly defined plan to update training measures that incorporates lessons learned from past situations and inspections. The training would be not only for new staff, but also veteran staff to be sure they are kept apprised.

4. Emergency Response Planning: A loss of circulation must be reported to the Department in accordance with 25 Pa Code §78a.68a (i) and 25 Pa Code §91.33. A very important part of the inspection and monitoring protocol includes a well-defined notification system. The developed notification system should identify which incidents are reportable, which need to be reported immediately, clearly state which staff are responsible for reporting, and which entities need to be notified.

   Regular quality controls should be in place to ensure that the correct contact information is available for all pertinent contacts. In the notification protocol, at a minimum, the following should be clearly identified and widely dispersed:

   a) Identify each agency, municipality(s), including names and contact information – and whether immediate reporting is required.

   b) Identify agencies where the project team must reach a live person (e.g., PADEP).

   c) Identify agencies where the project team must leave a message for further response (e.g., Pennsylvania Fish and Boat Commission, or PFBC).

   d) Identify conditions that warrant calling county Emergency Management Agencies or 911, and which conditions do not warrant such immediate calls.

   The inspection and monitoring protocol should also address water testing issues. Including what type of water tests are needed, water resources that must be tested, the action levels for water tests, and a response plan for adverse water tests. The developed protocol should include a list of options to avoid and/or minimize adverse water impacts, including a discussion and options for mitigation for unavoidable impacts.

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APPENDICES

A. Trenchless Technology Risk Evaluation
B. Data Resource List
C. Bore & HDD Flowchart
D. Instructions for Determining Public Water Supply Source Locations using eMapPA
E. Example Template for a PPC Plan
F. Example Notification Letter and Well Construction Questionnaire
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APPENDIX A
TRENCHLESS TECHNOLOGY RISK EVALUATION

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Trenchless Technology Risk Evaluation

This appendix is designed to provide guidance regarding risk considerations when it comes to Trenchless Technology (TT) including potential impacts to the environment regulated under Clean Streams Law, 35 P.S. §§ 691.1 – 691.1001, Dam Safety and Encroachments Act, 32 P.S. §§ 693.1 – 693.27, and the regulations promulgated thereunder for the protection of State water quality; Section 401 of the Clean Water Act, 33 U.S.C. § 1341; Section 3(d) of the Natural Gas Act, 15 U.S.C. § 717b(d) the various regulations promulgated thereunder. Project proponents are encouraged to read the Disclaimer section of this document. It is important to note, this is recommended guidance that does not require a new permit.

It is important to note that not all projects pose the same level of risk. This TGD may not be necessary for small projects that pose little to no risk to resources nor have any potential impacts to the environment. With that said, this appendix and associated checklist is to be used as an aid in determining whether your project is considered an above average risk project. This appendix presents a tool to help project proponents determine the extent that the example Prevention, Preparedness, Contingency (PPC) Plan for the application of trenchless technologies found in Appendix E, along with the Project Proponent's Erosion & Sedimentation Control Plan, would generally be used to abate the risks to safety, health, property or the environment associated with the proposed project. This appendix is also intended to inform project proponents as to when the Department may require more information regarding their evaluation of risk and/or to develop a more robust project-specific PPC plan for the use of trenchless technologies. The Department encourages project proponents to review this technical guidance in full, regardless of their self-assessment of risk, as it may help to identify ways to further minimize potential risks and inform the project proponent when future projects may need a more robust assessment.

NOTE: It is incumbent upon the project proponent to review this TGD, evaluate and address all risks to resources or any potential impacts to the environment associated with a project, and develop a PPC plan that is commensurate with the size and scope of the project that will abate risk. It is the sole responsibility of the project proponent to evaluate risk and diligently work to prevent and respond to IRs and releases.

What is Risk?

Risk is defined as the chance or probability of an event that exposes something or someone to a specific level of danger and peril. For every event, there is a cost. These costs can be monetary, affect schedule, affect finished product, or the environment (Doherty, 2019).

Risks associated with Trenchless Technology can involve various factors, including ground settlement, ground heaving, subsidence, opening of voids and sinkholes, movement of sensitive buildings, inadvertent returns, impacts to water supplies, changed ground conditions, broken down-hole tooling, damage to third party property, and damage to other utilities and structures.

Minimum Requirements for evaluating risks of Trenchless Technology Crossings

The minimum requirements for evaluating risk of Trenchless Technology methods should include a PA State licensed Professional Engineer (PE) with a geotechnical engineering specialty and experience in the Pennsylvania geology **and/or** a PA State licensed Professional Geologist (PG) with experience in Pennsylvania geology. A statement of qualifications signed and sealed, with

supporting documentation should be part of the assessment report, including a statement specifying that the investigator meets the definition as defined above (i.e., either a PE or PG).

Key items to consider when doing Trenchless Technology and evaluating Risk

1. Geology and Geohazards.
2. All subsurface conditions in both soil and bedrock.
3. Pipe Characteristics (e.g., material, diameter)
4. Work Zone Requirements
5. Topography and Terrain
6. Groundwater – depth to groundwater, location of private water supplies, location of public water supply wells, wellhead protection areas, location of industrial water wells.
7. Brownfields
8. Crossing Length
9. How the method disturbs the ground and the degree of difficulty to achieve stabilization.
10. Subsidence or heaving potential
11. Setbacks (property lines and environmental/sensitive resources, including streams, wetlands, wells, and T&E species habitat)
12. Curve radius
13. Are drilling fluids being used? (including air)
    a. Are these fluids under pressure?
14. Drilling Equipment (see Table 1 below)

Trenchless Technology Methods

The below list of trenchless technologies and specifications of drilling equipment (see Table 1). The list is for illustrative purposes only and is not intended to be an exclusive list, if considering a trenchless technology not listed below, this TGD should still be followed.

Trenchless Technology methods can be either launched from a pit or from the surface. In some cases, the method chosen requires the operator to switch between pit launched and surface launched methods.

Pit launched methods require an at-grade excavation to set machine and an at-grade receiving pit. The machine advances the bore/casing straight into the pit wall. The pit is slightly longer than the longest piece of casing to be installed. The casing is added one piece at a time after preceding piece is pushed to depth. These methods can be guided or unguided. The guided methods are good for installations with precise grade requirements (DTD, 2019; Bennet et al. 2004).

Surface Launched methods are where the machine is set at ground surface. A small entry pit is made to contain drilling fluid and provide working space. The casing is usually preassembled and installed in a single operation. The bore starts at a negative angle from the surface and curves along an arcuate (bow-shaped or curved), predesigned bore path. These methods are good for installations that do not require precise grade throughout and may be guided or unguided (DTD, 2019; Bennet et al. 2004).

Table 1.			
Drilling Equipment Considerations for Evaluation of Trenchless Technology Risk			
Item	**Small Rigs**	**Medium Rigs**	**Large Rigs**
Thrust/Pullback	< 40,000 lbs.	40,000 - 100,000 lbs.	> 100,000 lbs.
Maximum Torque	< 4,000 ft.-lbs.	4,000 - 20,000 ft.-lbs.	> 20,000 ft.-lbs.
Rotational Speed	> 130 rpm	90 - 210 rpm	< 210 rpm
Product Pipe Diameter	2" – 10"	4"-24"	8"-64"
Pilot Hole Size	2.3"	4.5"-6.5"	>6.5"
Drill Rod Segment Length	5 - 10 ft.	10 - 30 ft.	30 - 40 ft.
Drilling Distance	≤ 700 ft.	≤ 2000 ft.	≤ 6000 ft.
Power Source	< 150 hp	150 - 250 hp	> 250 hp
Mud Pump Capacity	< 75 gpm	50 - 200 gpm	> 200 gpm
Weight of Drill Rig	< 15,000 lbs.	<60,000 lbs.	> 60,000 lbs.
Rig Footprint Area (width x length)	3 ft. x 10 ft. to 7 ft. x 20 ft.	7 ft. x 20 ft. to 8 ft. x 45 ft.	> 8 ft. x 45 ft.
Recommended Work Area Requirements (width x length)	20 ft. x 60 ft.	100 ft. x 150 ft.	150 ft. x 250 ft.
Source: 1) Adapted from Table 3-1, page 3-2 of Bennett et al. 2004; **Notes:** rpm = rotations per minute; gpm = gallons per minute. (1) Rigs using air will not have a gpm capacity but a cubic feet/min rating; (2) This table does not address large HDD rigs that come in smaller components (3) This table does not address small rigs being used in situations where larger rigs were in order.			

Types of Trenchless Technology Methodology

- Pipejacking/auger boring
- Micro-tunneling
- Horizontal Directional Drilling (HDD)
- Direct Pipe
- Pipe Ramming
- Cradle Boring
- Guided Boring or Pilot Tube Method
- Pipe Reaming

1. Pipe-jacking and Auger boring: These methods use simultaneous casing advancement while cuttings are removed by auger. These methods use large diameter steel pipe which fully supports bore and overburden meaning there are rarely subsidence issues. This methodology is also a dry process, (no drilling fluids are used). Issues with these methodologies include limited capability for guidance and steering (Skonberg, 2014). Horizontal Auger Boring may only have an accuracy of +/- 1% of the drive length, conversely pipe jacking is very precise. Pipe Jacking is historically used for diameters 48" and greater. These methods also require a thrust wall to push against and are challenging to utilize in areas with uneven topography (DTD, 2019; Bennet et al. 2004).

2. Micro-tunneling: While limited in the pipeline industry, this type of method is not common for utility installations but can be found in urban areas or large conduit projects. It is an advanced form of pipe-jacking. It includes continuous advancement and cuttings removal with a closed slurry system. It has laser-guided steering and navigation control. Issues with this method are that it can be expensive, it requires a thrust wall and can generally only be used with larger bores (24-95 inches) (DTD, 2019; Bennet et al. 2004).

3. Horizontal Directional Drill (HDD): is a process that can be used alternatively from creating a trench. Although it can technically be used for any length, 800-2000ft is the optimal length (for time and cost conservation). This method is similar to "conventional" methods, except the hole is drilled from an inclined ramp instead of a vertical rig. HDD involves a three-step process. After identifying the area of interest for HDD drilling, the process begins by first drilling a "pilot" hole. HDD typically utilizes drilling mud to turn the bit. A motor located behind the bit is turned by the flow of mud and transforms energy from the mud into mechanical energy at the bit (DTD, 2019; Bennet et al. 2004).
   After drilling the pilot hole to the opposite side of the stream or piece of infrastructure (ex: road), the hole is enlarged through a process called, "prereaming". A cutter/reamer is attached at the end of the drill string and pulled back through the hole. Drilling fluid is pumped through behind the reamer to remove cuttings and prevent borehole collapse. If there isn't enough drilling mud used, a condition called, "hydra-lock", will occur. During hyrda-lock, drilling mud becomes stuck in the borehole and becomes pressurized. For depressurization to occur, the mud will either subside on its own or the back reamer will need to be dug up. Lastly, a piece of prefabricated pipeline is attached to the reaming assembly and a swivel is attached in between both pieces (the swivel will prevent the prefabricated section from turning). Through this whole process, drilling fluid is continually used and pumped into and out of both entrances of the hole. Issues with HDD include subsidence and inadvertent returns (DTD, 2019; Bennet et al. 2004).

4. Direct Pipe: This method combines micro-tunneling with HDD. The casing is preassembled and advanced in long strokes. The advantages with this method are that it can be very precise when steering, it reduces the entry pit size, the fully sized bore requires no reaming (or widening the bore hole). The issues with this method are that it utilizes a slurry-based cuttings removal and can only be used for pipe installs between 30-60 inches in diameter. Direct pipe is more practical for installs above 42 inches in diameter. (DTD, 2019; Bennet et al. 2004).

5. Pipe Ramming: This method requires that cuttings are cleared by an auger or air after the pipe advancement. There is bore support while driving pipe. This method does not require a thrust wall, it is a dry process, unless lubrication is needed to reduce friction, in which case bentonite/polymers are often used but not necessarily under pressure. This methodology also improves steering capabilities over pipe-jacking. The issues with this methodology include increased noise and this technology requires a bore for anything over 16 inches (DTD, 2019; Bennet et al. 2004).

6. Cradle Boring: This method is an old variation of auger boring but is a popular method because it is efficient. There is a fast set-up, no pit leveling, and is a dry process. Disadvantages with this method include that it is conducted on a suspended load, there is limited steering capability, and is very limited in rock. (DTD, 2019; Bennet et al. 2004).

7. Guided Bore or Pilot Tube Method: A true "Guided Bore Method" or GBM can be interchangeable with the Pilot Tube Method (see the Pilot Tube MOP. But sometimes one may say "Guided Bore" and mean that it is just a short/shallow, sometimes a pit to pit, bore using mini-HDD equipment.

Trenchless Technology Risk Evaluation Checklist

This checklist should be inclusive of all proposed Trenchless Technology (TT) crossing(s) for a project.

Section 1. Type(s) of Trenchless Technology (TT)

Please check the type(s) and provide the number of each crossing method to be employed:

☐ Bore x _____ ☐ HDD ×_____☐ Other TT: _____ (*If "other", provide description as needed*)

Section 2. Evaluation of Above Average Risk

The intention of this section is to help identify projects that the Department considers above average risk. If **all** below boxes are checked "N" and/or "N/A", the proposed activity may not be considered above average risk. Otherwise, the project poses an above average risk and a more detailed PPC plan is recommended (see Appendix E for an example PPC plan). If after completing the below checklist, a project proponent does not think their project is above average risk, they should contact the appropriate PADEP Regional Waterways and Wetlands Program(s), or the Regional Permit Coordination Office, to discuss and provide justification. Please see Section 3 below for the PADEP office contact information.

NOTE: It is the sole responsibility of the project proponent to diligently evaluate all risks associated with a project and assess when a more robust PPC plan is needed to abate risk, including preventing and responding to IRs and releases.

NOTE: It is incumbent upon the project proponent to review this TGD, address all potential risk to resources or any potential impacts to the environment, and develop a PPC plan that is commensurate with the size and scope of the project.

☐ Y ☐ N	Will drilling fluids containing substances other than bentonite or plant-based components be used under pressure?
☐ Y ☐ N ☐ N/A*	Does the PNDI Receipt indicate potential impacts to Threatened and Endangered species? (***select "N/A" if clearance letters have been obtained and the project is able to adhere to all avoidance/mitigation measures required by the reviewing agency**)

☐ Y ☐ N Are TT portions of the project located within a wellhead protection area of a potable ground water source or within the drainage area of a potable surface water source?

☐ Y ☐ N After conducting due diligence on the site, is there any evidence to suggest that the site may have, or be at risk to, soil or groundwater contamination (e.g. records of accidental releases, prior/existing underground storage tanks, brownfield sites, presence of monitoring wells, etc.)?

☐ Y ☐ N Are TT activity(s)/crossing(s) located in an area of steep slopes (≥ 2H:1V)? If "Y", provide a narrative explaining in further detail.

☐ Y ☐ N Are TT activity(s)/crossing(s) located in areas of mines, sinkholes, karst, or high-risk geology (e.g., faults, fractures, or a contact [change in geology])? If "Y", provide a narrative explaining in further detail.

☐ Y ☐ N Is the TT activity(s)/crossing(s) going from an entry point at a higher elevation to an exit point at a lower elevation where the elevation difference is greater than 100ft?

Section 3. PADEP Office Contact Information

Regional Permit Coordination Office
400 Market Street, 10th Floor RCSOB
Harrisburg, PA 17105
(717) 772-5987
RA-EPREGIONALPERMIT@pa.gov

Northwest Regional Office
230 Chestnut Street
Meadville, PA 16335
(814) 332-6984

Northcentral Regional Office
208 W. Third Street, Suite 101
Williamsport, PA 17701
(570) 327-3574

Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18711-0790
(570) 826-2511

Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745
(412) 442-4000

Southcentral Regional Office
909 Elmerton Avenue, Second Floor
Harrisburg, PA 17110
(717) 705-4802

Southeast Regional Office
2 East Main Street
Norristown, PA 19401
(484) 250-5970

References

Bennett, David, Ariaratnam, Samuel T., Como, Casey E. (2004) *Horizontal Directional Drilling, Good Practices Guidelines*. HDD Consortium.

Doherty, Dennis J. (2019) *It's not just a line on a piece of paper: Risk-based Engineering for Trenchless Project*. NASTT's Trenchless Today. NASTT.org pages 46-49

Directed Technologies Drilling Incorporated. Presentation at the DEP HDD Training, Harrisburg, PA. February 28, 2019.

Skonberg, Eric R. and Muindi, Tennyson M. (2014) Horizontal Directional Drilling Design Guideline Task Committee. American Society of Civil Engineers (ASCE). Second Edition MOP 108ISBN (print): 978-0-7844-1350-0 ISBN (PDF): 978-0-7844-7837-0

Hair, J.D. and Associates (2015) Installation of Pipelines by Horizontal Directional Drilling, An Engineering Design Guide. Catalog No. PR-277-144507-R01. Pipeline Research Committee (PRC), American Gas Association.

APPENDIX B
DATA RESOURCE LIST

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Formatting Key:

Bold, Black Underline – Name of data resource
Bold – Sub-category name of data resource
Blue underline – Weblink to data resource (if available)
(Parenthesis) / Black Underline / *Italics* – (General listing of available data) / Major data Categories / *Sub-categories*

- **Municipality / Township and County Websites and Contact** (Aerials, Topography, Tax / Parcel, Plats, Easements, Deed information, Hydrology, Hydrogeology, Manmade features, Geologic, Soil, Site specific impediments, Sewage service areas, private septic systems)

  Note: Township has contact information for sewage utility to obtain sewage service areas. Township Sewage Enforcement Officers keep records of private septic systems, though older systems may lack any record.

- **United States Geological Survey (USGS)**
  - **Earth Explorer (EE)** - https://earthexplorer.usgs.gov/ (Aerials, LIDAR / DEMS, Historic manmade features, Historic and current land uses)
  - **Historical Topographic Map Explorer (HT)** - http://historicalmaps.arcgis.com/usgs/ (Historic topography, Historic manmade features, Historic and current land use)
  - **National Geologic Map Database (NGMDB) and Association of American State Geologist (AASG)** - https://ngmdb.usgs.gov/ngmdb/ngmdb_home.html (Geologic overview, Strike and dip, Fractures and faults, Karst, Subsurface voids, Caves, Subsidence features)
  - **Pennsylvania Water Science Center** - https://pa.water.usgs.gov/infodata/groundwater.php (Groundwater, Groundwater table, Well and spring locations)
- **National Water Quality Monitoring Council** - https://www.waterqualitydata.us/portal/ (Groundwater table, Well and spring locations, USGS well water supply sampling)
- **Unites States Department of Agriculture Natural Resources Conservation Service (USDA)** - https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (Soil interfaces and unconsolidated material and soil drainage classes for potential wetlands [poorly drained and very poorly drained soils])
- **U.S. Fish and Wildlife Services (FWS)**
  - **FWS** - https://www.fws.gov/gis/data/national/ (Critical habitat, Regional boundaries)
  - **National Wetland Inventory (NWI)** - https://www.fws.gov/wetlands/ (Wetlands)
- **Federal Emergency Management Act (FEMA)**
  - **National Flood Hazard Layer (NFHL)** - https://catalog.data.gov/dataset/national-flood-hazard-layer-nfhl (Floodway, Floodplain)
  - **NFHL Viewer** - https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd (Floodway, Floodplain)
- **Pennsylvania Spatial Data Access (PASDA)**
  - **PASDA** – https://www.pasda.psu.edu/ (Aerials; LIDAR / DEM; Topography; County boundaries; Municipalities; Tax / Parcel information; Rivers; Streams; existing and designated stream uses; stream attainment status; Wetlands; Springs; Geologic overview; Soil interfaces; Geologic Contacts; Known contamination: *Beneficial land use, Captive hazardous waste operation, Commercial hazardous waste operation, Erosion & sediment control facilitates, Land recycling cleanup locations, Municipal waste operations, Residual waste operations, Storage tanks locations active or inactive, Water pollution control facility, Water resources, Encroachment Locations related to water resources;* Subsurface voids; Unconsolidated material; Surface and deep mines*: Abandoned mine land inventory – points, polygons,*

sites, Active underground permit boundaries, Coal mining operations, Coal pillar mining, Coal pillar location oil & gas, Digitized mined areas, Industrial mineral mining operations, Longwall mining panels, Mine drainage treatment / Land recycling project; Known oil and gas wells and related features – Active and abandon*: Conservation wells – plugged and unplugged, Encroachment locations for oil & gas, Oil Gas locations – conventional and unconventional, Oil & Gas Locations – wells, pits, land application, Oil & gas water pollution control facilities;* Public water supplier areas; Manmade features; Cultural / architecture features; Historic / Current land use)

Note 1: PASDA does not include all County or Municipality or Tax / Parcel boundary data in PA, if data is not listed on PASDA check specific County or Municipality website and/or contact.

Note 2: PA DEP public records search to obtain soil and groundwater contamination area delineations.

- ❒ **Pennsylvania Imagery Navigator (PSIEE)** - https://maps.psiee.psu.edu/ImageryNavigator/ (Aerials – Limited areas of PA)

- **Pennsylvania Department of Conservation & Natural Resources (DCNR)** - https://www.dcnr.pa.gov/Pages/default.aspx or http://data-dcnr.opendata.arcgis.com/
  - ❒ **Pennsylvania GEOlogic Data Exploration (PaGEODE)** - http://www.gis.dcnr.state.pa.us// (Topography, Groundwater, Groundwater table, Geologic overview, Geologic mapping, Strike and dip, Formation identification, Fractures / Faults, Subsurface voids, Karst, Caves, Subsidence features, Wells and springs)
  - ❒ **Open Data Portal** - http://data-dcnr.opendata.arcgis.com/ (Aerials, DEM / LIDAR, Groundwater, Groundwater table, Geologic overview, Geologic mapping, Formation identification, Fractures / Faults, Soil interfaces and geologic contacts, Subsurface voids, Karst, Caves, Subsidence features, Unconsolidated material)
  - ❒ **Pennsylvania Groundwater Information System (PAGWIS)** - https://www.dcnr.pa.gov/Conservation/Water/Groundwater/PAGroundwaterInformationSystem/Pages/default.aspx (Well and spring locations, Private well supply locations, Well construction, Groundwater table)
- **Department of Environmental Protection (DEP)** – https://www.dep.pa.gov/Pages/default.aspx and https://www.dep.pa.gov/DataandTools/Pages/GIS.aspx
  - ❒ **eMapPA** - http://www.depgis.state.pa.us/emappa/ (Web application for interactive mapping of: Complaints; Federal EPA sites; Regulated facilities and related information: *Air, Land reuse, Mining, Oil and gas, Radiation, Sample information system, Streams and water resources, Storage tanks, Waste, Water including public water service areas and public supply well listings;* Areas POI – geological; Areas POI – Environmental; Areas POI – General; Boundaries)

    Note 1: See eMapPA attachment for obtaining a detailed listing of: Public supply wells, Sewage discharge, Sewage treatment plant and Surface water intakes within a search radius. For related location information, wellhead protection area delineations and source water assessment reports, must public records search and/or contact the water / sewer authority.

    Note 2: Web application data layers available for download via: PASDA, PaGEODE, DCNR, DEP Open Portal.
  - ❒ **DEP Environmental Site Assessment Search Tool** - https://www.depgis.state.pa.us/esaSearch/ (Web application for interactive mapping of: Air emissions, Known contamination, Surface and deep mines, Known oil and gas wells, and related subcategories)

    Note: Data layers available for download on PASDA or DEP OPEN DATA.
  - ❒ **DEP Activity and Use Limitations Registry (AUL)** - http://www.depgis.state.pa.us/pa-aul/ (Activity and use limitations: including not limited to Fencing, Groundwater use prohibition, Groundwater treatment, Health and safety plan, Leachate collection system, Maintenance of cap, Municipal ordinance, Non-residential use, Other engineering control, Other institutional control, Maintenance of point-of-entry treatment systems, Slab on grade construction, Slurry wall, Soil management, Stormwater management, Vapor barrier, Vapor mitigation, Vapor investigation, Groundwater use monitoring)

Note: PA AUL provides direct links to AUL documents associated with a particular property (Document examples: Administrative Orders, EPA Consent Decrees, Consent Orders and Agreements, Deed restrictions, Environmental Covenants, Military master plans, Municipal ordinances, Post-remediation care plans)

- **Example water sample plans** that may be used as a template can be found on PADEP's Pennsylvania Pipeline Portal webpage.
  - ❒ An example of a "Well and Spring Monitoring Plan" is available here:

    http://files.dep.state.pa.us/ProgramIntegration/PA%20Pipeline%20Portal/AtlanticSunrise/August_2017/20170817_Well%20and%20Spring%20Monitoring%20Plan.pdf
  - ❒ An example of a "Water Supply Assessment, PPC Plan" is available here:

    http://files.dep.state.pa.us/ProgramIntegration/PA%20Pipeline%20Portal/MarinerEastII/Water%20Supply%20Assessment,%20Preparedness,%20Prevention%20and%20Contigency%20Plan%20w%20appendices%20-%20Revised%20080817.pdf
  - ❒ **DEP Water Attribute Viewer for the Enterprise (WAVE)** - http://www.depgis.state.pa.us/wave/ (Web application for interactive mapping of: Water Resources and related features: *Discharge; Groundwater withdrawal; Interconnection; Surface water withdrawal; Storage; Water pollution control facility;* Marcellus gas well water source, Mine orphan discharges, Public Water Supply service area) Note: Data layers available for download on PASDA or DEP OPEN DATA.
  - ❒ **DEP OPEN DATA** - https://data-padep-1.opendata.arcgis.com/ (Abandoned mine lands, air quality, coal mining, general, hazardous waste, industrial minerals mining, land recycling, oil & gas, public water supply, radiation, streams & lakes, waste management, water pollution control, water resources) Note: PASDA has search tool and offers same data layers for download.
  - ❒ **DEP Reports** - https://www.dep.pa.gov/DataandTools/Reports/Pages/default.aspx (Oil and gas reports, Land recycling reports, Radiation protection reports, Water reports, Laboratory reports, Hazardous sites cleanup reports, Grants and loans reports, Mining reports, Waste reports, Wastewater reports, Air quality reports)
  - ❒ **DEP Public Records** - https://www.dep.pa.gov/Citizens/PublicRecords/Pages/default.aspx - (Link for completing an informal public records review request)
  - ❒ **DEP eLibrary** - http://www.depgreenport.state.pa.us/elibrary/?aspxerrorpath=/elibraryredirect/dsweb/HomePage (Environmental laws of PA, Forms, Permit and authorization packages, Publications, Source water assessment summary reports, Technical guidance draft documents, Technical guidance final documents)
- **Pennsylvania Historical & Museum Commission** - http://www.phmc.state.pa.us/bah/dam/rg/di/r17-114CopiedSurveyBooks/r17-114MainInterfacePage.htm (Surveyed drawing - shows the name of the individual for whom the tract was surveyed, the acreage, the courses and distances and the names of adjoining property owners, and occasionally other significant geographical features of the landscape) Note: Not all parcels in Pennsylvania are included.
- **Pennsylvania Utility Commission (PUC)** - http://www.puc.state.pa.us/ (Existing utilities PA one call and survey markings and/or contact PUC for data)
- **Pennsylvania Department of Transportation (PennDOT)**
  - ❒ **General Site** - https://www.penndot.gov/Pages/default.aspx (Municipalities, Tax / Parcel Information in PDF or contact for GIS or CAD layers)
  - ❒ **Open Portal for GIS data download** - https://data-pennshare.opendata.arcgis.com/ (Manmade features and cultural / architectural features)
  - ❒ **PennDOT online map viewer** - https://www.dot7.state.pa.us/onemap/
- **Delaware River Basin Commission**

- **DRBC GIS** - https://www.state.nj.us/drbc/basin/map/GIS.html (Municipalities, Water resources, Geologic overview, Rivers, Streams, Wetlands)
- **DRBC SE PA Ground Water Protected Area GIS** - https://www.nj.gov/drbc/programs/project/pr/gwpa-data.html (Municipalities, Water resources, Geologic overview, Rivers, Streams, Wetlands)

- **Susquehanna River Basin Commission**
  - **SRBC Map Viewer** - https://www.srbc.net/portals/susquehanna-atlas/projects-map/ (Municipalities, Water resources, Geologic overview, Rivers, Streams, Wetlands)
  - **SRBC Data Request** - https://services.srbc.net/request-data/ (surface water and groundwater withdrawals, consumptive use facilities, oil and gas) Note: PASDA has search tool and offers a subset of data layers for download for free.

- **Environmental Protection Agency**
  - **Operating Procedure – Groundwater Sampling (3/6/2013) -** https://www.epa.gov/sites/production/files/2015-06/documents/Groundwater-Sampling.pdf

- **U.S. Office of Surface Mining Reclamation and Enforcement**
  - **Well Purging Procedures for Obtaining Valid Water Samples from Domestic and Monitoring Wells (5/21/2012) -** https://www.arcc.osmre.gov/about/techDisciplines/hydrology/docs/techGuidance/2012/tsd-wggb-Well_Purging.pdf

APPENDIX C
BORE & HDD FLOWCHART

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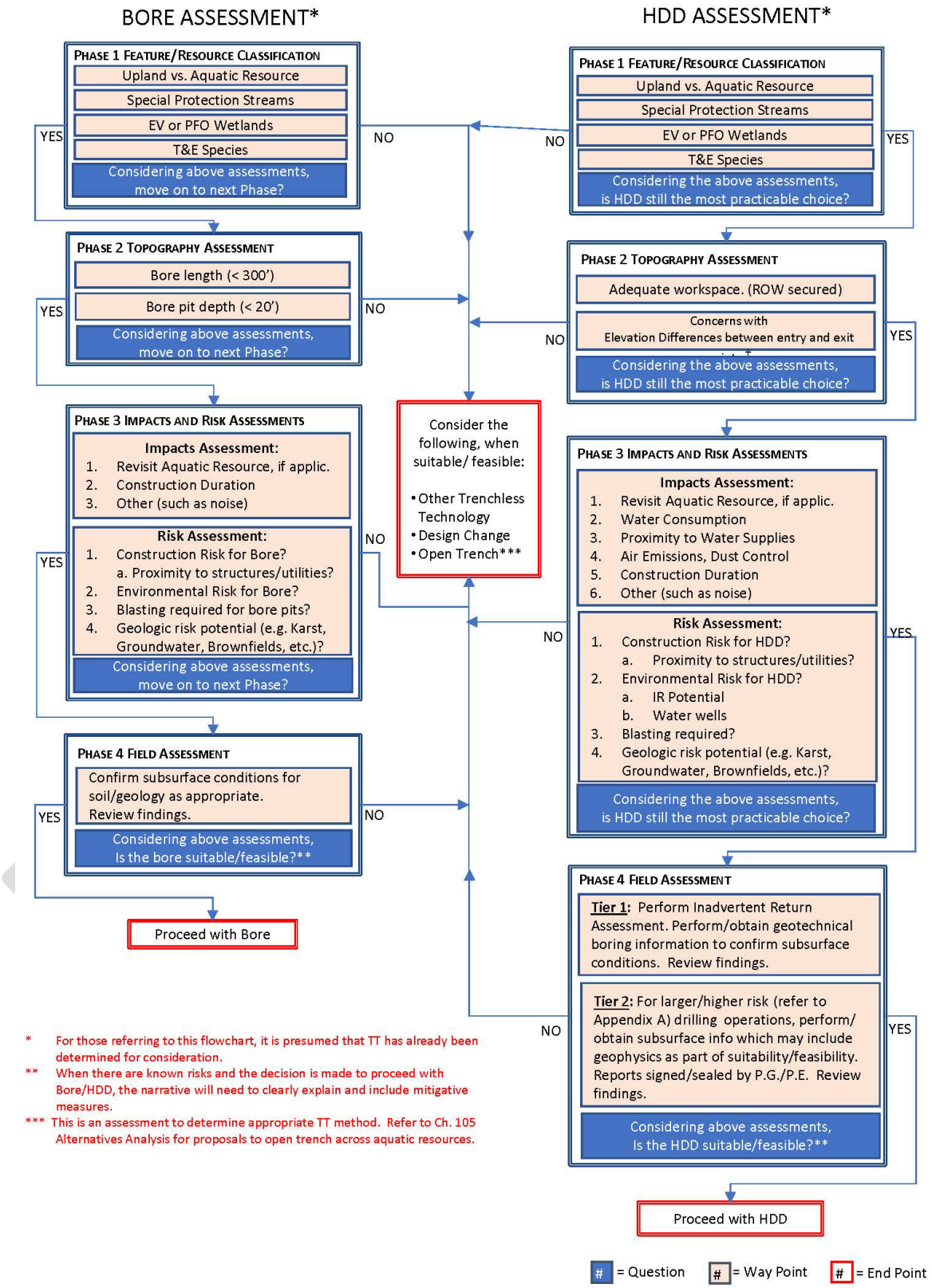
Site Suitability Assessment – A Tool for Trenchless Technology Assessment – *This Flow chart is not intended to be a complete guide of the TGD, rather one additional item to consider when deciding what path to take (i.e., HDD, conventional bore, or open trench). Users will begin at either Phase 1. Phase 1&2 – Desktop Assessments, Phase 3&4 – Field Assessments.*



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APPENDIX D
INSTRUCTIONS FOR DETERMINING PUBLIC WATER SUPPLY SOURCE LOCATIONS USING eMapPA

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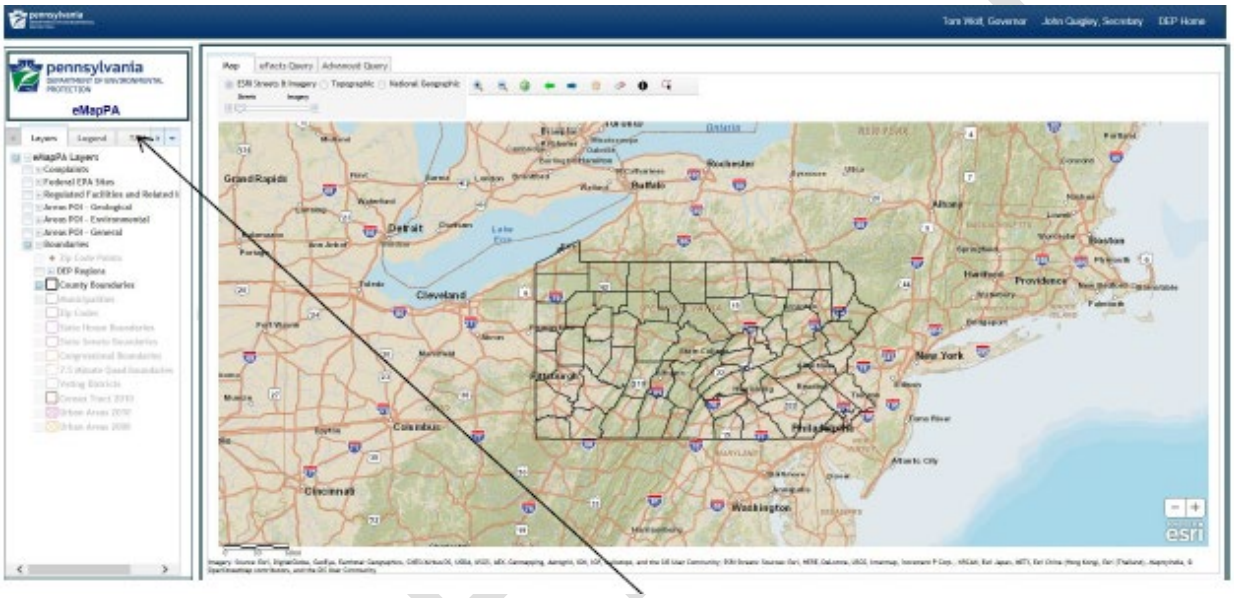
Instructions for Determining Public Water Supply Source Locations Using eMapPa

Note: The locations of public water supply sources are considered sensitive information, so they cannot be determined using the following process. This process will, however, enable the user to obtain a listing of public water supply sources within a specified buffer of a point of interest. This listing can then be used to conduct a file review in the local DEP Office if more specific data is required.

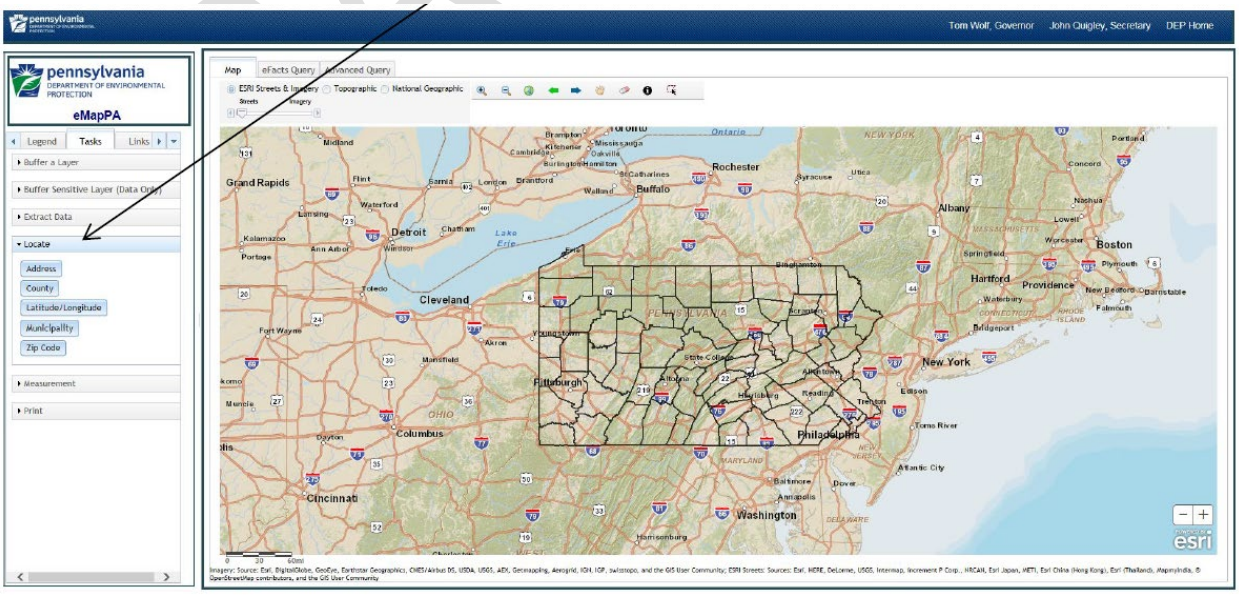
1. Enter www.depgis.state.pa.us/emappa/ in your browser's address bar.

2. The following webpage will appear in your browser window:



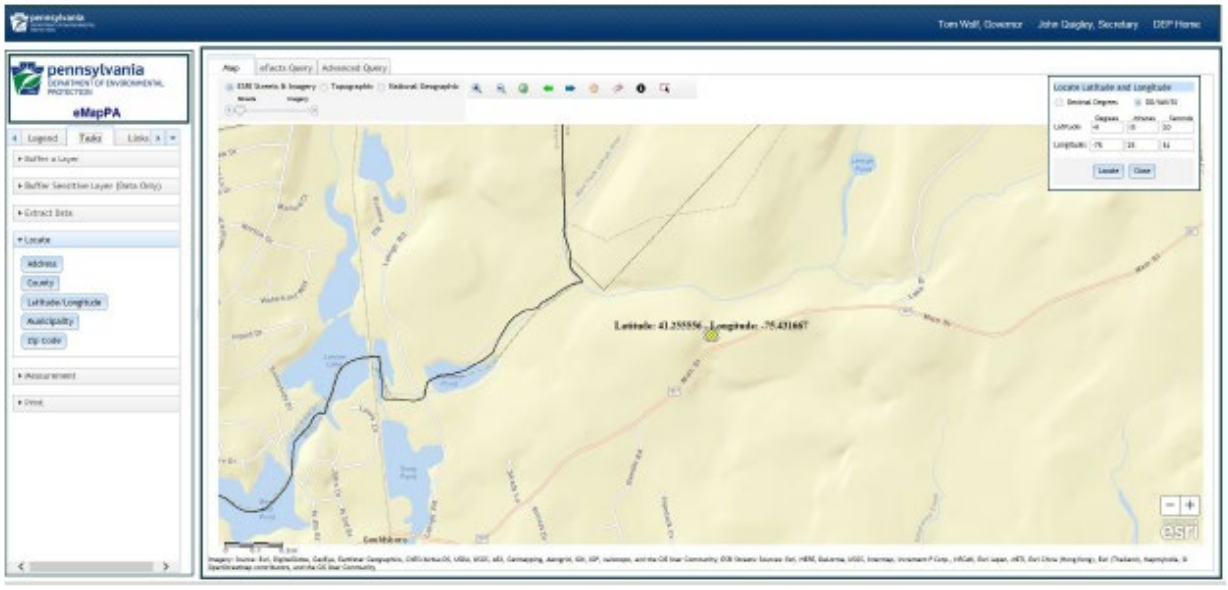
3. Begin by defining your point of interest. Select the "Tasks" tab under the table of contents.

4. Under the "Tasks" tab choose "locate" as shown below.

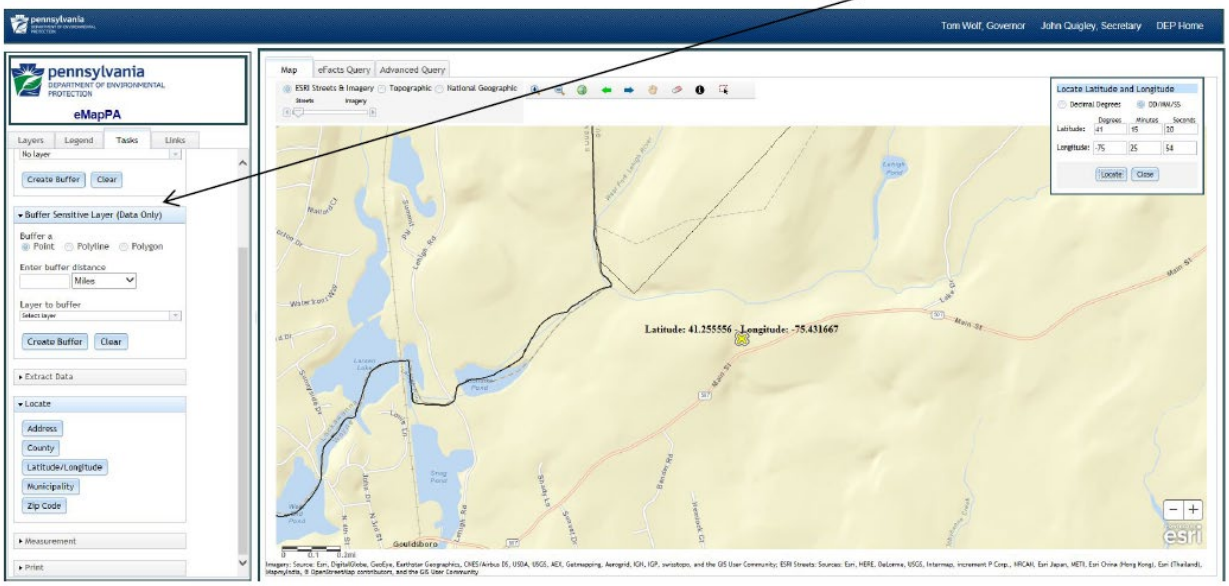


5. Now click on the appropriate locational method based on the location information that you have. In this example, the Latitude and Longitude were used, so the Locate Latitude and Longitude dialog box appears on the right-hand side of the screen. Enter your coordinates, being sure to use a negative (-) Longitude to indicate “west”.

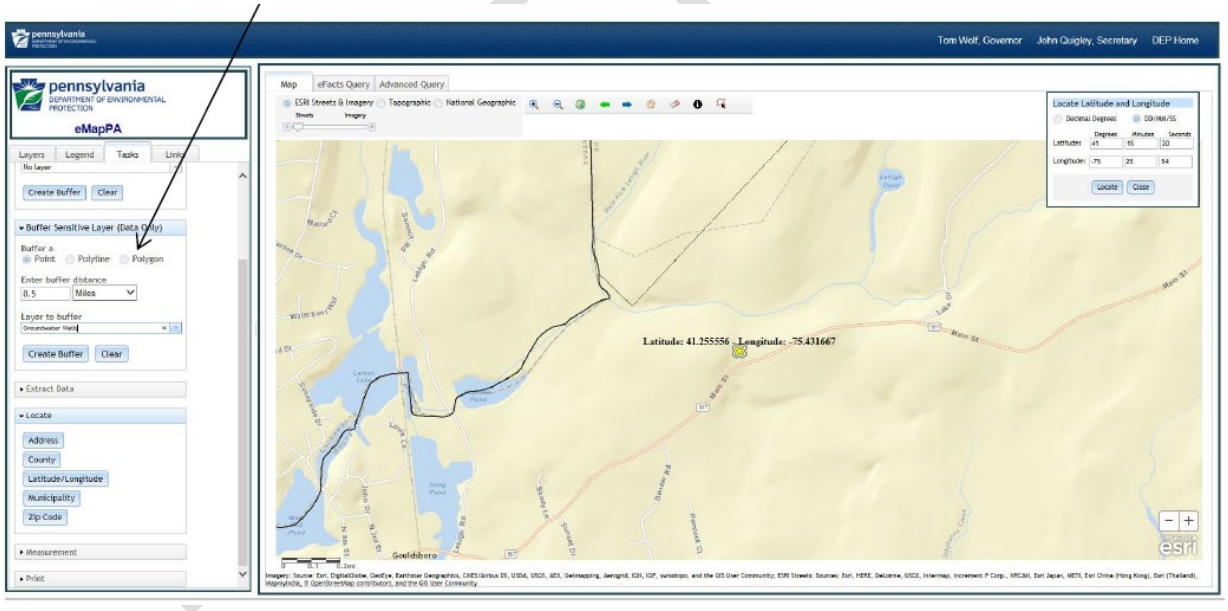
6. After Clicking locate in the dialog box, the map will be zoomed to your point of interest, which will be labeled as shown below.



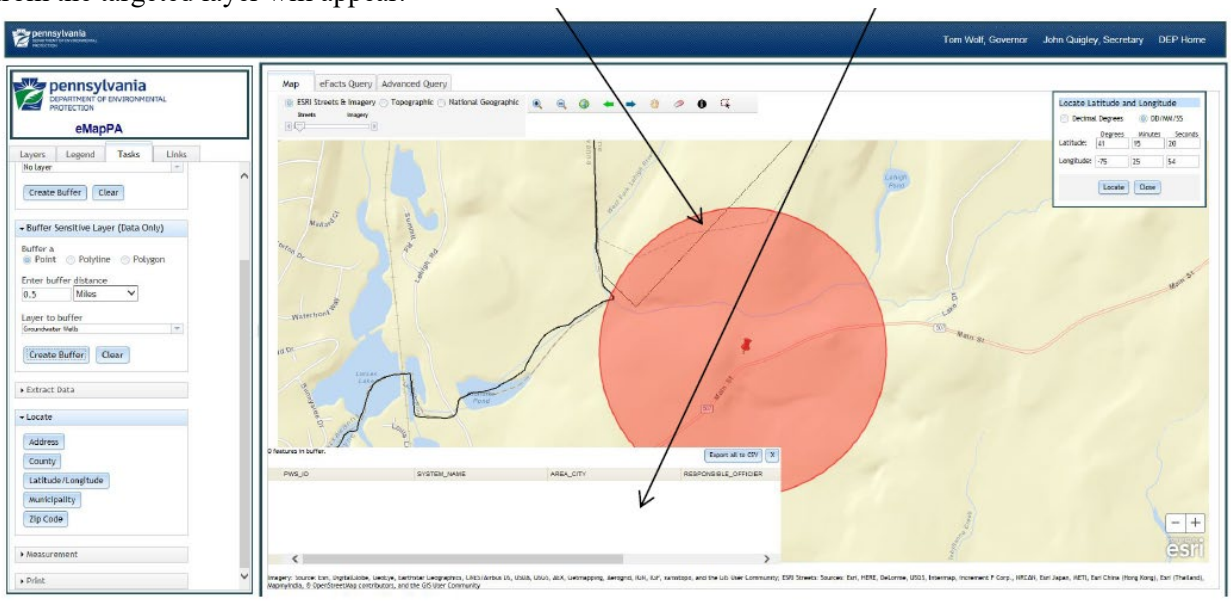
7. Under the "Tasks" tab you will now choose "Buffer Sensitive Layer (Data Only)".



8. Choose "Point", enter a buffer distance, in this example 0.5 miles is the area of interest and then choose the layer of interest, in this example, public water system groundwater sources are of concern, so Groundwater Wells was chosen.



9. Now select "Create Buffer" and then click on the point on the map that you had previously identified in step 6 above. A red circle delineating the buffer zone will appear and a dialog box showing any features from the targeted layer will appear.



In this example there were no public water system groundwater sources within a ½ mile buffer zone of the point selected, so the dialog box is empty. If any public water system sources were found within the buffer zone, they would be listed within this dialog box. **As was stated above, this information is considered sensitive, so the exact locations of the wells will not be provided. If this information is needed, the listing of sources can be used to schedule a file review with the appropriate Departmental office.**

APPENDIX E
EXAMPLE TEMPLATE FOR A PPC PLAN

Project proponents should refer to Appendix A, before starting the example PPC plan below. The document is set up to follow each logical step of a PPC plan. First, "Preparedness", then "Prevention" and then lastly "Contingency".

The purpose of this example PPC plan is to provide starting point. It is incumbent upon the project proponent to review this TGD, address all potential risk to resources or any potential impacts to the environment, and develop a PPC plan that is commensurate with the size and scope of the project.

The project proponent should review the TT TGD as they prepare the PPC plan. The example below includes several "placeholders" for project proponents to enter data and information after they have reviewed the TT TGD. It is the sole responsibility of the project proponent to diligently evaluate all risks associated with a project and assess when a more robust PPC plan is needed to abate risk, including preventing and responding to IRs and releases.
Please also refer to the PaDEPs *Guidance for the Development and Implementation of Environmental Emergency Response Plans*. [Technical Guidance/Document Number 400-2200-001] from April 2001 (http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=4582).

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Trenchless Technology (TT) Inadvertent Return Preparedness, Prevention and Contingency (PPC) Plan

[INSERT PROJECT NAME]
[Insert Company Name]

[INSERT PLAN PREPARER]
[INSERT DATE PREPARED]
[INSERT DATE UPDATED]

DEP Revision Date– March 2020

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FOREWARD

[Insert project-specific content. Standard/Sample language provided below.]

Trenchless Technology is defined as a type of subsurface construction work that requires few trenches or no trenches which includes any trenchless construction methodology, including without limitation, horizontal directional drilling, guided auger bore, cradle bore, conventional auger bore, jack bore/hammer bore, guided bores, and proprietary trenchless technology.

Trenchless technology (TT) is typically utilized when conventional trenching techniques are not desirable or practicable. TT is suitable for a variety of soil and geologic conditions and primarily intended for avoiding obstacles including, but not limited to, stream crossings, roads, and environmental features.

This plan satisfies the requirements set forth in 25 Pa. Code §78a.68a and §102.5(l) and is written in accordance with PADEP's Guidelines for the Development and Implementation of Emergency Response Plans. This plan presents methodologies to prevent, control and minimize the impacts to sensitive environmental resources from **inadvertent returns (IR)** of drilling fluids associated with the proposed crossings using trenchless technology (TT) during the construction of the Project.

[OPTIONAL depending on site conditions] This plan, as applicable, also contains sections outlining special procedures for:

- Water Supplies
- Geologic Concerns (Karst, Voids, Mines)
- Bog Turtle Areas
- Other Special Areas

1.0 PROJECT DESCRIPTION

[Insert project-specific content - General description of project: location, length, size, number of proposed drill location, etc.]

2.0 PREPAREDNESS

[Insert project-specific content – Standard/sample language provided below.]

Preparedness planning involves identifying organizational resources, determining roles and responsibilities, developing procedures and planning activities in order to reach a level of readiness to be able to respond timely and effectively to a pollution incident shall one occur.

2.1 OPERATIONS PLAN

[Insert project-specific content – Standard/sample language provided below.]

This Section references all of the measures and controls that will be implemented to ensure that all project-specific environmental permits, conditions, and plans will be followed at all times. In addition to federal, state, and local permits and their conditions, the following plans have been developed for this project.

[List Plans here. Examples given below]

- Site-Specific Plans for Trenchless Crossing of Stream/Wetland Resources

- Erosion and Sediment (E&S) Control and Site Restoration (SR) Plan
- Prevention, Preparedness, and Contingency Plan (PPC Plan)
- Aids to Navigation (ATON) Plan
- Conservation Plans for Threatened and Endangered (T&E) Species

2.2 PERSONNEL, ROLES AND RESPONSIBILITIES

[Insert project-specific content – Standard/sample language provided below. Also see TGD Section 4.B]

To ensure the highest probability of success on proposed TT installations, a technical team (Team) should be assembled which may include geologists, engineers, scientists, and other consultants having expertise in TT design, construction, subsurface geology/hydrogeology and environmental issues.

2.3 TRAINING

[Insert project-specific content. Also see TGD Section 4.B]

2.4 EMERGENCY RESPONSE PLANNING

[Insert project-specific content. Also see TGD Section 4.G]

3.3.1 NOTIFICATIONS AND CONTACT LISTS

[Cross-Reference to Section 8 of this Sample PPC Plan (or combine)]

3.0 PREVENTION

[Insert project-specific content – Standard/sample language provided below.]

Prevention planning involves written, approved, implemented, and periodically tested programs specifically outlining all actions to be taken to reduce the occurrence of avoidable incidents and minimize impacts shall an incident occur.

The use of TT for obstacle or resource avoidance during pipeline construction has been utilized extensively with high levels of success. However, IRs of drilling fluids can occur for various reasons. The following sections detail methodologies to be implemented for the Project with the intent of avoiding or minimizing IRs based on a sound understanding of the reasons that cause returns.

3.1 ENVIRONMENTAL/GEOLOGIC INSPECTION

[Insert project-specific content – Standard/sample language provided below. Also see TGD Section 2]

To ensure that operations associated utilizing trenchless construction methodologies (including HDD) are conducted in accordance with permit conditions, established requirements, and standard TT industry practice, pipeline companies should provide Environmental Inspectors (EIs) to monitor all pipeline construction activities, with increased attention provided to TT installations. Specifically, each construction spread should have an appropriate number of EIs, based on the size and complexity of the project. If TT is proposed, the EIs should have appropriate support from a Pennsylvania-licensed Professional Geologist (PG). The minimum recommended requirements of the PG are as follows:

- Current Professional Geologist licensed in Pennsylvania
- Experienced in the field of hydrogeology

- Received training and/or experienced on TT (e.g. methods to monitor TT activities and progress, and procedures for analyzing loss of circulation and IR events)

The EIs primary responsibility is to focus on environmental compliance. When necessary, this focus may include activities related to trenchless construction methodologies (including HDD). The EIs direct responsibilities, as they relate to this PPC plan, include:

List here. Examples given below:

- The EIs should document the progress of the TT including subsurface characteristics as evidenced by examination of cuttings and returns as the TT is progressing for the complete length of the TT profile either through the pilot hole, a ream hole, or a combination of both, such that one complete logging of the profile geology is acquired as early in the TT as possible;
- The EIs should document tool and mud pressures, TT materials (water, bentonite) consumption and document potential losses of circulation,
- The EIs should patrol the land surface along the TT alignment to inspect for IRs (see Section 3.2). The EIs should communicate regularly with the TT contractors. The TT contractor's performance should be evaluated on compliance with permit terms and conditions at the work location; construction design drawings; technical specifications; and PPC Plan requirements.

The EIs, including the PGs, should have "stop-work" authority, which is the authority to stop site-specific activities that violate the environmental permits or conditions. If prior notification or approval is required, such work should not begin until notification is given or approval is received.

3.2 TT ALIGNNMENT MONITORING AND IR PROTOCOLS

[Insert project-specific content – Standard/sample language provided below. Also see TGD Section 4.G]

Persistent monitoring of the TT alignment for an IR is an integral component in minimizing adverse environmental impacts. The intensity of this monitoring will vary depending upon the following drilling fluid operational conditions:

- Condition 1: Full circulation
- Condition 2: Loss of circulation
- Condition 3: Inadvertent returns

It is imperative that the driller and geologist interact to develop the best solution for overcoming loss of circulation and inadvertent return. In consultation with the driller, the PG will document as best as possible the downhole geologic and drilling conditions leading to the cause of the loss of circulation. This may include, but is not limited to, various drilling factors as well as rock fractures, voids, weathered rock zones, faults, conduits, and geologic contacts. The PG should note, including but not limited to, if voids are mud-filled or open and the size of open voids.

- **Monitoring Protocol for Condition 1 – Full Circulation**

  When TT operations are in progress and full drilling fluid circulation is being maintained at one or both of the TT endpoints, the following monitoring protocol should be implemented.

  List here. For example:

  - The presence of drilling fluid returns at one or both of the TT endpoints should be periodically monitored and documented.
  - Areas along the drilled alignment should be periodically walked and visually inspected for signs of inadvertent drilling fluid returns as well as surface heaving and settlement.
  - Streams should be visually inspected from the banks for a visible drilling fluid plume.
  - Drilling fluid products present at the jobsite should be documented.

- **Monitoring Protocol for Condition 2 – Loss of Circulation**

  When TT operations are in progress and there is a loss of drilling fluid from an endpoint, or mid-circulation, the following monitoring protocol should be implemented.

  List Here. For example:

  - PADEP and other entities should be immediately notified as addressed in Section 8.0.
  - The EI/PG should increase the frequency of visual inspections along the TT alignment and outside the limits of disturbance. (i.e. on public areas and where authorized without trespassing and conduct enhanced monitoring of sensitive environmental resources within [enter amount here – recommended **### feet]** of the TT alignment. Please see TGD for recommend distance)
  - The EI/PG should document periods of contractor downtime (during which no drilling fluid is pumped) and the contractor's drilling fluid pumping rate to estimate lost circulation volumes.
  - Drilling operations **with losses > [enter amount here-recommended 20%]**[1] should be temporarily suspended and PADEP should be provided with (1) a **loss prevention report**, which describes the measure(s) that should be implemented to prevent, to the maximum extent practicable, the likelihood of additional losses of circulation; and (2) proof that every public water supplier with public well source within **½ mile**[2] and surface water intake within **1 mile**[3] of the TT alignment, and every landowner with a private water supply within **450 feet**[4] of the TT alignment has been notified.(**1000 feet**[5] in Karst Areas, for example areas underlain by carbonate bedrock) Drilling

[1] Some losses are expected as part of normal drilling operations. When the percentage exceeds 20%, contingencies should be engaged.
[2] This amount is discussed in TGD.
[3] This amount is discussed in TGD.
[4] This amount is discussed in TGD.
[5] This amount is discussed in TGD.

operations should not resume until all required information has been submitted.

- The TT contractor should take one or more of the following actions to restore full circulation, as appropriate:
  - Minimize annular pressures by minimizing drilling fluid density consistent with hole cleaning and stabilization requirements.
  - Adjust viscosity as necessary to reduce annular pressures consistent with hole cleaning and stabilization requirements.
  - Adjust gel strength as necessary to reduce annular pressures.
  - Control the balling of material on bits, reaming tools, and pipe to prevent a plunger effect from occurring.
  - Control penetration rates and travel speeds to prevent a plunger effect from occurring.
  - Reduce drilling fluid pumping pressures to the minimum necessary to maintain hole cleaning requirements.
  - Size the hole frequently by advancing and retracting the drill string to keep the annulus clean and unobstructed.
  - Seal a zone of lost circulation using a high viscosity bentonite plug, loss control materials, or grouting.
  - Suspend drilling activities as long as necessary to allow plugs, loss control materials, or grout to cure.
  - If drilling fluid flow has been suspended, re-establish circulation slowly before advancing.
- In consultation with the driller, the PG should document as best as possible the downhole geologic and drilling conditions leading to the cause of the loss of circulation. This may include various drilling factors as well as rock fractures, voids, weathered rock zones, faults, conduits, geologic contacts, etc. Also, it should be noted if voids are mud filled or open, size of open voids, etc.
- Each construction spread should have an appropriate number of EIs, based on the size and complexity of the project for appropriate and timely coverage. If TT is proposed, the EIs should have appropriate support from a Pennsylvania-licensed Professional Geologist (PG). The EI/PG will document steps taken by the TT contractor to (1) restore circulation to the entry/exit and (2) reduce annular pressure down hole. Should the contractor fail to comply with the requirements of this plan, the EI/PG should notify appropriate personnel[6] so that appropriate actions can be taken.
- If circulation is regained, and there is no IR or other loss of circulation within 48 hours, the EI/PG should inform the appropriate personnel and resume the monitoring protocol associated with Condition 1.

[6] Appropriate personnel are defined by applicant but should include those with corporate oversight and decision making authority.

- If circulation is not re-established, the EI/PG should increase the frequency of visual inspection along the drilled path alignment and outside the limits of disturbance on public areas and where authorized without trespassing. Additionally, the EI/PG should document periods of contractor downtime (during which no drilling fluid is pumped) and the contractor's drilling fluid pumping rate to estimate lost circulation volumes.

➢ **Monitoring Protocol for Condition 3 – Inadvertent Returns**

If an IR is detected, the following monitoring and operational protocol should be implemented. Also see Section 4.3 in this PPC Plan. Please note, IRs impacting uplands only are addressed in Section 4.2 in this PPC Plan.

List here. For example:

- PADEP and other entities should be immediately notified as addressed in Section 8.0 of this PPC Plan.
- The EI/PG should document the location, magnitude, and potential impact of the IR.
- If the IR occurs in surface waters of the Commonwealth, confirmed to be less than **XX** gallons[7], and is the first IR at a TT location, TT operations may continue after;
    1) containment is achieved,
    2) cleanup of the IR has been completed, with all solid wastes properly managed in accordance with 25 Pa. Code Subpart D, Article IX (relating to residual waste management) (collectively "cleanup"),
    3) the project proponent submits to PADEP written notice and documentation that the IR has been contained and the cleanup has been completed, and
    4) PADEP has been notified and given the opportunity to respond. PADEP will typically have up to **72 hours** (3 business days) to respond after written notice and documentation is provided.
        - Written notice and documentation of the IR should be provided on the Initial IR and Interim/final report forms attached as Attachment B (the requirements of Initial, Interim, and Final IR reports are set forth below in Section 8.0 (Notifications).in this PPC Plan.
        - The Team should monitor and document the IR as well as periods of contractor downtime and the contractor's drilling fluid pumping rate to estimate IR volumes.
        - The basis for the estimate of the IR volumes, including any information, measurements, or calculations supporting that estimated volume, should be provided on the forms attached as Attachment B.
- If the IR is (i) **XX** gallons or greater (should match previous amount listed above), (ii) of unknown quantity, or (iii) is a second

[7] The applicant should insert an appropriate number here (e.g. 50 gallons has been previously used on other projects). Severity of IRs within surface waters will depend on both the volume of the IR, the size of the surface water and the speed of action per the contingency planning.

or subsequent IR at a TT location in surface waters of the Commonwealth, drilling operations should be suspended and PADEP notified, provided a **written restart report**, and given opportunity to respond. The restart report should contain:

- An overview of the TT activities,
- The stage of TT the drilling operation (pilot, ream, etc.)
- The PG's assessment of the strata where IR occurred,
- The Length, Depth and alignment of drill bit at time of IR,
- Profile of the drill path as constructed overlain on the permitted drill profile
- Moving forward - consideration of the use of following options. The restart report should include a detailed justification for eliminated options.
    - Options include:
        - Alternative entry and/or exit points – including the use of an intercept drill option,
        - Alternative entry and/or exit angles,
        - Alternative profile depth,
        - Reduced drilling fluid pressures,
        - Thickened drill mud and/or the use of pre-approved loss circulation materials,
        - Grout techniques,
        - Bore hole casing,
        - Relief wells.
    - Recommendations on measures that will minimize the likelihood of further IRs to adequately protect public health, safety and the environment.
    - An analysis of the risk of additional IRs after the use of the proposed mitigation measures.
- The proposed schedule for recommencement of TT operations and the anticipated duration of the TT operations.
- The restart report should be sealed by an experienced PA licensed professional geologist or experienced PA licensed professional engineer.
- TT activities may recommence after PADEP provides approval to restart. The restart report should not be approved unless there is a demonstration that the mitigation measures will adequately protect public health, safety, and the environment. Periods of contractor downtime and the contractor's drilling fluid pumping rate should also be documented to estimate IR volumes. The basis for the estimate of the IR volumes, including any information, measurements, or calculations supporting that estimate, should be provided on the forms in Attachment B. Notifications to government agencies and water supply owners is addressed in this PPC Plan and the TGD.

3.3 HYDROLOGIC (GROUNDWATER) CONSIDERATIONS

[Insert project-specific content – Standard/sample language provided below. Also see TGD Section 2]

During drilling operations, the TT contractor should monitor the annulus pressure of returns during the TT pilot hole phase of TT using an annular pressure

monitor. If the pressure spikes significantly and unexpectedly and all other drilling parameters are otherwise unchanged, or if the pressure drops, an inspection of the TT alignment and adjacent areas for returns should be conducted. The surfacing of groundwater over the TT profile as a result of TT activities, other than returning water to the entry or exit pit, could be indicative of an ongoing or impending IR. When groundwater surfacing is identified, it should be photographed, characterized (i.e., location, size, limits, flow rate, clarity, etc.) and appropriate mitigation measures taken (please see below). The inspection and early detection of any surfacing of groundwater over the trenchless construction profile will allow the trenchless construction contractor to stop or adjust the trenchless construction profile to reduce the potential for secondary impacts or an IR. If it is determined that the surfacing of groundwater over the trenchless construction profile, other than returning water to the entry or exit pit, is related to its construction activities or contains drilling fluids, or the presence of bentonite, the groundwater discharge may be treated as an IR.

During the pilot hole or reaming phase of an TT, a sudden increase in drilling fluid returns, the appearance of clear water mixed with drilling fluids, or clear water only returning to the TT entry point or exit point indicates that the TT has progressed into, or intercepted, a zone of groundwater with a hydrostatic pressure greater than the annular pressure of the TT phase in progress. If this occurs, the PG should document the current phase of the TT, the location and elevation of the tool, and consult with other experts, as necessary, regarding the known presence, or unknown potential for the TT to have intercepted a mine pool, just entered a void, encountered a water bearing zone at higher elevation, or encountered a water bearing zone under artesian pressure. The Team (as described previously) should collect samples of the water to test for acid mine pool constituents.

If the volume of produced water is minimal or does not exceed the volumes being used for the trenchless construction phase in progress, then this water should be pumped with the returning fluids and cuttings and recycled into the trenchless construction process. If the volume of produced water exceeds the water demand for continued drilling, the contractor should capture and haul away all produced water for treatment until the test results show that the water can be safely discharged at a suitable location at the trenchless construction location. The Team should obtain any required authorizations for on-site discharge of excess produced waters. If the volume of produced water exceeds the water demand for continued drilling, when weather permits, the necessary portion of the bore hole should be grouted and allowed an appropriate period of time for curing before proceeding with further trenchless construction activities.

If the produced groundwater returns persist after pipe pullback, the contractor should develop and implement a plan to establish a seal to stop groundwater flows and/or mine pool discharge as to avoid impacts to environment and public and private water supplies.

3.4 DRILLING FLUID MANAGEMENT

[Insert project-specific content – Standard/sample language provided below. Also see TGD Section 4.D]

The major component of drilling fluid used in TT pipeline installation is fresh water, typically obtained at a nearby crossing location. Water itself will not prevent hole collapse, coat boring walls, or efficiently flush cuttings from a borehole. It is generally necessary to modify water by adding a viscosifier, such as naturally occurring bentonite clay. Bentonite clay is comprised of a number of clay minerals with the most prominent one being sodium montmorillonite, a component of many Pennsylvania soils. Bentonite is non-toxic and has a number of uses in agriculture, food preparation, pet, makeup, and industrial sectors. Releases of significant amounts of bentonite, similar to sediment, can however impact aquatic environments and if unchecked can alter them to an uninhabitable state. Bentonite is not a listed hazardous material/substance as defined by the U.S. Environmental Protection Agency. Following drilling activities, if the product is released into the environment, it can be considered an industrial waste. It should be noted however that it does not meet the criteria of a hazardous waste, as defined by the USEPA.

Some methods of TT involve circulating drilling fluid from equipment on the surface, through a drill pipe, and back to the surface through a drilled annulus. Drilling fluid returns collected at the entry and exit points are typically stored in a tank and processed through a solids control system which removes spoil from the drilling fluid, allowing the fluid to be recycled. The cleaned fluid is returned to the entrance point for reuse. The excess spoil (cuttings) and drilling fluid are transported to, and disposed of, at an approved and permitted solid waste landfill. Meanwhile as drilling progresses, the borehole is made longer and wider, so additional drilling fluid is needed, which is managed by a trained mud specialist. This specialist should continually monitor the fluid viscosity adjusting fluid composition as necessary to achieve the goals of a stable hole and efficient cutting removal.

In the borehole, the most common situation has drilling fluid returning to the drilling rig in the annular space between the borehole wall and the drill rods pushing the drill bit. At times, drilling circumstances or the conditions in the surrounding soil/geology may lead to drilling fluids escaping the boring through loose, unconsolidated soils or through any number of void-producing geologic structures. The drilling fluid may even travel along manmade subsurface features. This fugitive drilling fluid may come to the surface to upland properties and at times water resources of the Commonwealth. When this occurs, it is called an inadvertent return (IR). DEP defines an IR as an unauthorized discharge of drilling fluids to the ground surface or surface waters, including wetlands, associated with TT or other trenchless construction methodologies.

In the drilled annulus, the path of least resistance may be an existing fracture or fissure in the soil or rock substrate, or a manmade structure. When this happens, circulation can be lost or reduced. This is known as a Loss of Circulation (LOC). This is a common occurrence in the TT process that can be effectively managed/controlled during the completion of the TT. However, the environment may be impacted if the drilling fluid from a LOC is not properly managed and discharges to the surface of the ground or within a waterway or wetland.

To counter LOCs and IRs, the drilling contractor should implement numerous strategies employing drill fluid composition, drill fluid additives, drill speed, return annular pressure, and grout techniques to abate an inadvertent return situation.

3.4.1 DRILLING FLUID CONTROL

[Insert project-specific content – Standard/sample language provided below. Also see TGD Section 4.D]

The most effective way to minimize environmental impact associated with TT installations and specifically with drilling fluids is to maintain drilling fluid recirculation. Maintenance of fluid circulation is the responsibility of the TT contractor. Monitoring of drilling mud volumes, pressures, and pump rates/returns will assist in determining if significant drill mud loss occurs signaling a possible IR. The following requirements should be placed upon each TT contractor with respect to drilling fluid control:

[List here – examples provided below.]

- Instrumentation – The TT contractor should monitor the annular pressure of returns during the TT pilot hole phase of TT using an annular pressure monitor. The contractor should always provide and maintain instrumentation which accurately locates the pilot hole, measures drill string axial and torsional loads, and measures drilling fluid discharge rate. Appropriate personnel should always have access to these instruments and their readings. A log of all recorded readings should be maintained and become a part of the "As-Built" information
- Composition – The composition of all drilling fluids proposed for use should be properly documented and meet established requirements.
- Recirculation – The contractor should maintain appropriate recirculation of drilling fluid to the bore pit. The contractor should provide solids control and fluid cleaning equipment of a configuration and capacity that can process drilling fluids to the bore pit that produce drilling fluids suitable for reuse.
- Loss of Circulation – The contractor should employ its best efforts to maintain full annular circulation of drilling fluids. In the event that annular circulation is lost or significantly diminished, the contractor should take one or more of the following steps to restore circulation:
    - Stop and wait an appropriate amount of time for bentonite to swell in order to plug any minor circulation losses.
    - Clean the hole frequently by advancing and retracting the drill string in order to keep the annulus open.
    - Minimize annular pressures by minimizing fluid density consistent with hole cleaning and stabilization requirements.
    - Adjust viscosity as necessary to reduce annular pressures consistent with hole cleaning and stabilization requirements.
    - Adjust gel strength as necessary to reduce annular pressures.

- Control the balling of material on bits, reaming tools, and pipe in order to prevent a plunger effect from occurring.
- Control penetration rates and travel speeds in order to prevent a plunger effect from occurring.
- Seal a zone of lost circulation using a high viscosity bentonite plug, loss control materials, or grouting. Drilling activities should be suspended as long as necessary to allow plugs, loss control materials, or grout to cure.
- When drilling fluid flow has been suspended, re-establish circulation slowly and before advancing.

3.4.2 DRILLING FLUID DISPOSAL

[Insert project-specific content. Sample language below adapted from TGD Section 4.D]

In addition to understanding and considering the aspects and uses of drilling fluid physical properties and in managing drilling fluids, project proponents must consider the disposal of all drilling fluids. Drill cuttings could become contaminated with regulated materials which could, in some instances, cause drilling fluids or cuttings to be classified as a hazardous or special waste.

If drilling fluids or cuttings are contaminated or otherwise require disposal, the TT contractor should follow appropriate disposal requirements. As part of their due diligence in managing drilling fluids, project proponents prior to commencement of drilling activities should identify a primary disposal location and a back-up disposal location, and a documented protocol should be developed and readily available upon request.

When using drilling fluid additives other than bentonite and water, drillers should characterize the drilling fluid (drill cuttings and drill fluids) prior to disposal/reuse onsite[8] or offsite by determining constituents of material to be disposed.

4.0 IR CONTINGENCY

[Insert project-specific content. Sample language below adapted from TGD Section 4.A and G]

If an IR is observed, the TT contractor should take measures to immediately eliminate, reduce, or control the return. The actions to be taken will depend on the location and time of return, site specific geologic conditions, and the volume of the return.

4.1 GENERAL CONDITIONS

[List here – examples provided below.]

[8] Once determined, the driller may apply on-site if the drilling liquid and cuttings meets the Department's co-product determination requirements 25 PA Code §287.8: https://www.pacode.com/secure/data/025/chapter287/s287.8.html.
The definition of co-product can be found in 25 PA Code § 287.1: https://www.pacode.com/secure/data/025/chapter287/s287.1.html.

- The PPC Plan(s), which may include an IR Plan, Water Supply Plan, and Void Mitigation Plan, should be present onsite during drilling operations and made available to PADEP or CCD upon request per 102.5(l) and 78a.68a(b);
- All required permits and Material Safety Data Sheets should also be onsite and made available to PADEP per 78a.6a(d);
- PADEP should be notified at least **24 hours** prior to the beginning of each TT, or any type of bore, under waters of the Commonwealth. For Oil and Gas (O&G) activities, this notification will be made through PADEP's online Oil and Gas Reporting Electronic (OGRE) application per 78a.68a(j). The OGRE application is accessed via the DEP Greenport login in system at https://www.depgreenport.state.pa.us. For non-O&G activities, this notification will be made by contacting the appropriate DEP regional office per 91.33. (See Notifications in Section 8.0 of this PPC Plan)
- Drilling fluid additives other than bentonite and water should be approved by PADEP prior to use per 78a.68a(f). All approved or referenced TT fluid additives are listed on PADEP's web link here: http://www.dep.pa.gov/Business/Energy/OilandGasPrograms/OilandGasMgmt/IndustryResources/InformationResources/Pages/default.aspx;

- When an IR or loss of circulation is discovered, the IR or loss of circulation should be immediately reported to PADEP per 78a.68a(g) and/or 91.33. (see Notifications in Section 8.0 of this PPC Plan)

4.2 IRs IN UPLANDS

[Insert project-specific content. Sample language below adapted from TGD Section 4.A, E and G]

If an inadvertent return (IR) is identified within or nearby the TT alignment, within the adjacent uplands (an "upland IR"), then notification, containment, and cleanup should be carried out as specified in this Section. Upland IRs include "punch-out returns", which may be defined as releases of drilling fluids in uplands that occur within the TT staging area as depicted in the approved erosion and sedimentation control plan. Punch-out returns may occur for a number of reasons, for example, when the TT nears the exit point during pilot hole drilling as a result of reductions in the depth of the drill and unconsolidated soil conditions near the exit point.

The EI should be present as the containment and cleanup may need to be conducted outside of pre-approved limits of disturbance. The TT Contractor, EI and PG (as applicable) should work closely to determine the best course of action for IRs occurring within upland areas and should immediately notify appropriate personnel and agencies (Notification of PADEP and other entities is addressed in this PPC Plan). Upon occurrence of an upland IR that impacts a water supply well, results in a complaint that a water supply well has been impacted, or enters a water of the Commonwealth, drilling operations should be suspended until the procedures in Monitoring Protocol for Condition 3 are complied with.

Drilling operations should immediately be suspended following an upland IR, except if the upland IR is a punch-out return where the drilling fluid is contained within the permitted limit of disturbance and does not enter a water of the Commonwealth or impact a water supply well. The EI/PG should quantify the

upland IR, document its location, photograph the return, determine the proximity of the return to any resource(s), assess the potential to impact any resource(s), and report the incident to appropriate personnel. Information about the upland IR, should be recorded and updated as necessary as a running interim report on the data form provided in Attachment B. As appropriate, the general reporting should be submitted as "Initial", "Interim", and then "Final". The initial, interim, and final reports should comprehensively document the return from initial discovery/notification through final restoration. For prolonged periods of time prior to final restoration, the photos should be updated periodically to reflect seasonal changes on site. PADEP, the County Conservation District, the municipality, and affected landowners (private or public) should be promptly notified of the upland IR. The TT contractor should take swift and appropriate actions to contain, reduce, eliminate, or control the return.

These actions may include, as appropriate:

[List here. Examples provided below.]

- Constructing a small pit or sandbag coffer around the return point, installing a section of sediment barrier to trap as much drilling fluids as possible, and placing a pump hose in the pit to pump the drilling fluid back to the bore site or temporary holding area or vessels (i.e., vac truck);
- Reducing drilling fluid pressures;
- Adjusting the properties of the drilling fluid mixture; and/or
- Adding pre-approved loss circulation materials to the fluid mixture, as listed or referenced on PADEP's website:
- http://www.dep.pa.gov/Business/Energy/OilandGasPrograms/OilandGasMgmt/IndustryResources/InformationResources/Pages/default.aspx;

When TT operations have been suspended pursuant to this section following an upland IR, TT operations may generally resume after (1) containment of the upland IR is achieved, (2) cleanup of the upland IR has been completed, and (3) PADEP receives written notice and documentation that the IR has been contained and the cleanup has been completed.

4.3 IRs IN SURFACE WATERS OF THE COMMONWEALTH

[Insert project-specific content. Sample language below adapted from TGD Section 4.A, E and G]

If an IR is identified within wetlands, springs, seeps, streams, rivers, lakes, or any other surface water, drilling operations should be suspended[9]. During the suspension the EI should quantify the return (gallons), document its location, photograph the return, assess the potential to impact to the resource(s), and report the incident to appropriate personnel. Information about the return should be recorded and updated as necessary on the data form provided in Attachment B. Each form should be updated as new information is learned about the return and as activities to restore the area occur. The general reporting should be "Initial", "Interim", and then "Final". The initial, interim, and final reports should

[9] See Section 3.3 of this PPC Plan regarding the surfacing of groundwater related to construction activities in an area other than the entry or exit pits

comprehensively document the return from initial discovery/notification through final restoration.

NOTE: All IRs in wetlands, springs, seeps, streams, rivers, lakes, or any other surface water, regardless of size, are considered a violation of the PA Clean Streams Law and should be reported to PADEP and other appropriate agencies.

Containment, clean-up, and restoration activities that would require the installation of construction matting, placement of materials in the wetland or waterway, or the entry of construction vehicles and equipment are not authorized without prior PADEP/USACE approval.

If mechanical methods are needed to facilitate containment, clean-up, and restoration, then the following procedures should be followed:

[List here. Examples provided below.]

- Draft containment and restoration plan, outlining the limits, types, and duration of disturbances, should be submitted to the PADEP/USACE for review and approval.
- Appropriate aquatic resource encroachment permits should be applied for depending on levels and types of disturbances required to clean up the material.
- Approved activities should only be implemented under the close, full-time supervision of the assigned EI.
- Drilling operations should only resume once the return is contained and successfully recovered and DEP given the opportunity to provide approval of restart in accordance with Monitoring Protocol for Condition 3. The return area should continue to be monitored during the daily inspection.

Ceasing operations completely during pipe pullback can present special situations threatening completion of the pipe necessitating drilling a new boring through what may have been a highly difficult subsurface environment. Therefore, an exception to ceasing operations, with DEP's consent, can be due to an inadvertent return during pipe pullback operations. To avoid delays, it is expected that the project proponent appropriately plans(s) for such contingencies to enable the Department to grant prior approval, where possible. If during-permitting analysis indications are that inadvertent returns will be unavoidable during pipe pull back, planning for that contingency should be clearly laid out in the application and PPC plan. During situations where persistent inadvertent returns during drilling and reaming operations are apparent, the permittee should contact the Department and propose a special contingency plan detailing measures to deal with anticipated inadvertent returns prior to beginning pull back operations.

4.4 CONTAINMENT AND CLEAN-UP MATERIALS AND EQUIPMENT

[Insert project-specific content. Sample language below adapted from TGD Section 4.A and G]

The TT contractor should have the necessary containment and clean-up equipment on-site, at the boring location and readily available for use. At a minimum, a combination of some or all the following material and equipment should be on site and in ample supply depending on the extent of sensitive areas:

[List here. Examples provided below.]

- Spill sorbent pads and booms
- Compost filter socks
- Straw bales (certified weed-free)
- Wood stakes
- Sand bags
- Sediment barriers (Silt fence, compost filter socks, etc.)
- Plastic sheeting
- Corrugated plastic pipe
- Shovels
- Push brooms
- Centrifugal, trash and sump pumps
- Vacuum truck
- Rubber tired or wide track back hoe
- Bobcat (if needed)
- Storage tanks (if needed)
- Floating turbidity curtain (prior approval required - may be considered for use on large streams)
- Timber Mats (enough to cross 50% of the wetland length need to be readily available)

If necessary, a 24-hour outside emergency response company may be called in for assistance.

4.5 RESPONSE TO WS INCIDENT

[Insert project-specific content. See Section 5.0 of this PPC Plan – if applicable]

4.5 RESPONSE TO IRs IN BOG TURTLE AREAS

[Insert project-specific content. See Section 6.0 of this PPC Plan – if applicable]

4.6 RESPONSE TO VOIDS

[Insert project-specific content. Sample language below adapted from TGD Section 4.A and G]

In response to drilling activities that encounter unanticipated underground voids, the following steps should be taken. The operation should be suspended until a professional engineer/geologist investigates the site subsurface in order to specifically develop a solution or to recommend another method of proceeding. Please note that this process can be time intensive as any action approved in these areas need to be protective of both the resources of the Commonwealth and the health and safety of the citizens of Pennsylvania and their property. The PPC plan should clearly discuss how this will be addressed.

5.0 SPECIAL WATER SUPPLY PROCEDURES [IF APPLICABLE]

[Insert project-specific content – Standard/sample language provided below. Please review the TGD for further details]

This section describes the methodology used to identify existing water supplies (i.e., private groundwater wells, public groundwater wells, and private water supply intakes) in relation to the project areas and presents a summary of the existing environment regarding these water supplies.

Next, this section provides an evaluation of the risks to the types of water supplies and outlines the prevention, preparedness, and contingencies regarding the potential impacts to those supplies.

Private and public water supplies have the potential of being impacted by hazardous material spills and alteration of aquifer conditions during any of the project activities including:

[List here – example provided below.]

- Open trenching and grading activities through karst terrain and mining areas have the potential to expose voids acting as conduits to groundwater which can introduce contaminants to groundwater sources.
- Construction and installation of block valves and pump/compressor station.
- Unanticipated encounters with contaminated soil may also threaten water resources and supplies.
- Additional risks to private and public water supplies may result from the activities associated with the TT method of pipeline installation, specifically, the use of drilling fluids during the drill process.
- Hydrostatic testing may require the use of and discharge to public water supply surface waters.

For this project, all landowners are to be identified with a private water supply within 450 feet of a TT alignment (1000 feet in Karst Areas) or water suppliers with a public well within ½ mile or a water supply intake within 1 mile downstream. These entities will be contacted within 15 days of commencement of TT operations (See Notifications in Section 8 of this PPC Plan)

5.1 PUBLIC AND PRIVATE OWNER CONSULTATIONS

[Insert project-specific content. Please review the TGD for further details.

5.2 PROCEDURES

[Insert project-specific content – Standard/sample language provided below. Please review the TGD for further details.

Prior to the start of any TT in a particular location, all landowners with a private water supply source located within a minimum of 450 feet (a minimum of a 1000 feet in Karst areas or areas underlain by carbonate bedrock) from the TT alignment should be offered an alternative temporary water supply (e.g., water buffalo with potable water adequate for purposed served) that should be installed and maintained, at project proponent's expense, for the entire period of the TT.

Installations should be approved as required with local zoning/building ordinances.

If a landowner who had not previously been connected to a temporary water supply reports a complaint of an impact to his or her water supply, the project proponent should immediately respond to the complaint and promptly provide the landowner with bottled drinking water. Temporary alternative water supply should be provided at the project proponent's expense until the impacted water supply is restored or replaced to the satisfaction of the property owner.

For each landowner with a private water supply located within **450 feet** (**1000 feet** in Karst areas) from the TT alignment, the project proponent should offer to collect water supply samples, before during and after the TT, at the project proponent's expense. Sampling should address quantity (yield) (unless the well is not accessible) and quality of the existing source. Once available, sampling results should be made available to PADEP within 24 hours of a request by PADEP for the results. If any impact to a private water supply attributable to pipeline construction is identified after post-construction sampling, the project proponent should restore or replace the impacted water supply to the satisfaction of the private water supply owner.

5.2.1 Response to Water Supply Complaints

[Insert project-specific content – Standard/sample language provided below. Also see examples on DEP's Pipeline Portal such as ME2 Water Supply PPC Plan or ASR Well & Spring Monitoring Plan.]

If an impact occurs on the groundwater supply or the water quality as a result of construction, the project proponent will work with the landowner to ensure a temporary supply of water, and if necessary, replacement of permanent water supply. Mitigation measures will need to be coordinated with the individual landowner in order to meet the landowner's specific needs

[List here – example provided below.]

- Any water supply complaints received that may be related to TT or related construction operations will be reported to PADEP per 91.33. For O&G activities, this should be done in accordance 78a.68a(j).
- Potable water should be supplied to affected users until the situation is resolved.
- Water quality and quantity re-sampling should be conducted to determine the extent of impact and help determine remedial actions, if any.
- All complaints received regarding water well yield or quality should be tracked and documented, including the results of any water quality or yield testing that was performed, and how the complaint was resolved.

6.0 SPECIAL BOG TURTLE (BT) AREA PROCEDURES [IF APPLICABLE]

[Insert project-specific content – Standard/sample language provided below]

Following final consultation with the USFWS, the bog turtle (*Glyptemys muhlenbergii*), a federally threatened species, has been identified along the construction corridor for this project. (**REFERENCE ANY CORRESPONDENCE HERE)** This has resulted in the

identification of **[LIST HERE LOCATIONS WHERE BOG TURTLE CONCERNS HAVE BEEN IDENTIFIED**] that would require special bog turtle IR procedures. In accordance with USFWS final determination letter, the following procedures including pre-construction and during construction procedures, should be followed to ensure no bog turtles are negatively impacted and outlines a contingency plan for IRs for special concern area(s).

The primary potential environmental impact associated with TT revolves around the use of drilling fluids. IR of drilling fluids is a potential environmental concern in general and is of concern to the USFWS regarding potential impacts to bog turtles. The purpose of this IR Plan is to present a plan to further minimize potential impacts to bog turtles associated with all phases of the TT process, in particular in the event of an IR. The goal of this plan is to avoid impacts to the bog turtle. The objectives to carry out this goal are:

[List here. Examples provided below.]

- List known or potential bog turtle habitats.
- Ensure that project work areas and wetlands are clearly defined on engineer approved project plans.
- Ensure all construction contractors are appropriately trained on the identification of this species and its biology, the notification procedures, and implementation of this contingency plan.
- Ensure bog turtle wetlands/areas are marked onsite prior to construction and that all work areas are appropriately defined (e.g., staked) according to project plans.
- Ensure bog turtle wetlands/areas are sealed off/protected from construction activities.
- Provide daily inspection of contractor activities to ensure compliance with project work plans.
- Provide daily inspection of the TT alignment and adjacent areas for timely detection of IRs.
- Ensure all appropriate notifications are made to the USFWS, United States Army Corps of Engineers (USACE) and PADEP, and all other applicable regulatory agencies in a timely manner and that all required documentation is completed as identified in this document.

6.1 PRE-CONSTRUCTION ACTIVITIES RELATED TO BOG TURTLE

[Insert project-specific content – Standard/sample language provided below.]

All construction, including professional survey personnel should be trained on implementation of this plan, the identification of this species and its biology, and the location of the areas of concern. All construction personnel, Environmental Inspector (EI), and onsite bog turtle Specialist (BT Specialist)[10] should be provided with the necessary project plans, mapping, permits, authorized impacts, clearance letters, conservation plans, and this contingency plan prior to the start of construction activities.

[10] A BT Specialist is defined as an individual holding a Pennsylvania Fish and Boat Commission a Scientific Collector's Permit, and a Special Permit to survey for and handle bog turtles species pursuant to 58 PA Code 75.4

To reduce the risk of unintentional impacts to bog turtles and their habitats, a BT Specialist should inspect the surveyed (e.g. staked) entrance and exit locations and access roadways associated with the TT prior to disturbance to ensure that they are not sited in bog turtle habitat and in accordance with project plans. In addition, the boundary of the bog turtle habitat nearest to the work areas should be temporarily marked to ensure no activities are unintentionally conducted within bog turtle wetlands and work is restricted to approved work-spaces. Under the direction of the BT Specialist, sediment barrier should be installed between wetlands and work areas to also prevent bog turtles from entering construction work spaces. Under the direction of the BT Specialist, some areas of herbaceous vegetation may require clearing so that inspection of the area for bog turtles can be made easier.

6.2 CONSTRUCTION ACTIVITIES FOR BOG TURTLE

[Insert project-specific content – Standard/sample language provided below.]

All procedures implemented by the drilling contractor discussed previously in this contingency plan to reduce the potential for, identification, and notification of IRs should be implemented at all TTs. At the potential bog turtle locations, inspection of the work areas and compliance with the project plans should be carried out daily by the BT Specialist. In addition, when drilling commences the BT Specialist should inspect all disturbed upland areas and sediment barriers multiple times for bog turtles and IRs. In addition, each wetland should be inspected once-daily for the occurrence of IRs, including the surfacing of ground water by the BT Specialist. These inspections should continue until drilling is completed and the IR risk in the wetlands has been removed.

6.3 BOG TURTLE OBSERVATIONS AND HANDLING

[Insert project-specific content – Standard/sample language provided below.]

Construction personnel should be trained to report all turtle observations to the EI immediately upon siting. All bog turtle observations that are not in harm's way should be documented within project logs and reported to the USFWS/ USACE/ PADEP within the final report. Documentation should include dates, times, photographs, and behavior. Additional, protection measures should be considered depending on where bog turtles are observed in relation to project areas. Bog turtles observed in harm's way should be handled by the BT Specialist assigned to the area and only if handling is determined necessary to remove the risk of injury or death. Other project personnel may be allowed to move turtles small distances, but only in cases of immediate danger. Otherwise steps to passively remove the threat and allow the turtles to continue normal behavior may be determined to be the best course of action. Bog turtles should only be moved to an area within the same wetland, only to a distance necessary to remove the threat. Additional sediment barrier installation may be required in the area to prevent turtles from returning to areas that presented the threat. Removal or relocation of the construction activity in that particular area should also be considered if practicable to completing the drill. Any bog turtles found within harm's way should be reported to the USFWS immediately as an incident and how it was handled.

6.4 RESPONSE TO INADVERTENT RETURNS IN BOG TURTLE AREAS

[Insert Content – Sample language provided below.]

See Section 4.0 for IR Contingencies outside of Bog Turtle Areas. For IRs that occur in the vicinity of known bog turtle habitat, see additional response protocols to follow below.

6.4.1 Inadvertent Returns in Bog Turtle Wetlands/ Streams

[Insert Content – Sample language provided below.]

If an IR is identified within bog turtle wetlands and/or streams, drilling operations shall be temporarily suspended to allow the EI and BT Specialist to appropriately quantify the IR, document its location, photograph the IR, assess the potential to impact to the resource(s), and report the incident to the project proponent. Information about the IR should be recorded and updated as necessary as a running report on the data form provided in Attachment B. The project proponent is responsible for completion of the data form with the assistance of the EI, BT Specialist, and environmental compliance contractor. Each form should be updated as new information is learned about the IR and as activities to restore the area occur. The general reporting should be "Initial", "Interim", and then "Final". The initial, interim, and final reports will comprehensively document the return from initial discovery/ notification through final restoration. **Containment, clean-up, and restoration activities that would require the installation of construction matting, placement of materials in the wetland or waterway, or the entry of construction vehicles and equipment are not allowed without prior PADEP/ USACE/ USFWS approval.** If upon reporting the incident, and under further consultation with the agencies, the IR is determined to be significant enough to warrant containment, clean-up, and restoration via mechanical methods, then the following procedures should be followed:

[List here. Examples provided below.]

- Draft containment and restoration plan, outlining the limits, types, and duration of disturbances, should be submitted to the PADEP/ USACE/ USFWS for review and approval.
- Appropriate aquatic resource encroachment permits should be applied for depending on levels and types of disturbances required to clean up the material.
- Approved activities would only be implemented under the close, full-time supervision of the assigned EI.
- Drilling operations may resume when the IR is contained and successfully remediated. The IR area should continue to be monitored during the daily inspection.

With prior DEP authorization, one exception to ceasing drilling operations would be a return of drilling fluids during the pipe pullback process. Ceasing operations would pose significant risk of causing the pulled pipe to be stuck and not able to resume.

7.0 OTHER SPECIAL AREA PROCEDURES [IF APPLICABLE]

[If applicable, insert project-specific content]

8.0 NOTIFICATIONS

[Insert project-specific content – Standard/sample language provided below.]

- **Commencement of TT or Bore:** Notify PADEP at least **24 hours** prior to the beginning of each TT, or any type of bore, under waters of the Commonwealth as to the anticipated date of commencement. For Oil and Gas projects, this notification will be made through PADEP's online Oil and Gas Reporting Electronic (OGRE) application. The OGRE application is accessed via the DEP Greenport login in system at https://www.depgreenport.state.pa.us. All other projects will notify the appropriate DEP regional office. (see contact list)
- **Pullback:** Notify PADEP at least **24 hours** prior to commencing pullback at any TT site as to the anticipated date of commencement.
- **Impact to Water Supply:** Notify PADEP with immediate verbal notification of any citizen complaint it receives of an impact to a private or public water supply upon becoming aware of an impact to a private or public water supply, and when an alternate water supply is provided. This notification includes a detailed description of the incident using the best currently available information which, for Oil and Gas Projects, should also be reported to PADEP's online Oil and Gas Reporting Electronic ("OGRE") application within **24 hours**. The OGRE application is accessed via the PADEP Greenport login in system at https://www.depgreenport.state.pa.us.
- **Inadvertent Returns:** When an IR is discovered (regardless of whether the IR is to uplands or waters of the Commonwealth), PADEP should be provided with immediate verbal notification and within **24 hours** reported to the County Conservation District, the municipality in which the IR occurred, any landowners affected by the return, and public water suppliers with an identified well source located within ½ mile of the TT alignment, public water intakes located within 1 mile downstream, and every landowner with a private water supply located within **450** feet of the TT alignment (**1000** feet in Karst areas). IRs occurring in or flowing into waters of the Commonwealth also require notification to the Pennsylvania Fish and Boat Commission, U.S. Army Corp of Engineers. If necessary for emergency response or remedial activities within DEP regulated areas, an emergency permit may be sought from the pertinent DEP office under § 105.64 (relating to emergency permits).
- **Loss of Circulation:** When a loss of circulation is identified, PADEP should be provided with immediate verbal notification and within 24 hours reported to identified public water suppliers with a well source located within ½ mile of the TT alignment and every landowner with a private water supply located within **450** feet of the alignment (**1000** feet in Karst) that a loss of circulation occurred and that their water supply may be impacted.
- **Groundwater:** When trenchless construction activities result in the surfacing of groundwater (other than at the entry or exit pit where the volume of water does not exceed the volume of water being used for trenchless construction), DEP should be immediately notified and within **24 hours** reported to identified public water suppliers with a well source located within ½ mile of the trenchless construction alignment and every landowner with a private water supply located within **450** feet of the alignment (**1000** feet in Karst Areas) that a surfacing of groundwater occurred and that their water supply may be impacted.
- **Interception of Mine Pool/Mine Seeps:** When trenchless construction activities intercept a mine pool or a mine seep, DEP should be immediately notified.

[IDENTIFY RESPONSIBLE PARTY WITHIN THE COMPANY] will be responsible for the notifications described below of all returns occurring in or flowing into aquatic resources.

The notifications will initially be via phone to the PADEP Emergency Response numbers listed below and then to the appropriate agency personnel via submittal of an initial IR data form located in Attachment B. Within one (1) business day of verbal notification of an IR, PADEP should be provided with an initial written report regarding the IR.

The Pennsylvania Clean Streams Law regulations require that when any pollutant discharged into surface or groundwater, including sewers, drains and ditches, the person spilling the substance or the person owning the premises from which the substance is spilled should notify PADEP immediately. Therefore, for all IRs in aquatic resources, DEP should be immediately notified using the appropriate PADEP regional emergency number upon discovery:

[LIST PERTINENT AGENCIES AND SPECIFIC CONTACT INFO]

- PADEP
- PFBC
- USACOE
- USFWS (if Bog Turtles or other threatened or endangered habitat that is affected)
- Local agencies and municipalities who are downstream users of water, as applicable]

Following notification to the appropriate emergency/regulatory numbers, notification should be made to the below listed individuals utilizing the IR form. This will consist of the initial reporting of the return, open consultation and further reporting to the PADEP/USACE regarding the IR. When necessary, further consultations should be held regarding remediation approval, restoration approval, and the need for appropriate approval/permits. The IR data form will be used to document the consultation and approvals and report final remediation/ restoration.

After submission of the initial written report, DEP should be provided with weekly interim written reports regarding any IR until a final report is submitted. The interim and final reports should be submitted on forms approved by the Department.

PPC PLAN ATTACHMENT A
Trenchless Technology (TT) Table

TT Crossing Identifier	Aquatic Resource Crossed	County	Municipality	Travel and Clearing LOD or Travel LOD (Identify)	EV Wetland (Y/N)	Bog Turtle Occupied Wetland (Y/N)

PPC PLAN ATTACHMENT B

Inadvertent Return Report - Data Form

4163 **INADVERTENT RETURN REPORT – DATA FORM**

Report Date:				**HDD Alignment No.**			
Project Site:				**HDD Company**			
Date and Time when IR was discovered				**Date:**		**Time:**	
Location: Street				**Munic:**		**County:**	
LAT: Decimal		**LONG: Decimal**		**From Station:**		**To Station:**	
DEP Permit Nos (102 and 105)							
Corps Permit No.							
IR Tracking ID							
Name of EI and/or PG							

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4165 **I. BACKGROUND INFORMATION**

4166

A.	**NAME OF ALL PERSON(S) PROVIDING INFORMATION FOR THIS REPORT AND CONTACT INFORMATION**		
B.	**MATERIAL(s) RELEASED:**		
C.	**DESCRIPTION OF THE RELEASE:**		
D.	**ESTIMATED QUANTITY OF MATERIAL RELEASED:**		
E.	**ESTIMATED AERIAL EXTENT OF MATERIAL RELEASED:**		
F.	**HAS IR BEEN CONTAINED WITHIN THE LIMIT OF DISTURBANCE? (Provide dates and times)**	Y/N	Note:
F1	**WHAT REVISIONS TO DRILLING WERE IMPLEMENTED PRIOR TO RESUMPTION OF DRILLING?**		
G.	**T&E / BOG TURTLE AREA:**	Y/N	Note:
H.	**TROUT STREAM**	Y/N	Note:
I.	**EV WATER**	Y/N	Note:
J.	**EV WETLAND**	Y/N	Note:
K.	**ANY DOWNSTREAM IMPACTS**	Y/N	Note:

	(If yes, describe) **Public? Private?**		
K1	**Did a fish kill occur? (Provide dates & times)**	Y/N	Note:
K2	**Has the substrate been coated?**	Y/N	Note:
K3	**Were any water supplies impacted? (Provide dates and times)**	Y/N	Note:
K4	**If water supplied were impacted, were the owner of the water supplies notified? Has anything been provided to the owners of the impacted water supplies? (Provide dates and times)**	Y/N	Note:

II. VERBAL NOTIFICATIONS

PADEP EMERGENCY NOTIFICATION:	WHO MADE CALL ON BEHALF OF PERMITTEE?:	
PHONE NUMBER CALLED:		
DATE:		
TIME:		
PERSON CALLED:		
V/M?		Note:
COUNTY CONSERVATION DISTRICT NOTIFICATION:	WHO MADE CALL ON BEHALF OF PERMITTEE?:	
PHONE NUMBER CALLED:		
DATE:		
TIME:		
PERSON CALLED:		
V/M?		Note:
USACE REGULATORY NOTIFICATION:	WHO MADE CALL ON BEHALF OF PERMITTEE?:	
PHONE NUMBER CALLED:		
DATE:		
TIME:		
PERSON CALLED:		
V/M?		Note:
FISH AND BOAT COMMISSION NOTIFICATION:	WHO MADE CALL ON BEHALF OF PERMITTEE?:	
PHONE NUMBER CALLED:		
DATE:		
TIME:		
PERSON CALLED:		
V/M?		
OTHER EMERGENCY NOTIFICATIONS	WHO MADE CALL ON BEHALF OF PERMITTEE?:	
PHONE NUMBER CALLED:		

DATE:		
TIME:		
PERSON CALLED:		
V/M?		Note:

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LIST ANY NOTIFICATION OF INCIDENT MADE TO WATER INTAKES, WATER WELL OWNERS AND LANDOWNERS							
Name:		Date:		Time:		Public or Private	Note:
Name:		Date:		Time:		Public or Private	Note:
Name:		Date:		Time:		Public or Private	Note:
Name:		Date:		Time:		Public or Private	Note:

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4172 **III. ACTIONS TAKEN/FOLLOW UP**

4173

IMMEDIATE ACTION TAKEN:						
A.	**When did the release occur?**					
B	**Volume of IR (gallons)**					
B1.	**Does this volume represent the total released from the beginning?**					
B2.	**Estimated areal extent of IR.**					
B3.	**Extend of downstream release, if any. (feet)**					
C.	**What is the duration of the IR?**					
D.	**Date and Time of cessation of drilling.**	**Date:**		**Time:**		**Note:**
	Was drilling resumed?	**Y/N**	**Note:**			
E1	**If so, what was the technical basis for resuming drilling?**					
E2	**If so, has the release continued or another release occurred?**	**Y/N**	**Note:**			

CORRECTIVE MEASURES SUMMARY:				
A.	**Was the IR ceased?**	**Y/N**	**How and when?**	

A1	**If so, what modifications to the HDD process were used?**			
B.	**Was the IR contained?**	**Y/N**	**How and when?**	
C.	**Was the drilling fluid recovered"**	**Y/N**	**How and when?**	
D.	**Was drilling resumed?**	**Y/N**		
D1	**If so, what modifications to the drilling process were used?**			
D2	**If so, has another release occurred?**	**Y/N**		
E.	**Describe root cause(s) of IR**			
F.	**Have impacts been remediated?**			
F1	**If so, date of remediation.**			

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	MAP:	**SEE ATTACHED**
	PHOTOGRAPH(S):	**SEE ATTACHED**

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IV. PHOTO DOCUMENTATION

PHOTO NUMBER	Comments:
PHOTO NUMBER	Comments:
PHOTO NUMBER	Comments:
PHOTO NUMBER	Comments:

Printed Name, Title and Signature of Person(s) Submitting this Report

_____ _____

Name **Title**

_____ _____

Signature **Date**

APPENDIX F
EXAMPLE NOTIFICATION LETTER AND WELL CONSTRUCTION QUESTIONNAIRE

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Example of Notification Letter for Well Access

RE: Well Testing and Sampling Access Request; HDD PROJECT DESCRIPTION

To Whom It May Concern,

[PROJECT PROPONENT] is writing to inform you that a certain construction activity known as Horizontal Directional Drilling (HDD) for the [PROJECT NAME/DESCRIPTION] is located at least within [450 OR 1000 FEET] of your property boundary. HDD activity includes construction site work to set-up HDD equipment and operations (e.g., tree felling, grading, erosion and sediment controls) and HDD drilling, reaming and pipe pullback activity.

Our records indicate that you may own a nearby well or water supply. As such, your interests are served by allowing us to collect well construction and operation information from you, as well as flow rate, water level and water quality data from your well prior to the HDD activity. If you agree we ask that you complete, to the best of your ability, the attached questionnaire, and authorize us to access your property for the purpose of locating your well with GPS and performing well testing and sampling.

Your voluntary cooperation would allow us to detect effects on your well from the HDD activity, if any, and to recommend mitigating and/or corrective measures as may be appropriate. Our methods simply involve reviewing the questionnaire, corresponding with you, and then visiting the property for the purpose of locating the well with GPS, and recording the water level and flow rate of your well while pumping the well for 30 minutes (i.e., a specific capacity test). We also would collect water samples for water quality analysis. The work and the results will be provided at no cost to you. Data also will be made available to the Pennsylvania Department of Environmental Protection.

We expect to coordinate with you in advance of site visits to facilitate testing and sampling at the following times: before the start of HDD activity, at the end of HDD activity and during the HDD activity if warranted. It remains possible that work could continue into the future should unforeseeable or unavoidable delays so dictate or multiple HDD activity mobilizations occur.

We do not anticipate that you will encounter problems because of your participation in this program. Nevertheless, should our work in your well result in impacts to your water quality or quantity, corrective measures will be undertaken as soon as possible at no cost to you.

We hope you will choose to participate; please call us immediately at [PROPONENT PHONE NO.] if this is your decision. Please then follow-up by completing the questionnaire and signing and dating below and returning a copy to us verifying permission to access your property on a periodic basis before, during and at the conclusion of the HDD activity for the purpose of performing the work described above. For your added convenience, feel free to fax the questionnaire and signed letter to [PROPONENT MAILING ADDRESS] or email a scanned version to [PROPONENT EMAIL ADDRESS]. Should you have any questions or require additional information regarding this voluntary testing and sampling program, please contact our office. Thank you in advance for your cooperation.

Sincerely,

[PROJECT PROPONENT SIGNATURE]

By my signature below, I represent that as an authorized owner and/or operator of this property, I give [PROJECT PROPONENT] permission to access my property and well for the purpose of collecting GPS, water quality and/or groundwater data as indicated herein. I understand that [PROJECT PROPONENT] plans to perform this work beginning on my authorization and continuing through [DATE], and that measurements may be made periodically throughout the HDD activity period. I also authorize [PROJECT PROPONENT] to make regulatory notifications required by permit or law.

_____

Property Owner Signature Date Daytime Tel No. Evening Tel. No. Email

cc:

Owner Questionnaire and Well Construction Details

Owner Questionnaire and Well Details HDD Project _____

OWNER / TENANT INFORMATION

Owner Name_____ Mailing Address_____
Business/Facility Name_____ City_____State____Zip_____
Premises Address_____ Is this a Primary Residence (Y/N)? Is this a Rental Unit (Y/N)?
City_____State___Zip_____ Tenant Name_____
Day Phone_____Evening Phone_____ Tenant Phone _____
Owner Email_____ Tenant Email _____

WELL CONSTRUCTION INFORMATION (please provide details to best of your ability and leave unknowns blank)

Location Details (e.g. front of house, etc.)_____ GPS Coordinates _____Lat_____Long
_____ Well Depth (feet)_____Well Diameter (inches)_____
Construction Date _____ Casing Type (circle): Concrete, Plastic, Steel, Other
Use for Water (circle): Residential, Irrigation / Livestock, Casing Depth (feet)_____ Was Well Grouted (Y/N)
Industrial, Public Supply, Monitoring, Screen Finish (circle): Steel, Plastic, Open Hole, Other
Geothermal, Dewatering, Other _____ Screen from top _____(feet) to bottom_____(feet)
Install Method (circle): Hand Dug, Bored / Augered, Water Bearing Zone(s) _____(feet)_____(feet) _____(feet)
Cable, Air Percussion, Other _____ Well Blown Yield (gallons per minute) _____
Is This a Replacement Well (Y/N)? Unsuccessful Drilling Attempts (Y/N)? If Yes (quantity)_____

QUESTIONNAIRE (please provide details)

1. When was the last time the well / spring had work completed on it (date and reason)?
2. Was the well / spring pump ever replaced (date and reason)?
3. Have you ever had water quality problems (when, what were they, how were they fixed)?
4. Have you had problems with yield (when, what were they, how were they fixed)?
5. Have you ever had problems with your well or water during a drought?
6. Does your water change color when it rains?
7. Do you ever smell anything odd from your water or your well?
8. Is your water conditioned or treated (type, location)? Is there point-of-use treatment (type, location)?
9. Is there an outdoor water sampling tap (type, location)?
10. Is there a septic system and where is the septic system in relation to the well / spring / building / facility?
11. Check if applicable regarding on-site well (a check YES may mean well is inaccessible for GPS or water level measurements):
    - ❑ Located where an un-tethered dog has access
    - ❑ Well is buried underground or located in a basement, pit, or other area with limited access
    - ❑ Excessive rust is on the outside or inside of the well casing
    - ❑ Well casing is less than 6 inches in diameter
    - ❑ Well cap is welded shut or cap has rubber, caulking or other material watertight seal
    - ❑ Well cap bolts are rusted shut or broken off the well head
    - ❑ Well cap is loose or completely off the casing
    - ❑ Inside the well, there are open, broken or frayed wires
    - ❑ Excessive rusting or material that may be knocked loose into the well is inside the well casing
    - ❑ Other (e.g. insects / nests)_____

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APPENDIX G
EXAMPLE OF STANDARD BORING LOG

DATE STARTED:		**DRILL COMPANY:**	
DATE COMPLETED:		**DRILLER:**	**LOGGED BY:**
COMPLETION DEPTH	145.0 ft	**DRILL RIG:**	
BENCHMARK:	N/A	**DRILLING METHOD:**	Casing/Rock Coring
ELEVATION:	N/A	**SAMPLING METHOD:**	2-in SS1.874-in Core
LATITUDE:	n/a°	**HAMMER TYPE:**	Automatic
LONGITUDE:	n/a°	**EFFICIENCY**	N/A
STATION:	N/A **OFFSET:** N/A	**REVIEWED BY:**	

REMARKS:

BORING B-##

Water
- While Drilling — 8 feet
- Post-Core — 14.6 feet

BORING LOCATION:
See Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) RQD & Recovery % (NX)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ / Moisture × / PL ◪ / LL ✚ (0–25–50) / STRENGTH, tsf ▲ Qu ✳ Qp (0–2.0–4.0)	Additional Remarks
	0			S-1	1	**FILL**-Dark gray-brown, SILT with Sand, trace organics and woody matter, moist	ML	1-3-6-50/4" N=9	31		
						Possible FILL-Diabase Boulder, Light gray to dark gray, Fine to medium grained, very hard					
				R-1	16	**Possible FILL**-No recovery within this stratum		RQD=24 Rec=32%		>>◎	
	5			S-2	0			4-4-11-12 N=15			
				S-3	24	**RESIDUUM**-Stiff, Brown, Sandy Silty CLAY with Gravel, moist/wet	CL	9-5-6-7 N=11	18	◎ ◪	LL = 24 PL = 18
	10										
						DIABASE-Light gray to dark gray, Fine to medium grained, Slightly Weathered, slightly broken to massive, very hard				>>▲ Q_u = 1837.1 tsf	189.8 pcf
	15			R-2	56			RQD=86 Rec=94%			2 min. 2 min. 3 min. 3 min.
										>>▲ Q_u = 1141.5 tsf	188.8 pcf
	20			R-3	78			RQD=93 Rec=93%			2 min. 2 min. 2 min. 2 min. 2 min. 2 min. 2 min. 2 min. 2 min. 2 min.
	25										
	30					*Continued Next Page*					

Name

Address
Telephone:

PROJECT NO.:
PROJECT:
LOCATION:

The stratification lines represent approximate boundaries. The transition may be gradual.

Sheet 1 of #

APPENDIX H
EXAMPLE LETTER CONVEYING WATER QUALITY RESULTS AND NOTIFICATION OF EPA MAXIMUM CONTAMINANT LEVEL (MCL) EXCEEDANCES

Date

_____

_____

_____

RE: Well Water Quality and Flow Rate Testing – <Property Owner(s)> Well

Introduction

On <Date>, <Entity>collected a water quality sample from a residential water well owned by <Property Owner(s)>. The residential water well was located on the property at an approximate address of 123 Main Street, Harrisburg PA 17112 (approximate *Latitude: 39.1234º, Longitude: -76.1234º*). The sections below provide details specific to the water well water quality sampling and/or testing performed on the aforementioned water well.

Water Well Water Quality Sampling and Testing

<Entity> collected the water well water quality sample from the <Property Owner(s)> water well on <Date>, around 09:30 AM. EST. The water sample was collected from the following location on the property (Picture shown in Attachment B): Spigot on rear side of house next to garage door. The collected water sample was stored in sample bottles, which were further stored in a cooler with loose ice. The sample bottles and cooler were provided to <Entity> by <Laboratory>. <Laboratory>, the third-party testing laboratory used by <Entity> to complete the water well water quality testing. Once collected, the water well water quality samples were transported by <Entity> personnel to <Laboratory>located at <Address>.

As requested by <Entity>, the following water quality tests were performed by <Laboratory>:

Total Coliforms	Calcium	Benzene	Potassium
E. Coli	Magnesium	Ethylbenzene	Boron
Nitrate	Sodium	Toluene	Chloride
Nitrite	Zinc	Total Xylenes	Sulfate
Fluoride	Arsenic	Ethane	Total Hardness
Iron	Barium	Ethylene Glycol	Turbidity
Manganese	Chromium	Methane	Specific Conductance
Total Dissolved Solids	Lithium	Propane	Total Suspended Solids
pH	Selenium	Alkalinity	
Total Petroleum Hydrocarbon	Vanadium	Copper	
Aluminium	Bromide	Strontium	

The results of the water quality tests are provided in Attachment A.

These water quality test results have been compared to the Environmental Protection Agency's (EPA's) Primary Drinking Water Regulations and Secondary Drinking Water Standards (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations). The EPA's Primary Drinking Water Standards establish maximum contaminant levels to protect public health against the consumption of drinking water contaminants which may present a risk to human health. Secondary Drinking Water Standards are water quality guidelines for aesthetic considerations such as taste, color, and odor that do not present a risk to human health.

A complete list of results and the corresponding EPA primary and secondary standards is included in the attached table for reference (see Attachment A). Additionally, in Attachment A, we have provided a comparison which shows the test results meet EPA's standards with the following exceptions:

- Well 1
    - pH
    - Total Hardness
    - Specific Conductance

Please note the samples were not tested for the entire list of EPA primary and secondary drinking water standards but were tested for the constituents as required by the Federal Energy Regulatory Commission's (FERC) permit to <Entity>.

Water Well Flow Testing

The water well flow test consisted of measuring the flow of water at the water well over a 10 minute period by pumping the water (with the existing pump within the water well) through a Pulsafeeder In-Line Water Flow Meter. The Pulsafeeder In-Line Water Flow Meter conforms with American Water Works Association (AWWA) Standard C-708 and is rated for a maximum flow of 30 gallons per minute. For the test procedure, water was pumped through the flow meter for a period of 10 minutes and water flow readings were collected at 1-minute increments. In total, the average flow rate measured for the water well was as follows:

- Well 1: 2.5 gallons per minute

If you have any questions or need additional information, please don't hesitate to contact us at <Contact Info>.

Sincerely,

Attachments: Attachment A - Water Quality Test Results
Attachment B – Well Photo

Attachment A

Water Quality Test Results from <Laboratory>

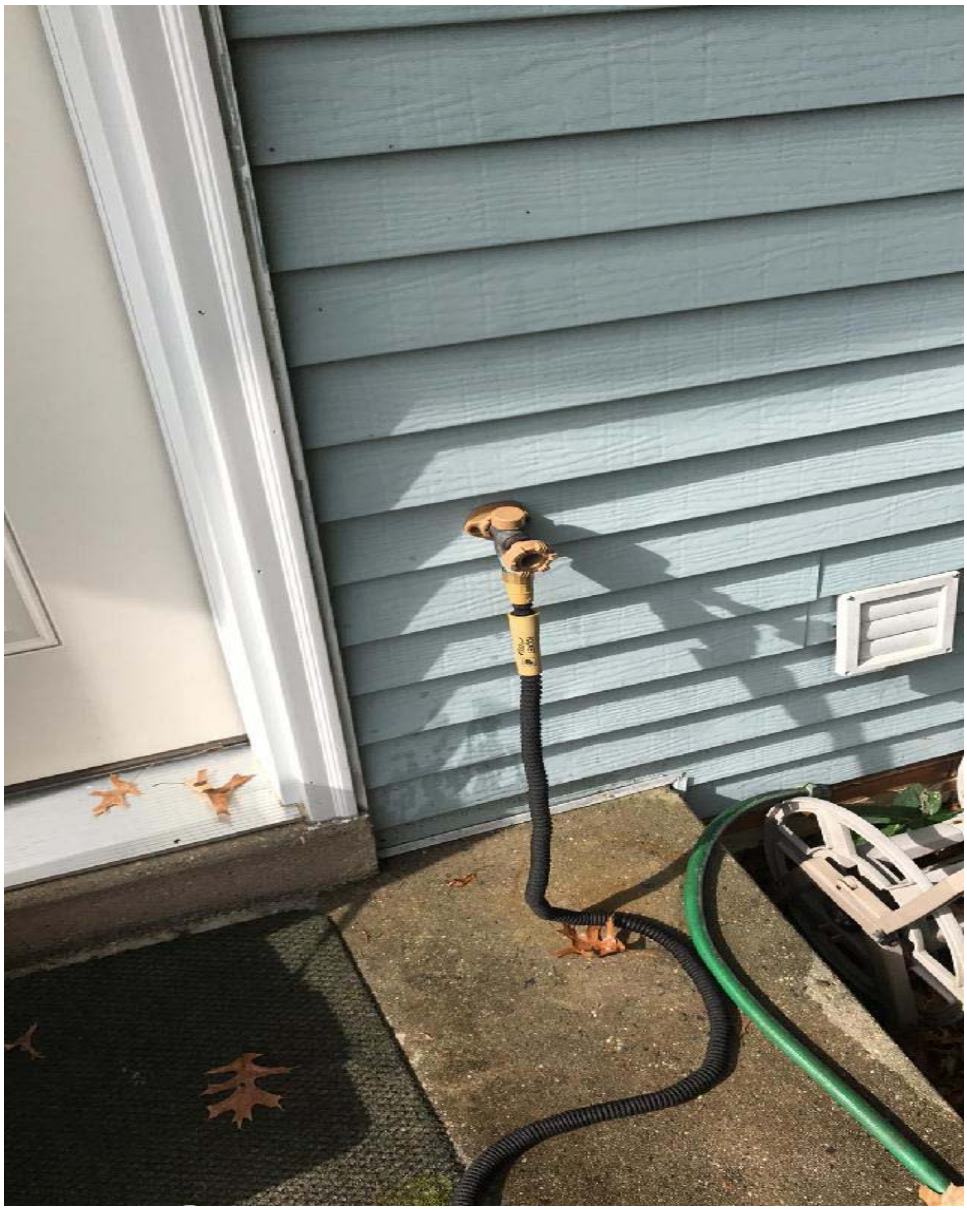
Sampling Parameter	Measurement Unit	Test Results for Well 1	Recommended Threshold	EPA Standard
Total Coliforms	Present/Absent	Absent	Absent	Primary
E. Coli	Present/Absent	Absent	Absent	Primary
Nitrate	mg/L	5.86	10.0	Primary
Nitrite	mg/L	BDL	1.0	Primary
Fluoride	mg/L	BDL	4.0	Primary
Iron	mg/L	BDL	0.30	Secondary
Manganese	mg/L	BDL	0.050	Secondary
Total Dissolved Solids	mg/L	299.0	500.0	Secondary
pH	N/A	6.14	6.5 - 8.5	Secondary
Total Petroleum Hydrocarbon	mg/L	BDL	2.5	Other[2]
Aluminum	mg/L	BDL	0.2	Secondary
Calcium	mg/L	27.5	---	N/A[3]
Magnesium	mg/L	13.0	---	N/A[3]
Sodium	mg/L	49.5	---	N/A[3]
Zinc	mg/L	0.029	5.0	Secondary
Arsenic	mg/L	BDL	0.01	Primary
Barium	mg/L	0.0308	2.0	Primary
Chromium	mg/L	BDL	0.1	Primary
Lithium	mg/L	0.0018	1.0	Other[2]
Selenium	mg/L	BDL	0.05	Primary

Vanadium	mg/L	BDL	0.0029	Other[2]
Bromide	mg/L	BDL	1.0	Other[2]
Benzene	mg/L	BDL	0.005	Primary
Ethylbenzene	mg/L	BDL	0.7	Primary
Toluene	mg/L	BDL	1.0	Primary
Total Xylenes	mg/L	BDL	10.0	Primary
Ethane	mg/L	BDL	---	N/A[3]
Ethylene Glycol	mg/L	1.51	---	N/A[3]
Methane	mg/L	BDL	---	N/A[3]
Propane	mg/L	BDL	---	N/A[3]
Alkalinity	mg/L	48.7	---	N/A[3]
Copper	mg/L	0.0502	1.0	Primary
Strontium	mg/L	0.29	4.0	Other[2]
Potassium	mg/L	3.37	---	N/A[3]
Boron	mg/L	BDL	0.006	Other[2]
Chloride	mg/L	113.0	250.0	Secondary
Sulfate	mg/L	19.1	250.0	Secondary
Total Hardness	mg/L	122.0	10.0	Other[2]
Turbidity	NTU	BDL	1.0	Other[2]
Specific Conductance	umhos/cm	558.0	5.0	Other[2]
Total Suspended Solids	mg/L	BDL	3.0	Other[2]

[1] BDL - Below Detectable Limit
[2] No Primary or Secondary EPA Drinking Water Standard
[3] No Primary or Secondary EPA nor PADEP Drinking Water Standard

Attachment B

Well Picture



APPENDIX I
TECHNICAL GUIDANCE DOCUMENT – PLAN SUBMITTAL CHECKLIST(S)

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CHECKLIST(S) FOR TRENCHLESS TECHNOLOGY TGD

Prior to completing the following checklist, it is strongly recommended that all Sections of the TT TGD are read thoroughly to avoid costly delays in the permitting and completion of any proposed action. The following checklist is considered a companion of the TT TGD and should not be completed without proper reference and examination of the TT TGD. The checklist(s) should help project proponents confirm their due diligence as recommended by this guidance document.

Prior to completing this checklist, project proponents are encouraged to review **Appendix A**.

The TGD has 5 Sections, Section 1 is the Preamble and Section 5 are the References. Therefore, below you will find a checklist that follows Sections 2, 3 and 4. If an applicant does not check a box, in any of the following sections below, the applicant should be prepared to explain why the information was not examined.

SECTION 2 CHECKLIST

The following is a checklist for Section 2 of the TT TGD. By checking the boxes below, the project proponent is stating that the item has been thoroughly examined and that they are prepared to illustrate their findings at the request of the PADEP per 25 Pa. Code § 91.34(b). Alternatively, if a project proponent does not check a box below, the project proponent must equally be prepared to explain why the information was not examined.

☐ *If a project proponent has evaluated all items listed below in the Section 2 checklist, as described in Section 2 of the TT TGD, the project proponent may check this box. By doing so, the project proponent is stating that a comprehensive examination was completed for every item listed in the Section 2 checklist below and therefore does not need to check every box.*

A. Proposed Alternative – the project proponent should have a proposed alternative prior to examining the Suitability, Feasibility, or Environmental Considerations. Please read the narrative in Section 2.A

☐ I acknowledge that I have read and understand the narrative in Section 2. A. Proposed Alternative

B. Suitability Analysis

☐ I acknowledge that I have read and understand the narrative in Section 2. B. Suitability Analysis.

1. Existing Surface Conditions

☐Topography
☐Waters of the Commonwealth
☐Manmade features
☐Cultural/Historical/Archaeological features
☐Land use - Historic and current.
☐Geopolitical boundaries

☐Floodplains

2. Subsurface Conditions

☐Geologic Conditions
☐Soil Interfaces and Geologic Contacts
☐Groundwater
☐Potential Contamination of Soil and/or Groundwater
☐Residual/Municipal Waste Operations
☐Geologic Hazards and Subsurface Voids
☐Existing utilities
☐Unconsolidated material
☐Surface and Deep Mines
☐Oil and Gas Wells (active and abandoned)
☐Any other site-specific impediments
☐Public Water Supplies
☐Wellhead Protection Areas
☐Locate Private Water Supplies
- ☐Horizontal Offset of 450' used
- ☐Horizontal Offset of 1000' used
- ☐Another Horizontal Offset used
- ☐Identify Wells
- ☐Well Construction Details
- ☐Identified any other sources of water

3. Field Exploration

☐Geotechnical Investigation
☐Geophysical Investigation
☐Hydrogeologic Investigation

C. Feasibility Analysis

☐ I acknowledge that I have read and understand the narrative in Section 2. C. Feasibility Analysis.

- ☐Overall and site-specific analyses have been completed for each use of trenchless technology
- ☐All the physical, technical and geologic constraints have been investigated and evaluated for all aspects of drilling activities associated with each use of trenchless technology
- ☐At least one alternative method for each use of trenchless technology has been documented and evaluated.

D. Environmental Considerations

☐ I acknowledge that I have read and understand the narrative in Section 2. D. Environmental

Considerations.

- ☐Threatened and Endangered Species
- ☐Wild and Stocked Trout Streams
- ☐Exceptional Value (EV) wetlands
- ☐EV and High Quality (HQ) streams
- ☐Regimen and ecology of the watercourse or body of water
- ☐Water quality
- ☐Stream flow
- ☐Fish and wildlife
- ☐Aquatic habitat
- ☐Instream and downstream uses
- ☐Other significant environmental factors
- ☐Pennsylvania Natural Diversity Inventory (PNDI) complete

E. Conclusion - The project proponent is expected to discuss and support why each alternative is considered the most practicable alternative. Please read the narrative in Section 2. E.

☐ I acknowledge that I have read and understand the narrative in Section 2. E. Conclusions.

SECTION 3 CHECKLIST

The following is a checklist for Section 3 of the TT TGD. By checking the boxes below, the project proponent is stating that the item has been thoroughly examined and that they are prepared to illustrate their findings at the request of the PADEP per 25 Pa. Code § 91.34(b). Alternatively, if a project proponent does not check a box below, the project proponent must equally be prepared to explain why the information was not examined.

☐ *If a project proponent has evaluated all items listed below in the Section 3 checklist, as described in Section 3 of the TT TGD, the project proponent may check this box. By doing so, the project proponent is stating that a comprehensive examination was completed for every item listed in the Section 3 checklist below and therefore does not need to check every box.*

A. Preferred Alternative - After analyzing the proposed alternative for suitability, feasibility and environmental analysis, the project proponent can determine their preferred alternative. Please read the narrative in Section 3.A.

☐ I acknowledge that I have read and understand the narrative in Section 3.A. Preferred Alternative.

B. Design - discuss the detailed design components of the selected Trenchless Technology method, if they are deemed suitable and feasible.

☐ I acknowledge that I have read and understand the narrative in Section 3.B. Design.

1. Site Constraints and Topographic Considerations

☐ Aboveground disturbances or clearings that will be needed between the drilling entry and exit workspaces during construction have been identified.

☐ Minimum setbacks from entry/exit points have been included and considered.

☐ A justification of the drill path chosen, including a minimum drill path depth below streams and wetlands and design geometry considerations has been provided.

2. Inadvertent Returns (IRs)

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 2 and have considered and planned for IRs.

3. Hole Flush

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 3 and have considered and planned for Hole Flushing.

4. Hole Stability

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 4 and have evaluated hole stability in the design of each use of Trenchless Technology.

5. Failure Mode Contingency Planning

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 5 and have developed a contingency plan, as part of my PPC plan, in the event the drill or borehole is unsuccessful for each use of Trenchless Technology.

I have also evaluated the following as part of Section 3.B., Item 5:

☐ All the alternative entry and/or exit points considered and attempted, including all the alternative entry and/or exit angles attempted, and any alternative profile depths attempted have been documented.

☐ Every available Alternate Crossing Measure has been documented and considered.

☐ Finally, if a drill and/or borehole is unsuccessful and it has been determined to abandon the drill hole, the PPC plan includes all necessary steps.

6. Water Supplies

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 6.

☐ I have gathered all pertinent information, and identified all water supplies, as described in Section 3.B., Item 6, a-i, including Table 3.1.

7. Waters of the Commonwealth

☐ I have identified all Waters of the Commonwealth associated with my project, crossing, or activity as described in Section 3.B., Item 7.

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 7, including the sampling analysis described in Table 3.2.

C. Confirmation - This TGD recommends the project proponent explain why the preferred alternative (described in Section 3) is still the most practicable choice. Project proponents should support their reasoning with the additional data and information gathered, as described in Section 3. If the data suggests that the preferred alternative is not the most practicable choice, project proponents should explain why a different alternative should be chosen and be prepared to support the decision with gathered data and information.

☐ I acknowledge that I have read and understand the narrative in Section 3.C and confirm that the preferred alternative is still the most practicable choice.

☐ I acknowledge that I have read and understand the narrative in Section 3.C and confirm that the preferred alternative no longer the most practicable choice. I have re-evaluated my alternatives and prepared data to support a new most practicable alternative.

B. Permitting - Once the feasibility analysis has been completed, a project proponent is ready to prepare and submit the appropriate permits.

☐ I acknowledge that I have read and understand the narrative in Section 3.D and I am prepared to submit my permit(s), including but not limited to, items a-d in Section 3.D.

Section 4. Construction and Compliance

The following is a checklist for Section 4 of the TT TGD. By checking the boxes below, the project proponent is stating that the item has been thoroughly examined and that they are prepared to illustrate their findings at the request of the PADEP per 25 Pa. Code § 91.34(b). Alternatively, if a project proponent does not check a box below, the project proponent must equally be prepared to explain why the information was not examined.

☐ *If a project proponent has evaluated all items listed below in the Section 4 checklist, as described in Section 4 of the TT TGD, the project proponent may check this box. By doing so, the project proponent is stating that a comprehensive examination was completed for every item listed in the Section 4 checklist below and therefore does not need to check every box.*

A. Preparedness Prevention Contingency (PPC) Plan – In addition to generally addressing spill prevention, countermeasures, and response actions, the PPC plan also addresses potential impacts related to, but not limited to, Inadvertent Returns (i.e., an IR plan), Public and private water supplies (Water Supply Plan), and underground mining and karst terrain (Void Mitigation Plan).

☐ I acknowledge that I have read and understand the narrative in Section 4.A.

☐ I have prepared a PPC plan in accordance with the Trenchless Technology TGD and other pertinent regulations and a copy is, or will be available, on-site and updated.

B. Personnel, Responsibilities, and Trainings

☐ I acknowledge that I have read and understand the narrative in Section 4.B.

☐ In the PPC plan I have defined and listed the roles and responsibilities for all key personnel, including contact information, and a back-up contact when possible and provided it to all key personnel.

☐ I have identified all key elements of training, including aspects of the permit(s), required for this project as described in the TGD.

☐ I have, or will, document all key personnel who have taken the training prior to entering or working on any portion of the project site. Staff, or key personnel, that join the project will receive the same training prior to being allowed on the project site.

☐ I have prepared a site-specific safety training plan in accordance with the TGD and other pertinent regulations.

☐ I have prepared a training plan, including but not limited to, site safety, permit conditions, key personnel and their authorities, and maps showing sensitive resources on all areas as described in Section 2 and 3 of this TGD.

C. Preconstruction Activities

☐ I acknowledge that I have read and understand the narrative in Section 4.C.

☐ I have identified all appropriate agencies and acquired, and maintain copies of, all necessary licenses, permits, or authorizations, including those required by any contractors (e.g., subcontractors), for this project.

☐ Several days prior to the start of construction, or any land clearing of any kind in preparation of the project, I have conducted meeting(s) with the project managers, site superintendents, Environmental Inspectors (EIs), Professional Geologists (PG), Trenchless Technology (e.g., HDD) experts and inspectors, all professional engineers, drillers and driller support staff meet to discuss and go over all permit conditions and expectations of permitting and regulatory agencies and to clarify any misunderstandings several days before construction begins.

- ☐ I have documentation showing all individuals who attended the training and have provided them with documentation of completion (e.g., a helmet sticker or certificate).
- ☐ I will ensure that any staff that joins the project after this training or plans to enter the project site after this training, will take this same training.

☐ I, and all subcontractors, will hold tailgate meetings prior to the start of construction or land clearing on the day the work is to begin for all new project areas. These on-site tailgate meetings should include all parties responsible for design and construction, including but not

limited to Project Manager (or their delegate), EI, PG, Trenchless Technology (e.g., HDD) inspector, PE, driller operators, and all driller and contractor support staff associated with the drilling activities.

☐ All tailgate meetings will cover the information as described in the TGD.

D. Drilling Fluid Management - A drilling fluids management plan should be prepared for each crossing utilizing Trenchless Technology (e.g., HDD) and drilling fluids which includes the source of drilling water, anticipated water use, volume, any required sampling and laboratory analysis of the water source, and any procedures for reuse or disposal of circulated drilling fluid and cuttings.

☐ I acknowledge that I have read, understand, and have documentation as described in the narrative in Section 4.D.

☐ I am prepared to provide documentation showing that location(s) have been identified for the disposal of all drilling fluids and associated parts (e.g., cuttings), including a primary disposal location and a back-up disposal location.

☐ I have a documented protocol for handling drilling fluids and associated parts.

E. Inadvertent Return Minimization Methodologies

☐ I acknowledge that I have read and understand the narrative in Section 4.E.

☐ All Trenchless Technology (e.g., HDD) operations will be conducted in accordance with permit conditions, established requirements, and standard industry practice.

☐ I have met with the EIs, site construction staff, and all key personnel to discuss the protocol for handling and minimizing IRs as described in the TGD.

F. Inspection, Monitoring, Compliance and Emergency Response - This TGD considers one of the most important aspects of the construction phase to be inspection, compliance, monitoring and emergency response planning.

☐I acknowledge that I have read and understand the narrative in Section 4.F.

☐I have identified inspection protocols and communicated them to all individuals.

☐I have (or will) introduced EIs to key staff for every active site. As new sites become active or as new staff join the project, I will ensure that EIs always have a key point of contact for each site or with the project manager or site superintendent.

☐I have (or will) ensured that all staff, including contractors and new staff joining the project late, will or have been trained on the PPC plan, permit conditions, and the expectations of this TGD to ensure inspection, monitoring, compliance, and emergency response is successful.

☐Regular maintenance and inspection of equipment, materials, and contractors coming onto all sites will take place to minimize deficiency of compliance with all permit conditions as described in this TGD.

☐I have, in conjunction with all staff, contractors, and EIs, developed inspection protocols including checklists to maintain standardization. The checklist includes frequency of inspections, protocol for filing inspections, and management inspection findings as described in this TGD.

☐I have identified protocol for handling the findings of inspections as described in this TGD.

☐I have identified a protocol for transitioning these protocols to new staff as they arrive on site, including coordination with new EIs or contractors as described in this TGD.