DEPARTMENT OF ENVIRONMENTAL PROTECTION

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TITLE: Trenchless Technology Guidance

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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 or Department) requirements for use of any trenchless technology installation method.

PURPOSE: This guidance document outlines the steps and options to consider, and implement as appropriate, when proposing to use a trenchless technology installation method on any portion of a project.

APPLICABILITY: This guidance document is intended to inform the level of analysis that may be necessary for a project to demonstrate compliance with applicable regulations, including 25 Pa. Code § 78a.68a (relating to horizontal directional drilling for oil and gas pipelines). The guidance may be useful in developing an Alternatives Analysis under 25 Pa. Code Chapter 105, in environmental emergency response planning, or in developing other materials needed to satisfy regulatory requirements when proposing to use a trenchless technology installation method.

DISCLAIMER: The policies and procedures outlined in this guidance document are intended to further the Department's development of more formalized guidance on pipeline construction and existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. DEP does not intend to give this guidance that weight or deference. This document establishes the framework, within which DEP will exercise its

administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 77 pages

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SECTION 1. INTRODUCTION

A. Background

This guidance document outlines the policies, procedures, and best practices for the prevention of adverse environmental effects from construction utilizing trenchless technology, as defined in Section 1.C, which includes horizontal directional drilling (HDD). This guidance document has been prepared to provide information to project proponents that may help to prevent environmental issues and to improve project planning, permitting, and compliance with applicable regulatory requirements. It is important to note that this is recommended guidance that does not require a new permit.

This guidance document outlines the steps and options to be considered when the use of a trenchless technology construction methodology is proposed as part of a project, which may include a pipeline, utility construction, or other similar projects. The level of analysis needed for a project should be commensurate with the level of environmental risk. It is the project proponent's responsibility to perform the due diligence, but DEP may request this, if necessary, to determine compliance with the statutes or the rules and regulations administered by DEP. 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 and site-specific issues, impacts, and public and agency comments.

DEP recommends a Site Suitability Analysis and a Feasibility Analysis which include evaluating the potential effects of trenchless technology construction on the environment and impacts to aquatic resources in advance of and throughout the permitting process. Guidelines for supplemental measures to be incorporated into Preparedness, Prevention, and Contingency (PPC) Plans are also outlined in the event they should be needed either during or after construction.

The Site Suitability Analysis includes, but is not limited to, an evaluation of site topography, soil type, geology, hydrogeology, water supplies (public, private, and industrial), known oil or gas wells, mining sites, and contaminated sites.

The Feasibility Analysis includes the assessment for use of trenchless technology construction as the least environmentally impacting alternative. The Feasibility Analysis includes an evaluation of economics and constructability (see 25 Pa. Code §§ 105.18a(a)(3) and 105.18a(b)(3), and DEP's *Guidance for Developing a Chapter 105 Alternatives Analysis* (310-2100-002)).

For projects that are considered above average risk, DEP recommends that 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 during the Site Suitability Analysis and Feasibility Analysis. This guidance document also includes design considerations when proposing trenchless technology and construction considerations when executing trenchless technology as well as a plan submittal checklist and suggested attachments. In addition, this guidance document outlines the need for an inspection and monitoring program and most importantly the need for Emergency Response Planning.

The design and permitting guidance includes identification, detailed design, and confirmation of the preferred construction method. Any 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. Applicability

DEP recognizes that all projects do not pose the same level of risk. This guidance document may not be necessary for projects that pose little to no risk to environmental resources. Project proponents are responsible to diligently evaluate all risks associated with a project and determine if the information in this guidance document may help minimize or eliminate those risks. Please see the Trenchless Technology Risk Evaluation in Appendix A.

It is important to note that DEP has a limited role in siting of projects. DEP strongly recommends that project proponents review if other agencies (e.g., Pennsylvania Utilities Commission) regulate pipeline siting or other obligations not regulated by DEP 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). DEP is bound by the authorities listed in the "Authority" section above.

The issuance of this guidance document is not meant to dissuade the use of trenchless technology, nor should it form the basis for dismissing consideration of trenchless technology methods, which can help to avoid, minimize, or eliminate environmental impacts. Conversely, this guidance document is not meant to indicate that DEP exclusively views trenchless technology methods as the least impacting environmental alternative in all cases. Each crossing scenario should be evaluated on a case-by-case basis to make informed decisions regarding the suitability, feasibility, and environmental considerations of using trenchless technology methods.

C. Definitions

- **Alternative** - Any alternative to the proposed action, including alternative locations, routings, or designs to avoid or minimize adverse environmental impacts.

- **Aquatic Resources** - For the purposes of this document, the term aquatic resources refer to *Regulated waters of this Commonwealth*, as defined in 25 Pa. Code § 105.1, which include watercourses, streams, or bodies of water (e.g., wetlands, lakes, ponds) and their floodways wholly or partly within or forming part of the boundary of this Commonwealth (25 Pa. Code § 105.1).

- **Artesian Groundwater** - An aquifer under 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).

- **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 (Atalah, 2017).

- **Borehole Investigation** - An investigation where a hole is drilled into the earth to explore subsurface conditions.

- **Cone of Depression** - The depression, roughly conical in shape, produced in the water table or potentiometric surface by pumping water from a well.

- **Cross bore** - A cross bore is the intersection of an existing underground utility or underground structure by a second utility installed using trenchless technology. The potential exists for an intersection of the utilities, compromising the integrity of either, or both, utility or underground structure.

- **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 (Skonberg and Muindi 2014).

- **Dry Hole** - Drilling term; a condition that occurs when the drilling tools advance beyond the drilling mud (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. Risks associated with trenchless technologies can involve various factors, including ground settlement, ground heaving, subsidence, opening of voids, sinkholes, movement of buildings, inadvertent returns, impacts to water supplies, impacts to the environment, and changed ground conditions (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 land sliding, steep slopes, karst, sinkhole formation, coal seams, acid-producing rock, radioactive or arsenic bearing formations, surface mines (existing, abandoned, or reclaimed), deep mines (active or abandoned where the earth disturbance activities have the potential to encounter a mine void), mine spoil dump area, abandoned mine drainage, abandoned mine drainage treatment systems, or other potential geologic hazards (adapted from DEP's *Erosion and Sediment Control General Permit (ESCGP-3) Permit and Standard Conditions for Earth Disturbance Associated with Oil and Gas Exploration, Production, Processing or Treatment Operations or Transmission Facilities*).

- **Horizontal Directional Drilling (HDD)** - 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 or conduit into the enlarged hole. The method is accomplished using a horizontal drilling rig (adapted from Hair, 2015).

- **Hydraulic Fracture -** A soil or rock 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 (IR)** - An unauthorized or unplanned 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 (adapted from DEP's *Standard Operating Procedures (SOPs) Regarding Inspection and Compliance of Trenchless Construction Methodologies Associated with DEP Permits*).

- **Karst Areas** - Terrain formed by the dissolution of carbonate rock and characterized by closed depressions, sinkholes, disappearing streams, springs, caves, and an absence of surface streams and lakes.

- **Limit of Disturbance (LOD) -** The boundary within which it is anticipated that earthmoving, including installation of best management practices (BMPs), will take place (adapted from DEP's *Erosion and Sediment Pollution Control Program Manual*, 363-2134-008).

- **Loss of Circulation (LOC)** - The reduced or total absence of drilling fluid flow up the annulus when fluid is pumped through the drill string. Loss of circulation occurs when the drill bit encounters coarsely permeable unconsolidated formations, natural fissures, fractures or caverns, and drilling fluid flows into the newly available space. Loss of circulation may also be caused by applying more drilling fluid pressure (that is, drilling overbalanced) on the formation than it is strong enough to withstand, thereby opening up a fracture into which mud flows (adapted from Schlumberger Energy Glossary).

- **Municipality -** A county, city, borough, town, township, school district, institution, 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 § 102.1).

- **NSF/ANSI 60 -** National Science Foundation/American National Standards Institute set of standards and health effects criteria, published in 1988, for water treatment chemicals developed by a team of scientists, industry experts, and key industry stakeholders (see https://blog.ansi.org/nsf-ansi-60-2021-drinking-water-chemicals-health).

- **Pennsylvania Spatial Data Access (PASDA)** - Pennsylvania's official public access open-geospatial data portal, accessible at www.pasda.psu.edu.

- **Potable Water Supply** - 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 § 96.1).

- **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, and 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 should 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 on-site during drilling operations and shall be made available to DEP upon request (25 Pa. Code §§ 102.5(l) and 78a.68a(b)).

- **Project Proponent** - The project proponent is any individual or organization that has responsibility for the project. This individual or organization may change throughout the life of the project. The project proponent may include the applicant, the permittee, contractors, sub-contractors, or any individual or organization that holds responsibility for the project during any phase of the project from design to implementation to completion.

- **Public Water Supplier's (PWS) Service Area -** Active service boundary areas for Pennsylvania public water systems, excluding nontransient noncommunity and transient noncommunity systems (see the Public Water Supplier's (PWS) Service Area dataset on PASDA).

- **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, as more fully defined in 25 Pa. Code § 109.1. Types of public water systems include community water systems, nontransient noncommunity water systems, and transient noncommunity water systems, which are also defined in 25 Pa. Code § 109.1.

- **Right-of-Way (ROW)** - For highways, pipelines, and utility lines, it is the boundary line within which the applicant or operator has a legal right to do earthwork, and, following construction, maintain and operate (adapted from DEP's *Erosion and Sediment Pollution Control Program Manual*, 363-2134-008).

- **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 (25 Pa. Code § 109.1).

- **Stop-Work Authority** - The authority to stop site-specific activities that violate permit terms or conditions, or may threaten public health, safety, property, or the environment. Stop-work authority should be given to all 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 from 25 Pa. Code § 109.1).

- **Surface Water Intake Protection Program** - A comprehensive program designed to protect each surface water source used by a public water system from contamination (25 Pa. Code § 109.1).

- **Trenchless Technology** - A type of subsurface construction work that requires few trenches or no trenches which includes any trenchless construction methodology, including, but not limited to: horizontal directional drilling, guided auger bore, cradle bore, conventional auger bore, jack bore, hammer bore, guided bores, and proprietary trenchless technology (adapted from Pennsylvania Environmental Hearing Board Docket No. 2017009L).

- **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, 2022).

- **Unconventional 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 (25 Pa. Code § 78a.1).

- **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 25 Pa. Code § 78a.1).

- **Wellhead Protection Area (WHPA)** - The surface and subsurface area surrounding a water well, well field, spring, or infiltration gallery supplying a public water system, through which contaminants are reasonably likely to move toward and reach the water source, as more fully defined in 25 Pa. Code § 109.1.

- **Zone of Contribution** - The volume of a geologic formation or unit that directly contributes groundwater to a pumping well over time.

- **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: *Prior to beginning any analysis associated with this guidance document, project proponents are encouraged to review* Appendix A. *Project proponents are also encouraged to read the disclaimer at the beginning of this document. It is important to note, this is recommended guidance that does not require a new permit.*

A Site Suitability Analysis and Feasibility Analysis are recommended as initial steps 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 found on DEP's Trenchless Technologies webpage. 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 drilling proposals) based on the size, complexity, and risk of the project, and may also include site geotechnical, geologic, geospatial, and/or geophysical investigations to further investigate potential for adverse environmental impacts.

The Feasibility Analysis should provide conclusions and recommended construction methods for the various types of crossing (e.g., road, stream, wetland, groundwater, or reservoir). The recommended Feasibility Analysis should include a decision matrix for use of trenchless technology construction as the ***least environmentally impacting practicable alternative***.

When an alternatives analysis is prepared, any considered alternatives to minimize potential adverse environmental impacts should be identified in the Site Suitability Analysis and Feasibility Analysis. If an alternatives analysis was not prepared (e.g., Chapter 105 General Permit), DEP may exercise its administrative discretion and request an evaluation of alternatives to determine compliance with statutes or rules and regulations of the Department. For more information on alternatives analysis guidance, see DEP's *Guidance for Developing a Chapter 105 Alternatives Analysis* (310-2100-002).

For projects that are above average risk, DEP recommends that a summary of the results from the Site Suitability Analysis and Feasibility Analysis are incorporated into the public participation process, so stakeholders can have an opportunity to become familiar with the project. For more information, see DEP's *Policy on Public Participation Policy in the Permit Review Process* (012-0900-003).

A. Alternatives Evaluation Process

The project proponent is responsible for providing a detailed analysis of the proposed action, including alternative locations, routings, or designs to avoid and minimize adverse environmental impacts as required under 25 Pa. Code § 105.13(e)(1)(viii). Section 2 and Section 3 of this guidance document discuss several trenchless technology specific elements which the project proponent may want to consider incorporating in their Chapter 105 alternatives analysis. It is important to note that the Dam Safety and Encroachments Act (32 P.S. §§ 693.1-693.27) and the implementing regulations under 25 Pa. Code Chapter 105 independently require an alternatives analysis which may be different than the federal National Environmental Policy Act (NEPA) requirements under 40 CFR Chapter V, Subchapter A. Therefore, a NEPA alternatives analysis may not satisfy the requirements of a Chapter 105 alternatives analysis. Please refer to

DEP's *Guidance for Developing a Chapter 105 Alternatives Analysis* (310-2100-002) for more information.

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 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, water supplies (public, private, and industrial), known oil or gas wells, mining sites, and contaminated sites. To assist in obtaining this information, a data resources list can be found on DEP's Trenchless Technologies webpage. The data resource list is not a complete list of resources. The following items are topics DEP recommends are evaluated, as necessary. Project proponents should be prepared to support their evaluations with documentation and explain why any of the following 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 areas within the Right-of-Way (ROW) and areas draining into the ROW 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 a trenchless technology. This source of risk can be magnified by many factors including 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. DEP recommends project proponents pay special attention to crossings with elevation differential between entry and exit points. Please also refer to PASDA as a possible source of topographic data.

b) **Waters of the Commonwealth**. Analyze and examine potential impacts to the following: rivers, streams, creeks, rivulets, impoundments, ditches, watercourses, storm sewers, lakes, dammed water, ponds, springs, wetlands, and all other bodies or channels of conveyance of surface water or groundwater, 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 Pennsylvania-designated and existing uses, and their

attainment status can be identified from data available at PASDA. Please refer to the references in the data resource list found on DEP's Trenchless Technologies webpage. Approximate stream and waterbody locations can also be obtained from the National Hydrography Dataset maintained by the United States Geological Survey (USGS).

For some wetlands, the National Wetlands Inventory (NWI) mapping by the United States Fish and Wildlife Service (USFWS) can be used, but only as a coarse screening tool because it is based on high-altitude aerial photography and is significantly insufficient in documenting all regulated wetlands. NWI mapping should not be relied upon as the only source in identifying possible wetlands.

The Pennsylvania Wetland Mapping Database is another useful screening tool for identifying potential wetlands. However, like NWI, it should not be considered a substitute for on-site delineations performed by experienced wetland professionals.

Information derived from the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey (WSS) can be used to supplement NWI mapping and other wetland screening tools. 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 which together may be used as an indication of 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 is required (25 Pa. Code § 105.13(e)(1)(i)(A)). The wetlands should be identified and delineated in accordance with DEP's Wetland Identification and Delineation Policy under 25 Pa. Code § 105.451.

c) **Human-made Features**, including highways, rail embankments, flood protection levees, airport runways, landfills, and other utilities. When planning to drill beneath a flood protection levee or floodwall, or within 500 feet of a dam, contact DEP'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 of Waterways Engineering and Wetlands is essential to prevent damage to structures or their underlying foundations. Please also refer to PASDA.

d) **Cultural, Historical, and Archaeological features**. When DEP authorizations are required, project proponents should verify data and resources with the Pennsylvania Historical and Museum Commission (PHMC). Please refer to PHMC's Cultural Resources Geographic Information System webpage.

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 the USGS Earth Explorer, Google Earth, and other land use cover data available from

PASDA. Project proponents may consult with local zoning maps and ordinances to ascertain land use aspects to better understand local land use and historic land use. Project proponents should make sure that they understand enough about prior land use to have a reasonable assessment about prior contamination they may encounter.

f) **Geopolitical Boundaries**, including property tax map and parcel boundaries, should be reviewed for the project area. Data is available from PASDA.

g) **Floodplains** for their project area(s), which can be reviewed at the Federal Emergency Management Agency's Flood Map Service Center or PASDA. Project proponents are encouraged to consult with local zoning authorities' flood zone designations.

2. Subsurface Conditions

Analyze the existing conditions below the surface in proximity to the project prior to project activity. To assist in obtaining this information, a data resources list can be found on DEP's Trenchless Technologies webpage. Project proponents should investigate for geologic and hydrogeologic hazards within the area of the proposed project. If the project proponent determines any potential geologic or hydrogeologic hazards exist, they should plan for avoidance or mitigation of the hazard(s). Geologic and hydrogeologic hazards may include, but are not limited to karst, coal seams, coal refuse, landslides, geologic contacts or fracture zones, acid-producing rock, and groundwater. The following information should be reviewed, at a minimum, to accomplish this task:

a) **Geologic and Hydrogeologic Conditions**, including geologic mapping, formation identification, known fractures or faults in the area, known strike 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 for all proposed drill path alignments. Greater detail should be used if the proposed drill path is through highly deformed bedrock and is near water wells, exceptional value wetlands, or surface waters with designated or existing special protection uses under 25 Pa. Code Chapter 93. Project proponents are encouraged to utilize the best available data, including the Pennsylvania Department of Conservation and Natural Resources (DCNR) Geology of Pennsylvania webpage, DEP's eMapPA website, and the USGS National Geologic Map Database.

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 WSS. WSS 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**. DEP recommends the use of data from the following 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, *A Quick Guide to Groundwater in Pennsylvania*, helps project proponents understand where Pennsylvania groundwater comes from, how it's used, and potential risks this vital resource.

ii. DCNR's Pennsylvania 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 Pennsylvania 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 well locations. Project proponents are encouraged to identify and locate all public and private water supplies as described in this document.

iii. USGS's National Water Information System (NWIS). NWIS consists of data on roughly 80,000 wells and springs. This USGS database provides precise locations of wells (usually within one second or less), contrasted with the often-inaccurate location of wells in PaGWIS. Plus, many wells in NWIS have associated water quality attributes. Information and data from NWIS can be accessed through the USGS Groundwater Data for the Nation webpage.

d) **Potential Contamination of Soil or Groundwater**, including storage tanks. Project proponents should prepare and review a characterization of any former or active contaminated sites. DEP expects that project proponents coordinate with DEP's Environmental Cleanup and Brownfield program and through the United States Environmental Protection Agency's (USEPA) Brownfield Program. USEPA's Brownfields program provides grants and technical assistance to communities, states, tribes, and others to assess, safely clean up, and sustainably reuse contaminated properties. For an additional source of information project proponents may also coordinate with the USEPA's RCRA Corrective Action Program.

Project proponents are encouraged to evaluate all available data resources, including PASDA, DEP's Activity and Use Limitations Registry, and DEP's Environmental Site Assessment Search Tool. 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. DEP'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 DEP concerning permitting, licensing, inspection, compliance, discharges of pollution, regulated storage tanks, site remediation, and enforcement. Consultation with DEP'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, USEPA's Superfund program, which is responsible for cleaning up some of the nation's most contaminated land, provides access to a Search for Superfund Sites website allowing users to search for superfund sites by state, USEPA region, city, county, ZIP code, or site name.

It is important to note that project proponents utilizing trenchless technologies would be held liable for exacerbating conditions at a contaminated site if it was shown they did not take proper precautions, including the measures summarized in this guidance. To that end, project proponents should also give consideration to review DEP files for any sites with their project Limit of Disturbance (LOD).

e) **Residual and Municipal Waste**. DEP recommends coordinating with DEP's Bureau of Waste Management which manages the statewide hazardous, municipal, and residual waste programs. The Bureau of Waste Management also oversees implementation of municipal waste planning and recycling, waste transportation, and the Covered Device Recycling Act. Data on residual and municipal waste operations is also available from PASDA.

f) **Geologic Hazards and Subsurface Voids** should be identified, including but not limited to 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. The variability of Pennsylvania's surficial geology may require special attention. To assist with the characterization and review, 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 Pennsylvania's geology.

DCNR also provides information about geological hazards, such as sinkholes, which can also be mapped on PaGEODE. For information about sinkholes in Pennsylvania, see DCNR's Sinkholes webpage.

Pennsylvania Geological Survey staff have also compiled and published 19 different groups of rock types (i.e., statewide Map 63). DCNR's County Rock-Type Maps of Pennsylvania webpage provides maps and a description of rock-type by county. 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, but they should not be used for detailed analysis or site-specific applications.

The USGS National Geologic Map Database also provides information about geologic hazards.

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 Pennsylvania One Call (a.k.a. Pennsylvania 811). In addition to Pennsylvania One Call, users of this guidance document are encouraged to seek out locally available information through the local municipality. It is recommended that project proponents do not solely rely on Pennsylvania 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, potentially compromising the integrity of either utility or underground structure. Cross bores can lead to immediate or delayed issues and potential environmental impacts. Cross bore awareness should 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 document, cross bores merit mentioning in this guidance document due to the potential impacts to safety and the environment.

ii. Excavation Damage. The biggest risk to pipeline integrity is excavation damage. This guidance document considers all uses of trenchless technologies, but gas and liquid pipelines crisscross the Commonwealth and any subsurface activity with the potential to damage existing pipelines presents significant risks to those pipelines and to the subsurface activity.

Project proponents should identify and make note of all nearby utilities and should plan excavations carefully to ensure the project will not impact these adjacent utilities. Project proponents should also coordinate installations with the owner(s) of all nearby utilities to safely complete and operate the project.

h) **Unconsolidated Material**. DEP recommends that an initial desktop review be completed for the project area utilizing the NRCS WSS.

Moreover, the Pennsylvania Geologic Survey has several open file reports covering surficial geology of Pennsylvania's glaciated regions. Data on surficial geology is available from DCNR's PaGEODE application.

The USGS National Geologic Map Database also provides information about surficial geology of glaciated or coastal plain regions of Pennsylvania.

Following the initial desktop review, DEP expects project proponents 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 investigations as identified in Section 2.B.3 of this guidance document.

i) **Surface and Deep Mines**. DEP recommends coordinating with DEP's Bureau of Mining Programs. Some of the potential mining facilities that could affect or be affected by use of trenchless technologies include shafts, boreholes, slopes, portal sites, beltlines, refuse areas, preparation plants, waterlines, water wells, and powerlines. Any overlap between the use of trenchless technologies and these facilities should result in the notification of DEP's Bureau of Mining Programs and coordination between the 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. Contact information and available data can be found on the Bureau of Mining Programs webpage.

In addition to coordinating with the Bureau of Mining Programs, DEP also recommends utilizing the Pennsylvania Mine Map Atlas. The Pennsylvania Mine Map Atlas database contains information relevant to past and present underground mining in Pennsylvania, including maps, indices, locations of mines, and other pertinent data contained in various collections held or obtained by DEP's Office of Active and Abandoned Mine Operations. The Pennsylvania Mine Map Atlas allows users to search by county and municipality, street address and ZIP code, or by latitude and longitude.

The USGS National Geologic Map Database also provides information about Pennsylvania coal and non-coal mining activity. Pennsylvania has a long history of unauthorized mining, so 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. DEP recommends using DEP's Oil and Gas Mapping website. 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 query the website using a variety of filters including permit number, the operator that submitted the report, and the county or municipality in which the well is located. The user can also use map functionalities to locate a specific address, county, latitude and longitude, municipality, or ZIP code. Additionally, the user can also link to DEP's Oil & Gas Reporting webpage 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.

DEP also recommends coordinating directly with the following two DEP programs; contact information is available on each program's webpage, linked below:

1. DEP's Oil and Gas Programs

2. DEP's Office of Oil and Gas Management

The USGS National Geologic Map Database also has reports on Pennsylvania oil and gas wells.

k) **Site-Specific Impediments**, such as old landfills, acid-producing rock, old tree stumps or roots, animal burrows, and any natural or human-made impediment. Project proponents should conduct all due diligence necessary to characterize their project area. One such example to note that is common in Pennsylvania is acid-producing rock. DCNR's Bureau of Geological Survey (a.k.a. the Pennsylvania Geological Survey) 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.

l) **Locate Public Water Supplies**[1], including surface water intakes, that may be impacted in the event of an unauthorized sediment or other pollutant release; please see Table 3.1 for additional details. As part of a project proponent's due diligence, the following data and information should be reviewed and characterized:

i. eMap Pennsylvania Public Water Supplier List. DEP recommends utilizing DEP's eMapPA website. eMapPA 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 DEP-permitted facilities, eMapPA includes over 50 map layers relating to administrative and political boundaries, culture and demographics, geology, mining, streams and water resources, and transportation networks. The eMapPA 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 can be found on DEP's Trenchless Technologies webpage.

ii. Public Information for Locations. The location of public water supplies may be considered sensitive and protected; therefore, information not obtainable through eMapPA may require direct coordination with local water supply companies or DEP's Bureau of Safe Drinking Water. The Bureau of Safe Drinking Water is charged with managing the federally

[1] In addition to the definitions in Section 1.C of this guidance document, definitions of "water supply" and "public water supply" can be found in 25 Pa. Code § 78a.1. Regulations applicable to unconventional gas well operators pertaining to the protection of water supplies can be found in 25 Pa. Code § 78a.51.

delegated drinking water program and implements both the federal and state Safe Drinking Water Act and associated regulations. The Bureau of Safe Drinking Water can be contacted at RA-epwater@pa.gov.

iii. Wellhead Protection Areas. Nearly half of Pennsylvania's residents rely on groundwater as a source of drinking water. Pursuant to Section 1428 of the Federal Safe Drinking Water Act (SDWA, 42 U.S.C. 300h-7), DEP has developed a Wellhead Protection Program (WHPP) to protect groundwater sources used by public water systems from contamination that may have an adverse effect on public health. Participation in the WHPP 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 DEP regional office(s). It is important to note that while participation in WHPP is voluntary, public water systems still must meet the requirements of 25 Pa. Code § 109.603.

iv. Surface Water Intake Protection. DEP has also developed Surface Water Intake Protection Areas and Surface Water Intake Protection Programs that are the surface water analogs to wellhead protection. For more information, please refer to USEPA's Source Water Protection webpage.

v. Public Water Suppliers and Other Water Resources. Another important tool a project proponent can utilize in reviewing and identifying public water resources is PASDA, which includes a Public Water Supplier's (PWS) Service Area dataset that can be found by searching keywords "PWS service area". This dataset and other datasets on PASDA include information on discharges, groundwater withdrawals, interconnections, storage, surface water withdrawals, and water allocations.

vi. Public Information Act for Wellhead Protection Areas. WHPAs may be considered sensitive and protected; therefore, information not obtained through DEP's WHPP may require direct coordination with local water supply companies or DEP's 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 can be contacted at RA-epwater@pa.gov.

m) **Private Water Supplies**. In Pennsylvania, 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 records or digital databases. Therefore, a plan to conduct any trenchless technology, needs to also incorporate a plan for locating water supplies. To accomplish this task, this guidance document provides the following recommendations.

In addition to the definitions in Section 1.C of this guidance document, a definition of "water supply" can be found in 25 Pa. Code § 78a.1. Regulations applicable to unconventional gas well operators pertaining to the protection of water supplies can be found in 25 Pa. Code § 78a.51. Other regulatory provisions relevant to the protection of water resources, including private water supplies, can be found in 25 Pa. Code §§ 91.31-91.34. Project proponents should evaluate all relevant sources of information to locate and identify all private water project proponents should document the sources and procedures used in this effort. DEP recommends using the following guidelines to locate and identify private water supplies:

i. Horizontal Offset, or the distance from alignment measured from the centerline of the pipeline or utility line, giving the project proponent the area that DEP expects to be investigated for the existence of private water supply wells. After careful consideration of multiple factors, DEP recommends identifying private wells within a minimum horizontal offset distance of 450 feet in non-karst terrain and a minimum of 1,000 feet in karst terrain or areas that include limestone and dolomite bedrock. DEP 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 recommended minimum horizontal offset distance. DEP recommends that any project proponent evaluate when this horizontal offset distance should be expanded due to local geological conditions.

ii. Well Recon Listing. Within the recommended minimum horizontal offset distance, the project proponent should prepare a Well Recon Listing to identify wells. DEP recommends that all areas served by a public water system are identified and mapped. In doing so, it is important to note that tax parcels outside of the service area of a public water system 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 within the service area of a public water system. Project proponents are encouraged to start by referring to PaGWIS, using all available data packages, but should recognize the limitations of the data in PaGWIS (Please see the Data Resource List found on DEP's Trenchless Technologies webpage). It is anticipated that the available information (particularly from PaGWIS) may be extremely limited; therefore, additional investigation may be needed to accomplish this task.

DEP recommends researching current tax parcel information and assuming 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). Information about county and municipal health

departments can be found on the Pennsylvania Department of Health's County and Municipal Health Departments webpage.

iii.. Tax Parcel Mailing List. The project proponent should compile mailing, or contact, lists for all properties within the recommended minimum horizontal offset distance (i.e., 450 feet in non-karst terrain, 1,000 feet in karst terrain). Many parcels outside of the service area of a public water system and some parcels inside of the service area of a public water system may have a private well, so it is imperative to include all tax parcels on the mailing list and assume each parcel in or outside of the service area of a public water system has a well until facts prove otherwise. Local conditions may require further due diligence and the use of best professional judgement; documentation should be used to support any reasoning for not needing, or needing, to extend beyond the recommended minimum horizontal offset distance. If the property owner does not respond, documentation should be made (i.e., proof of the mailing) to show the request was made. This documentation should be available to show the request was made and any responses received.

iv. Well Construction Details. Table 2.1 below lists the information that DEP recommends gathering. Information denoted with an asterisk (*) are considered the most critical. This information may be available from municipal records, the independent well driller (i.e., the contractor) that installed the well(s), or interviews with the well owner or operator (see Section 3.B.6). If the well owner cannot provide information, documentation should be made, using professional judgement, showing, at a minimum, all efforts to confirm information was requested.

Table 2.1. Recommended Data to Gather on Well Construction Details
GPS Coordinates of Wellhead *
Date Well Constructed *
Depth of Well *
Depth to Bedrock*
Depth to Bottom of Casing *
Method of Well Construction, including:
a. Primary and Secondary Filter Pack
b. Type of Annular Seal
c. Grout Seal Interval (top and bottom)
d. Type of Surface Seal
e. Protective Casing
Method of Well Installation
Casing Diameter
Casing Material
Water Bearing Zones
Static Water Level
Use of Well
Blown Yield
Primary Aquifer
Note: Items marked with an asterisk (*) are most critical; all others are recommended.

v. Identify Any Other Sources of Water. To examine all resources, DEP recommends that the project proponent identify water supplies within the recommended minimum horizontal offset distance (i.e., 450 feet in non-karst terrain, 1,000 feet in karst terrain). At a minimum, DEP recommends identifying all groundwater sources, such as seeps or springs, and all surface water sources, such as ponds and creeks. If the property owner does not respond, documentation should be made (i.e., proof of the mailing) to show the request was made. This documentation should be available to show the request was made and any responses received.

3. Field Investigation

During the desktop review of the site-specific suitability analysis, areas requiring further investigation (e.g., field investigation) should be identified. Those areas identified for field investigation will determine the level of analysis and effort deemed necessary in this step of process outlined in this guidance document. The extent of the field investigation necessary should be based on the size and scope of the proposed trenchless technology method being used. DEP 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 is especially important for HDD. A complete geotechnical investigation report should be prepared and sealed by a Pennsylvania-licensed professional engineer (PE) or professional geologist (PG). The geotechnical investigation and

associated report should include a borehole investigation. The borehole(s) 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. DEP recommends that test borings are generally drilled no more than 100 feet from the proposed drill path and at intervals not greater than 300 feet. In some situations, shorter intervals may be necessary to adequately define subsurface conditions. The geotechnical investigation, and subsequent borehole investigation, should be conducted under the direction of a licensed PG or a licensed PE, with knowledge of the local geology. Any information gathered should be logged with oversight by a licensed PG. 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 IRs. Table 2.2 provides considerations of data to be collected, analyzed, and discussed for any geotechnical report prepared. The Department recommends utilizing geotechnical information to prepare a hydrofracture evaluation. A site-specific hydrofracture evaluation includes a comparison analysis of the expected drilling fluid pressures and the expected confining or "frac-out" pressure to determine if a trenchless method utilizing fluids under pressure is feasible with a minimal risk of inadvertent return.

b) **Geophysical Investigation** should also be conducted, if applicable, based on the evaluation of risk (see Appendix A) and should be reviewed by a Pennsylvania-licensed PG experienced in geophysical techniques and analysis. Non-intrusive exploratory geophysical methods may be employed to augment exploratory borings and assist in characterizing the subsurface conditions, ideally 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 approach can be effective when large gaps between completed borings exist, when environmental or land restrictions prevent the ability to gather geotechnical borings, 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, DEP does not expect borings to be entirely replaced with geophysical methods. Where possible, any geophysical investigation should be physically correlated with a geotechnical investigation and reviewed by a Pennsylvania-licensed PG. DEP recommends that any engineering effort should consult with a subject matter expert to determine the appropriate geophysical method(s), including an explanation of why a particular method or set of methods was chosen. DEP recommends a minimum of one geophysical method to aid in the identification and characterization of relevant risk factors, including 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. In complex geologic regions, like highly developed karst, contrasting geophysical methods are often needed to fully understand, or verify, conditions.

Table 2.2. Drilling Procedures and Recommended Data
Drilling Procedures
a. Soil
b. Rock
Field Classification of Soil and Rock†
Laboratory Determination of Soil and Rock Properties†
Determine Strike or Dip (i.e., Core Fracture, Bedding Orientation)
Groundwater Level Data - recommend data collection at 0 hr and 24 hr
Downhole logging, including high-resolution televiewer, 3-arm caliper and other logging techniques.
Note: Please see DEP's Trenchless Technologies webpage 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: • Unified Soil Classification System • Standard Penetration Test (SPT) • Rock core classification

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 PE or PG 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*, Appendix A of DEP's *Land Recycling Program Technical Guidance Manual* (261-0300-101). Anticipated depth to groundwater and groundwater flow direction are particularly useful to inform the trenchless design process and may be able to be inferred from desktop sources.

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

i. Geologic interpretations should be reviewed, sealed, and signed by a Pennsylvania-licensed PG who is knowledgeable in local geology. Geophysical interpretation should be reviewed, sealed, and signed by a Pennsylvania-licensed PG.

ii. Geotechnical engineering reviews should be sealed and signed by a Pennsylvania-licensed PE who is knowledgeable in the subject matter.

Table 2.3. Recommended Geophysical Methods
Electromagnetic Surveys
Electric Resistivity Tomography
Seismic Surveys
Ground penetrating Radar
Gravity
Other relevant 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 PG that made the interpretation of the data for that segment. An overarching signature for an entire 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, DEP recommends the project proponent to complete a Feasibility Analysis. A site-specific Feasibility Analysis should be conducted to evaluate the level of difficulty or constructability of any trenchless technology being utilized. The Feasibility Analysis should, at a minimum, identify areas of potential risk and geologic concern. DEP recommends that the feasibility analysis also include a decision matrix explaining the reasoning behind selecting trenchless technology as the least environmentally impacting alternative and as 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 investigation of all regulated waters of the Commonwealth, including wetlands, should be conducted as the basis for the site-specific Feasibility Analysis.

This section has been formatted in the chronological order a project proponent should follow when conducting a Feasibility Analysis for any trenchless technology employed.

In conducting a Feasibility Analysis, DEP 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 should specify all actions taken to reduce or control the release, loss of circulation, or IRs of drilling fluids 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 should also be considered at this stage.

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

D. Environmental Considerations and Analysis

The project proponents should complete resource identification as required by the Chapter 105 Water Obstruction and Encroachment Permit, including:

- 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 a member of NatureServe, 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 should access PNHP's Pennsylvania Natural Diversity Inventory (PNDI). In addition to PNDI, other resources include PASDA, USFWS Geospatial Services, and the data resource list found on DEP's Trenchless Technologies webpage.

E. Conclusion

In this section, DEP 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 and least environmentally impacting alternative. DEP expects the project proponent 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 Analysis, Feasibility Analysis, and Environmental Analysis). This section should also discuss and support why trenchless technology was selected versus open trench or another technology.

SECTION 3. DESIGN AND PERMITTING

Note: *Prior to beginning any analysis associated with this guidance document, project proponents are encouraged to review* Appendix A. *Project proponents are also encouraged to read the disclaimer at the beginning of this document. It is important to note, this is recommended guidance that does not require a new permit.*

The results of the Site Suitability Analysis, Feasibility Analysis, and Environmental Analysis, including the field investigations (e.g., geotechnical, geological, geophysical), should be included in the design and permitting documents. If a trenchless technology method 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 or more complex projects, workspaces for a trenchless technology crossing typically requires some clearing and grading, depending on site conditions at the entry and exit locations 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 and stable ground conditions to support heavy equipment.

DEP 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, (2) monitoring of the drill path, and (3) mitigating during containment and clean-up operations in the event of an IR. 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. DEP 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 pipeline route during the site-specific suitability and feasibility analysis. The final path design should also consider physical and access limitations at entry and 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. Consideration for the slope and elevation change of the entrance and exit points to minimize or eliminate gravity drain systems.

Subsurface conditions evaluated during the site-specific Site Suitability Analysis and Feasibility Analysis along the pipeline alignment, should identify potential problem areas which may prevent successful trenchless technology pipeline installation. Examples include the possible occurrence of cobbles and boulders in till soils, the 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 or fractured bedrock units, or karst areas. Any potential problem area identified should be avoided whenever possible during the design and permitting stage. When potential problem areas are

not avoided, supporting documentation and justification, should be provided as to why those areas 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

Informed by the Site Suitability Analysis, Feasibility Analysis, and Environmental Analysis for the proposed alternative, the project proponent can determine their preferred alternative. This section should include a discussion of the preferred alternative based on the information identified during the Site Suitability Analysis, Feasibility Analysis, and Environmental Analysis, and should make clear any changes made from the proposed alternative and why those changes were made. Data gathered during the Site Suitability Analysis and Feasibility Analysis should be referenced to support the reasoning behind the selected preferred alternative. For more information on alternatives analysis guidance, see DEP's *Guidance for Developing a Chapter 105 Alternatives Analysis* (310-2100-002).

B. Design

Using the information gathered and analyzed in Section 2 of this guidance document, this section discusses the detailed design components of the selected trenchless technology method and whether they may be deemed suitable and feasible. This can be an iterative process since some design is necessary to determine feasibility. DEP 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 located between the drilling entry and exit workspaces that may be needed during construction.

   b) In addition, minimum setbacks from entry and 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

   DEP expects project proponents 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 DEP prior to beginning any trenchless technology activity (25 Pa. Code § 78a.68a(c)); monitor for pressure loss and loss of circulation (25 Pa. Code § 78a.68a(g)); and notify DEP of drilling fluid discharge or loss of drilling fluid circulation (25 Pa. Code § 78a.68a(i)). In addition, project proponents

should prepare a PPC Plan that addresses IRs and describes how they may be prevented, planned for, and dealt with if they happen. At a minimum, the PPC Plan should consider including a risk assessment for IRs and measures to prevent, control, or mitigate loss of circulation.

3. Hole Flush

Another area a project proponent should consider is hole flushing. Specifically, DEP recommends the project proponent should ensure adequate containment measures are in place to contain any drilling fluid that may return during hole flush activity. 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. In managing hole stability, project proponents should consider fluid composition, fluid rate, drilling rate, and downhole pressure, among other variables. While DEP recognizes that these variables cannot easily be accounted for in calculation method design, DEP recommends using both theoretical calculation methods combined with engineering judgement based on previous trenchless technology experience.

5. Failure Mode Contingency Planning

Risk cannot be eliminated and, therefore, should be managed or mitigated. Project proponents should develop a trenchless technology contingency plan, as part of their PPC Plan, in the event the drill or borehole is unsuccessful. If a drill 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. Prior to seeking to modify to an open trench design or to reroute, project proponents should describe every approach considered to succeed in continuing with the drill or borehole. This trenchless technology contingency plan may include the following considerations:

a) Alternative entry or exit points, angles, profiles, or depths.

b) Documentation of nearby attempts at employing trenchless technology methods under similar conditions and circumstances, entry and exit points, angles, profiles, and depths attempted or completed; mitigative or adaptive measures employed; and an analysis of the failures and successes of the project.

c) Project proponents should consider every available alternate crossing measure.

d) If abandoning a drill hole, identify the type of grout to be used, which should be listed in the PPC Plan (please refer to DEPs *Guidelines for the Development and Implementation of Environmental Emergency Response Plans* (400-2200-001)

and see DEP's Trenchless Technologies webpage for PPC Plan templates), and include specifications from a recognized industry standard.

Project proponents should evaluate potential failures and follow-up actions as part of the PPC Plan. 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, project proponents should notify and coordinate with DEP according to the regulations and conditions of their permit.

6. Water Supplies

During the design phase, project proponents should consider all water supplies, including surface and groundwater. Project proponents should provide notification, including detailed design plans, to all users and managers (e.g., municipalities) of water supplies. It is recommended that notifications and requests for permission to sample and test water supplies take place before starting site preparation work, including vegetation clearing. Project proponents should not wait to engage the public until just prior to drilling. To assist in making notifications and obtaining well construction information and permission to access water supply wells, an example notification letter and well construction questionnaire is provided on DEP's Trenchless Technologies webpage. The following is a list of information DEP recommends a project proponent gather when identifying water supplies:

a) Private groundwater wells, including a consideration of the zone of influence and zone of contribution. If the zone of influence isn't known or able to be determined, DEP recommends using the distances listed in Table 3.1.

b) Public water supply wells and intakes, including a consideration of the zone of influence and zone of contribution. If the zone of influence isn't known or able to be determined, DEP recommends using the distances listed in Table 3.1.

c) Available mapping of municipal sewer systems and private sewage disposal systems.

d) Public water supplies, WHPAs, and surface water intake protection areas.

e) Analysis of risks to water supplies.

f) Public and private water supply owner consultations and notifications. DEP recommends using a combination of some, or all, of the following methods to determine the location and construction details of public and private water supplies.

- Media broadcast (local television or radio)
- Local newspaper
- Announcement on municipality website
- Social media posts (to local community groups)

- Letter sent by certified mail to any potentially affected resident, business (e.g., farm), school district, or municipality (see Table 3.1 for recommended minimum distances)
- Phone calls (document efforts)
- Site reconnaissance (document efforts)
- Door hangers (document efforts)

g) The Department recommends that project proponents update their designs and sampling methods for private and public water supplies based on the well construction details collected in Table 2.1 and industry standard sampling methods (referenced in the Data Resource List available on DEP's Trenchless Technologies webpage).

h) Project proponents should develop and provide a water supply well sampling and testing protocol that includes: what constituents will be sampled, what quantity testing will be completed, the distance from the proposed centerline of the project corridor to be sampled, reasons for sampling constituents and distances based on geologic findings, a mode of sharing test data, and an explanation of the results. If the project proponent decides to share this information with the property owner(s), DEP recommends that any results shared include an explanation of what the data (e.g., numbers and exceedances) means using terms a layperson would understand.

i) Project proponents should develop a plan for situations where water sources have existing contamination or high background levels of certain constituents. To assist in conveying water quality results and notification of USEPA maximum contaminant level (MCL) exceedances, if observed, an example letter can be found on DEP's Trenchless Technologies webpage.

Table 3.1 and Table 3.2 provide, respectively, the sampling protocol and parameters recommended by DEP. Table 3.1 provides a list of recommended actions a project proponent should accomplish and prepare as part of the sampling parameters. Pre-construction refers to a time period prior to land altering, clearing, and other types of site work in the limit of disturbance (LOD) or right-of-way (ROW).

Table 3.1. Pre-Construction Water Supply Identification and Sampling Protocol
1. Identify the location of the following*:
a) Private water supply within a minimum of 450 feet, and in karst, a minimum of 1000-feet, 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 upstream and 10 miles downstream[1]
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 (Or purged for 10-15 min to allow for water to be purged from the pressure tank, as applicable)[2]*
c) Record pumped volume*
d) Record rate of pumping*
e) Record duration of pumping*
f) Perform 30-minute specific capacity testing[3]
Notes: [1] All public water supply intakes should be identified in accordance with 25 Pa. Code § 105.401(1). [2] USEPA Region 4 Laboratory Services and Applied Science Division Potable Water Supply Sampling Guidance [3] Perform specific capacity testing after water quality testing is complete so as not to introduce a potential source of bacterial via capacity testing instrumentation. * Items marked with an asterisk are most critical.

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 Parameters		
Field Chemistry[1]		
Temperature	Conductivity	
pH	Oxidation Reduction Potential	
Total Dissolved Solids	Dissolved Oxygen	
Turbidity		
Microbiological - (Reported in Most-Probable-Number [MPN] colonies, not absence or presence)		
Total Coliform		
E. Coli		
Fecal Coliform		
Inorganic[2]		
Nitrate	Hardness	
Chloride	Sulfate	
Bromide	Total Suspended Solids	
Total Dissolved Solids	Montmorillonite (x-ray diffraction)	
Alkalinity		
Trace Metals		
Barium	Calcium	Iron
Magnesium	Manganese	Potassium
Sodium	Strontium	Arsenic
Zinc	Aluminum	Lithium
Selenium		
Organic		
Methane		
Ethane		
Propane		
Total Petroleum Hydrocarbons		

Sources:

[1] USEPA Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers issue paper

[2] DEP Recommended Basic Oil and Gas Pre-Drill Parameters fact sheet

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 analyzed 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 DEP'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 of these documents are publicly available on DEP's Pennsylvania Pipeline Portal webpage and are also linked in Data Resource List available on DEP's Trenchless Technologies webpage.

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 DEP recommends.

a) Streams and wetlands which should be field delineated and confirmed during the 25 Pa. Code Chapter 105 permitting process.

b) Pre-project and post-project function and value assessment for wetlands as required for 25 Pa. Code Chapter 105 permitting.

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

C. Confirmation

With design phase nearly complete and additional data gathered and analyzed, DEP recommends the project proponent explain why the preferred alternative (Section 3.A) is still the most practicable and protective of the environment . It is also possible that at this stage the data suggest that the preferred alternative is not the most practicable and least environmentally impacting 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 permit applications. Appendix B contains a checklist for project proponents to complete as part of their due diligence. Many of the items on the checklist and in this guidance document are equally examined during the preparation of a permit application submittal. The checklist may be submitted with the permit application to demonstrate that proper due diligence was completed and to guide the conversation between the applicant and the reviewer. Below are some examples of the items a project proponent should include with their permit application submittal.

a) Site-Specific Crossing Plans.

b) Safety Data Sheets (SDS) – (formerly known as MSDS) include information such as: the properties of each chemical; the associated physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. SDS should be included for each chemical used. If SDSs are unavailable at the time of permit submission, they can be submitted once available.

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

d) Checklists – see Appendix B for checklist(s).

e) PPC Plans – see Section 4.A for more information. Please also refer to DEPs *Guidelines for the Development and Implementation of Environmental Emergency Response Plans* (400-2200-001) and see DEP's Trenchless Technologies webpage for PPC Plan templates.

SECTION 4. CONSTRUCTION AND COMPLIANCE

Note: *Prior to beginning any analysis associated with this guidance document, project proponents are encouraged to review* Appendix A. *Project proponents are also encouraged to read the disclaimer at the beginning of this document. It is important to note, this is recommended guidance that does not require a new permit.*

This section includes information and recommendations for construction and compliance of any trenchless technology utilized.

A. Preparedness, Prevention, and Contingency Plan

A PPC Plan can include various elements. The overarching PPC Plan generally addresses spill prevention, countermeasures, and environmental emergency response in general. For additional guidance see DEP's *Guidelines for the Development and Implementation of Environmental Emergency Response Plans* (400-2200-001).

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 25 Pa. Code § 102.5(l) and 25 Pa. Code § 78a.68a (relating to 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 on DEP's Trenchless Technologies webpage. 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*" (25 Pa. Code § 78a.68a(b)).

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

- Within approved workspaces and 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 any trenchless technology utilized. The equipment and materials should be appropriate for the scale of the project and should 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 restore impacted areas to pre-existing conditions. The IR Plan should also include measures necessary to restore aquatic resources. Aquatic resource restoration may vary depending on the extent of disturbance and specific regulatory requirements; therefore, appropriate agency contact information should be included in the IR Plan. Finally, the IR Plan should provide procedures necessary to secure landowner permission and anticipate securing any necessary environmental and other 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.

A PPC plan should include information on when to notify the Department when different hazards or incidents occur. Hazards and incidents include, but are not limited to, IRs, subsidence or sinkholes, interception of groundwater, LOC, and commencement of drilling operations.

Lastly, the PPC Plan should include protocols for compliance documentation. The PPC Plan should be maintained for all visual and pedestrian monitoring, trenchless technology instrument logs, and drilling fluid composition including any laboratory testing of drilling fluid or 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 please refer to DEP's *Guidelines for the Development and Implementation of Environmental Emergency Response Plans* (400-2200-001) and DEP's Trenchless Technologies webpage for an example of 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 are recommended to 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 the lead contractor. It should be noted that personnel with operational control or oversight over earth disturbance activities are operators, as defined at 25 Pa. Code § 102.1, and

operators who are not the permittee are co-permittees of a Chapter 102 permit (see § 102.5(h)). Operators assume joint liability for compliance with Chapter 102 permits.

The defined roles and responsibilities for key personnel, including on-site crews and support staff should be available in the PPC Plan, maintained and available on-site, and updated as needed. This list should include the contact information (e.g., cell phone numbers) for all individuals, including a backup contact, when possible, 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
- Trenchless Technology Inspector
- Incident Response entities
- Others, as needed

Project proponents should 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 be made available to DEP upon request. Examples of training may include:

- The locations of resources being crossed (e.g., wetland or stream delineations).
- The local site layout, including ingress and egress.
- When to call 811 and identify potential interferences.
- The locations of local sensitivities (e.g., schools, daycares, places of worship, assisted living facilities, recreational facilities, amusement parks, or other places frequently used by the local community).
- 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 on-site crew manage.
- Plans and procedures that the on-site crew may implement during the project, (e.g., the PPC Plan).
- Contacts and resources, both on-site and those on standby.
- Specific notifications as required and 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 the 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 should 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 on-site staff, including employees, contractors, and sub-contractors, especially those responsible for being aware of the permits and designs 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:

- Off-site staff (e.g., professional or administrative) who may be called in for technical assistance or for other factors.
- Off-site staff who may be involved in decision making for on-site work.

To reduce risk and potential compliance problems, project proponents should adopt a policy where no employees or contracted individuals may access the project site or begin work unless they have completed all pertinent trainings. In the scenario where an individual may only need to access the project site once, or infrequently, the project proponent should plan to provide a responsible escort who has completed necessary trainings.

The project proponent and the lead contractor are each responsible to verify and maintain records that the training objectives have been met for all staff accessing the project site, and these records should be provided to DEP upon request.

C. Pre-construction Activities

A project proponent should consider the following recommendations prior to beginning any construction activities, including any vegetation clearing.

Project proponents should identify all appropriate agencies and acquire all necessary licenses, permits, or other authorizations. 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.

DEP recommends the project proponent, prior to construction, to identify as part of its due diligence, potential impacts as defined in the Site Suitability Analysis and Feasibility Analysis. 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. DEP expects project proponents to do their due diligence and incorporate, at a minimum, the following items:

- Geology or geophysics
- Local land use
- Water supply or disposal issues

- Critical resources
- Soil conditions or constraints

Another important aspect recommended by DEP is that a project proponent analyze and consider implementation planning. DEP 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. Project proponents 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 guidance document (e.g., Site Suitability Analysis and Feasibility Analysis) and adjust as necessary. All these steps should be taken prior to scheduling a pre-construction meeting with regulatory agencies.

There are several meetings that should occur prior to construction. DEP recommends that training on all permit conditions and expectations of permitting and regulatory agencies is conducted for all staff. DEP recommends, to the maximum extent practicable, that the project managers, site superintendents, Environmental Inspectors (EIs), PGs, trenchless technology experts and inspectors, all PEs, 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, DEP 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 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 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 pre-construction 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 pre-construction trainings and include, at the discretion of the project proponent, the following:

- Review PPC Plan.
- Identify chain of command and team members.
- If a high-risk trenchless technology 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 all personnel on-site.

- The role of the EIs, the Conservation District, and DEP.
- Review of Chapter 102 Erosion and Sediment Control (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 Chapter 105 Permit(s), if applicable, including physical location of permits on-site.
- Any site-specific HDD drawings.
- Any additional site-specific permits.
- Any additional documentation needed.

DEP 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 projects that pose above average risk (see Appendix A). These voluntary outreach efforts would be most ideal if they included municipal agencies, landowners, conservation districts, and applicable regulating agencies.

D. Drilling Fluid Management

For each crossing utilizing trenchless technology, a drilling fluids management plan should be prepared 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. DEP maintains a list of pre-approved drilling additives and their associated SDSs.

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

Drilling fluid and additives used in many trenchless technologies should not be used in a manner that causes pollution or a threat of pollution to waters of the Commonwealth. All trenchless technology activities related to oil and gas operations must be done in accordance with, or should be consistent with, 25 Pa. Code § 78a.68a (relating to horizontal directional drilling for oil and gas pipelines). Drilling additives, specifically for HDD, are addressed in 25 Pa. Code § 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 NSF/ANSI Standard 60 (Drinking Water Treatment Chemicals – Health Effects) with a product function of drilling fluid are deemed acceptable to DEP 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 "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 DEP 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 at:
https://info.nsf.org/Certified/PwsChemicals/Listings.asp?ProductFunction=Drilling+Fluid.

Use of drilling additives certified for conformance with NSF/ANSI 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 IR 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 DEP for review. To request a review of an unlisted product, please submit an SDS for the product to RA-epOilandGas@pa.gov. For DEP 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 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 during pipeline installation is fresh water. In drilling applications, it is generally necessary to modify water by adding a viscosifier. The viscosifier used almost exclusively in HDD drilling fluids is naturally occurring bentonite clay, which is principally sodium montmorillonite. Bentonite is not a listed hazardous material or substance as defined by USEPA's Emergency Planning and Community Right-to-Know Act (EPCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulatory criteria. If the product is characterized as a waste following drilling operations, the drill cuttings and fluid must be disposed of as required by DEP's Waste Management Program rules and regulations.

In addition to understanding and considering the aspects and uses of drilling fluid physical properties and in managing drilling fluids, project proponents should 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 handling waste (25 Pa. Code § 271.1). 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 backup disposal location, and a documented protocol should be developed and readily available upon request.

When using drilling fluid additives, drillers should characterize the drilling fluid (drill cuttings and drill fluids) prior to disposal or reuse on-site or off-site by determining constituents of material to be disposed. Once determined, the drill cuttings and fluid must be disposed of as required by DEP's Waste Management Program rules and regulations.

E. Inadvertent Return Minimization Methodologies

To ensure that all trenchless technology 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 installations.

As part of the pre-construction 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 environmental permit terms or conditions.

The most effective way to minimize environmental impact associated with trenchless technology installations, particularly with drilling fluids management, is to maintain drilling fluid recirculation. DEP recommends that project proponents take preventative measures to minimize the likelihood of adverse environmental impacts from IRs by controlling and monitoring drilling fluid. Protocols should be prepared, understood, and followed by persons responsible for monitoring fluids during drilling operations. Monitoring of drilling mud volumes, pressures, pump rates, and 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 IR. 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. The annular pressure should be compared to anticipated annular pressure developed by the engineer. Monitor drilling fluids, by using an annular pressure monitor, or provide justification for an alternative monitoring methods 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 pumping rate. A log of all recorded readings should be maintained.

2. Fluid Circulation

   Recirculation of drilling fluid to the bore pit is important in maintaining operations, providing solids control, and sustaining capacity of drilling fluids suitable for reuse. Fluid circulation can fall under one of three categories: (1) Full or Normal Circulations, (2) Partial Loss of Circulation, and (3) Total or Full Loss of Circulation. If circulation is lost, a PG should be consulted.

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, or if excess water is produced, 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 viscosifier 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 DEP in accordance with 25 Pa. Code § 78a.68a(i), as appropriate, and 25 Pa. Code § 91.33.

F. Hydrogeologic (Groundwater) Considerations

During drilling operations, the trenchless technology contractor should monitor the annulus pressure of returns during the pilot hole phase 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 trenchless technology alignment and adjacent areas for returns should be conducted. The encountering of groundwater within the profile as a result of trenchless technology 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.) and the PG should be consulted. The inspection and early detection of any surfacing of groundwater over the trenchless construction profile will allow the contractor to stop or adjust the 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, a sudden increase in drilling fluid returns, the appearance of clear water mixed with drilling fluids, or clear water only returning to the entry point or exit point indicates that the trenchless technology has progressed into or intercepted a zone of groundwater under pressure greater than the annular pressure of the trenchless technology phase in progress. If this occurs, the PG should document the current phase of trenchless construction, the location and elevation of the tool, and consult with experts regarding the known presence, or unknown potential for the trenchless technology 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 or mine pool discharge as to avoid impacts to the environment and to public and private water supplies.

G. Inspection, Monitoring, Compliance, and Emergency Response

DEP considers one of the most important aspects of the construction phase to be inspection, compliance, monitoring, and emergency response planning. The following are recommendations DEP 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 parties should ensure that the terms and conditions of the various permits are appropriately addressed. As needed, the project proponent should follow up with DEP, and any other relevant agency imposing conditions on the project, to clarify compliance requirements. DEP's expectation 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 (e.g., daily or weekly) project alignment walks to monitor for any ongoing or potential impacts to the environment, and regular inspections of equipment (e.g., drill rigs) and the mud system. 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. DEP 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 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 identified during inspections. Decisions on issues identified in the inspection reports and checklists need to be addressed by the project proponent with on-site 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

DEP 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
- IRs, including prior IRs

25 Pa. Code § 78a.68a(g) requires monitoring for pressure and loss of drilling fluid returns. Bodies of water and watercourses over and adjacent to trenchless technology activities should also be monitored for any signs of drilling fluid discharges. Monitoring should be in accordance with the PPC Plan. This monitoring requirement represents current best practices for projects that are not specifically regulated under 25 Pa. Code § 78a.

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 DEP 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 may reach a live person (e.g., DEP).

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

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 should 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 minimize adverse water impacts, including a discussion and options for mitigation for unavoidable impacts.

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APPENDICES

Appendix A. Trenchless Technology Risk Evaluation
Appendix B. Technical Guidance Document – Plan Submittal Checklists

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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 technologies including potential impacts to the environment regulated under: Pennsylvania's 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; and § 401 of the federal Clean Water Act, 33 U.S.C. § 1341, § 3(d) of the federal Natural Gas Act, 15 U.S.C. § 717b(d), and the various regulations promulgated thereunder. Project proponents are encouraged to read the disclaimer at the beginning 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 guidance document 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, and Contingency (PPC) Plan for the application of trenchless technologies, 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. Please refer to Department of Environmental Protection's (DEP's) *Guidance for the Development and Implementation of Environmental Emergency Response Plans* (400-2200-001) and see example template PPC plans on DEP's Trenchless Technologies webpage. This appendix is also intended to inform project proponents as to when DEP may require more information regarding evaluation of risk or when to develop a more robust project-specific PPC Plan for the use of trenchless technologies. DEP encourages project proponents to review this guidance document in full, regardless of project proponents' self-assessment of risk, as a full review of this guidance document may help to identify ways to further minimize potential risks and inform project proponents when future projects may need a more robust assessment.

NOTE: The project proponent is responsible to review this guidance document, evaluate and address all risks to resources or any potential impacts to the environment associated with a project, and develop a PPC Plan, commensurate with the size and scope of the project, that would adequately abate risk. It is the sole responsibility of the project proponent to evaluate risk and diligently work to prevent and respond to inadvertent returns (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 affect the environment (Doherty, 2019).

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

Minimum Elements for Evaluating Risks of Trenchless Technology Crossings

The minimum elements for evaluating risk of trenchless technology methods should include a Pennsylvania-licensed Professional Engineer (PE) with a geotechnical engineering specialty and

experience in the Pennsylvania geology **and/or** a Pennsylvania-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 Evaluating Risks of Trenchless Technologies

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 or sensitive resources, including streams, wetlands, wells, and threatened and endangered (T&E) species habitat)
12. Curve radius
13. Are drilling fluids (including air) being used and how are they being managed?
    a. Are these fluids under pressure?
14. Drilling equipment (see Table A.1 below)
15. Human-made subsurface features (e.g., utilities, septic systems)

Trenchless Technology Methods

The below list of trenchless technologies and specifications of drilling equipment (see Table A.1) is for illustrative purposes only and is not intended to be an exclusive list; if considering a trenchless technology not listed below, this guidance document 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 the machine and an at-grade receiving pit. The machine advances the bore or casing straight into the pit wall. The pit is slightly longer than the longest piece of casing to be installed. The casing or drill stem is added one piece at a time after the 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 pre-assembled 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), pre-designed 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 A.1. Drilling Equipment Considerations for Evaluation of Trenchless Technology Risk			
Item	**Small Rigs**	**Medium Rigs**	**Large Rigs**
Thrust or 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. – 7 ft. x 20 ft.	7 ft. x 20 ft. – 8 ft. x 45 ft.	> 8 ft. x 45 ft.
Recommended Work Area Dimensions (width x length)	20 ft. x 60 ft.	100 ft. x 150 ft.	150 ft. x 250 ft.
Source: 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 would 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[2]

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

1. Pipejacking 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 (i.e., no drilling fluids are used). Issues with these methodologies include limited capability for guidance and steering (Skonberg and Muindi, 2014). Horizontal Auger Boring may only have an accuracy of +/- 1% of the drive length; conversely, pipejacking is very precise. Pipejacking 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; Bennett et al. 2004).

[2] This list of trenchless technology methods is not considered all-inclusive. There may be additional trenchless technology methods utilized that is not listed here. However, this guidance document would still be applicable to trenchless technology methods not listed here.

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 pipejacking. 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 it can generally only be used with larger bores (24" – 95") (DTD, 2019; Bennett et al. 2004).

3. Horizontal Directional Drill (HDD): This method is similar to "conventional" methods, except the hole is drilled from an inclined ramp instead of a vertical rig. Although it can technically be used for any length, 800 feet – 2000 feet is the optimal length (for time and cost conservation). 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; Bennett et al. 2004).

   After drilling the pilot hole to the opposite side of the stream or piece of infrastructure (e.g., a road), the hole is enlarged through a process called, "pre-reaming". A cutter or 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 not enough drilling mud is used, a condition called "hydra-lock" may occur. During hydra-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 would 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 would 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, and 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" in diameter. Direct pipe is more practical for installs with diameters larger than 42" (DTD, 2019; Bennett 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 or polymers are often used, but not necessarily under pressure. This methodology also improves steering capabilities over pipejacking. The issues with this methodology include increased noise and this technology requires a bore for any application with a diameter larger than 16" (DTD, 2019; Bennett 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 it is a dry process. Disadvantages with this method include that it is conducted on a suspended load, there is limited steering capability, and it is very limited in rock (DTD, 2019; Bennett et al. 2004).

7. Guided Bore or Pilot Tube Method: A true "Guided Bore Method" (GBM) can be interchangeable with the Pilot Tube Method (see the American Society of Civil Engineers' Manual of Procedure 133, *Pilot Tube and Other Guided Boring Methods*). But sometimes one may say "Guided Bore" and mean that it is just a short or 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 crossings for a project.

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

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

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

Section A.2. Evaluation of Above-Average Risk

The intention of this section is to help identify projects that DEP considers above average risk. If **all** below boxes are checked "N" 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. Please refer to DEP's *Guidance for the Development and Implementation of Environmental Emergency Response Plans* (400-2200-001) and see example template PPC plans on DEP's Trenchless Technologies webpage. If, after completing the below checklist, a project proponent does not think their project is above average risk, they should contact the appropriate DEP Regional Waterways and Wetlands Program(s), or DEP's Regional Permit Coordination Office, to discuss and provide justification. Please see Section A.3 below for DEP office contact information.

NOTE: The project proponent is responsible 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: The project proponent should review this guidance document, 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.

NOTE: Positively confirming any of the below questions is not meant to dissuade the use of trenchless technology, nor should it form the basis for dismissing consideration of trenchless technology methods. The Department considers trenchless technology methods useful to avoid, minimize, or eliminate environmental impacts after conducting an appropriate Alternatives Analysis (see DEP's *Guidance for Developing a Chapter 105 Alternatives Analysis* (310-2100-002)).

☐ Y ☐ N Will drilling fluids be used under pressure?

☐ Y ☐ N Are you crossing under an aquatic resource? (Please see Section 1.C of this guidance document for definition of an aquatic resource.)

☐ 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 or mitigation measures required by the reviewing agency.**)

☐ Y ☐ N Are portions of the trenchless technology project located within a Zone II wellhead protection area of a Public Water System groundwater source or within a 1,000-foot radius of a potable groundwater source?

☐ Y ☐ N Are portions of the trenchless technology project located within a 2-mile radius of a Public Water System surface water intake?

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

☐ Y ☐ N Are any trenchless technology activities or crossings located in an area of steep slopes (≥ 2 Horizontal:1 Vertical)? If "Y", provide a narrative explaining in further detail.

☐ Y ☐ N Are any trenchless technology activities or crossings 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 Are any trenchless technology activities or crossings going from an entry point at a higher elevation to an exit point at a lower elevation where the elevation difference is greater than 100 feet?

Section A.3. DEP Office Contact Information

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

Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18701-1915
570-826-2511

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

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

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

Northwest Regional Office

Southwest Regional Office

230 Chestnut Street
Meadville, PA 16335
814-332-6984

400 Waterfront Drive
Pittsburgh, PA 15222-4745
412-442-4000

References

American Society of Civil Engineers, Task Committee on Pilot Tube and Other Guided Boring Methods. (2017). *Pilot Tube and Other Guided Boring Methods*. ISBN (print): 9780784414743. ISBN (PDF): 9780784480571.

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

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

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.

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.

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

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APPENDIX B:
TECHNICAL GUIDANCE DOCUMENT – PLAN SUBMITTAL CHECKLISTS

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CHECKLISTS FOR TRENCHLESS TECHNOLOGY GUIDANCE

To avoid costly delays in the permitting and completion of any proposed action, it is strongly recommended that all sections of the *Trenchless Technology Guidance* are read thoroughly prior to completing the following checklists. The following checklists are considered a companion of the guidance document and should not be completed without proper reference and examination of the guidance document. The checklists should help project proponents confirm their due diligence as recommended in this guidance document.

Prior to completing these checklists, project proponents are also encouraged to review Appendix A.

The guidance document has five sections; Section 1 is the introduction and Section 5 are the references. Therefore, below you will find a checklist that follows Sections 2, 3, and 4 of the guidance document. If a project proponent does not check a box in any of the following sections below, the project proponent should be prepared to explain why the information was not examined.

CHECKLIST FOR SECTION 2– SUITABILITY, FEASIBILITY, AND ENVIRONMENTAL CONSIDERATIONS

The following is a checklist for Section 2 of the guidance document. By checking the boxes below, the project proponent is stating that the item has been thoroughly examined and that the project proponent is prepared to illustrate their findings at the request of DEP per 25 Pa. Code § 91.34(b). Alternatively, if a project proponent does not check a box below, the project proponent should 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 guidance document, 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. Alternatives Evaluation Process - The project proponent should have a proposed alternative prior to conducting the Site Suitability Analysis, Feasibility Analysis, or Environmental Analysis. Please read the narrative in Section 2.A of this guidance document regarding the alternatives evaluation process.

☐ I acknowledge that I have read and understand the narrative in Section 2.A of this guidance document regarding the alternatives evaluation process.

B. Site Suitability Analysis

☐ I acknowledge that I have read and understand the narrative in Section 2.B of this guidance document regarding the Site Suitability Analysis.

1. Existing Surface Conditions

☐ Topography

- ☐ Waters of the Commonwealth
- ☐ Human-made features
- ☐ Cultural, Historical, and 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 or Groundwater
- ☐ Residual and Municipal Waste Operations
- ☐ Geologic and Hydrogeologic 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 Investigation

- ☐ Geotechnical Investigation
- ☐ Geophysical Investigation
- ☐ Hydrogeologic Investigation

C. Feasibility Analysis

- ☐ I acknowledge that I have read and understand the narrative in Section 2.C of this guidance document regarding the 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 and Analysis

☐ I acknowledge that I have read and understand the narrative in Section 2.D of this guidance document regarding Environmental Considerations and Analysis.

- ☐ 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
- ☐ Pennsylvania Natural Diversity Inventory (PNDI) complete

E. Conclusion - DEP expects the project proponent to discuss and support why each alternative is considered the most practicable alternative. Please read the narrative in Section 2.E of this guidance document.

☐ I acknowledge that I have read and understand the narrative in Section 2.E of this guidance document.

CHECKLIST FOR SECTION 3 – DESIGN AND PERMITTING

The following is a checklist for Section 3 of the guidance document. By checking the boxes below, the project proponent is stating that the item has been thoroughly examined and that the project proponent is prepared to illustrate their findings at the request of DEP per 25 Pa. Code § 91.34(b). Alternatively, if a project proponent does not check a box below, the project proponent should 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 guidance document, 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 of this guidance document regarding the preferred alternative.

☐ I acknowledge that I have read and understand the narrative in Section 3.A of this guidance document regarding the 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 of this guidance document regarding 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 and 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 of this guidance document 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 of this guidance document 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 of this guidance document 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 of this guidance document 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 exit points considered and attempted, including all the alternative entry and exit angles attempted, and any alternative profile depths attempted have been documented.

☐ Every practical alternate crossing measure has been documented and considered.

☐ The PPC plan includes all necessary steps to take if a drill or borehole is unsuccessful and it has been determined the borehole should be abandoned.

6. Water Supplies

☐ I acknowledge that I have read and understand the narrative in Section 3.B., Item 6 of this guidance document regarding water supplies.

☐ 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 of this guidance document.

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

C. Confirmation - DEP recommends the project proponent explain why the preferred alternative (described in Section 3 of the guidance document) 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 of this guidance document and confirm that the preferred alternative is still the most practicable choice.

or

☐ I acknowledge that I have read and understand the narrative in Section 3.C of this guidance document 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.

D. **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 of this guidance document and I am prepared to submit my permit(s), including items a-d in Section 3.D.

CHECKLIST FOR SECTION 4 – CONSTRUCTION AND COMPLIANCE

The following is a checklist for Section 4 of the guidance document. By checking the boxes below, the project proponent is stating that the item has been thoroughly examined and that the project proponent is prepared to illustrate their findings at the request of DEP per 25 Pa. Code § 91.34(b). Alternatively, if a project proponent does not check a box below, the project proponent should 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 guidance document, 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, and Contingency (PPC) Plan** - In addition to generally addressing spill prevention, countermeasures, and response actions, the PPC Plan also addresses potential impacts related to inadvertent returns (i.e., an IR Plan), public and private water supplies (i.e., a Water Supply Plan), and underground mining and karst terrain (i.e., a Void Mitigation Plan).

☐ I acknowledge that I have read and understand the narrative in Section 4.A of this guidance document regarding the PPC Plan.

☐ I have prepared a PPC Plan in accordance with this trenchless technology guidance document and applicable 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 of this guidance document regarding personnel, responsibilities, and trainings.

☐ In the PPC Plan, I have defined and listed the roles and responsibilities for all key personnel, including contact information, and a backup contact, when possible, and provided the list 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 this guidance document.

☐ 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 this guidance document and applicable regulations.

☐ I have prepared a training plan, including site safety, permit conditions, key personnel and their authorities, and maps showing sensitive resources on all areas as described in Section 2 and Section 3 of this guidance document.

C. Pre-construction Activities

☐ I acknowledge that I have read and understand the narrative in Section 4.C of this guidance document regarding pre-construction activities.

☐ I have identified all appropriate agencies and acquired, and will 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 experts and inspectors, all Professional Engineers (PEs), 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 that 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 will include all parties responsible for design and construction, including the Project Manager (or their delegate), EI, PG, trenchless technology 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 this guidance document.

D. Drilling Fluid Management - A drilling fluids management plan should be prepared for each crossing utilizing trenchless technology 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 of this guidance document regarding drilling fluid management.

☐ 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 (IR) Minimization Methodologies

☐ I acknowledge that I have read and understand the narrative in Section 4.E of this guidance document regarding IR minimization methodologies.

☐ All trenchless technology 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 this guidance document.

F. Hydrogeologic (Groundwater) Considerations

☐ I acknowledge that I have read and understand the narrative in Section 4.F of this guidance document regarding hydrogeologic (groundwater) considerations.

G. Inspection, Monitoring, Compliance, and Emergency Response - DEP 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.G of this guidance document regarding inspection, monitoring, compliance, and emergency response.

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

☐ I have introduced, or will introduce, 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 ensured, or will ensure, that all staff, including contractors and new staff joining the project late, have been or will be trained on the PPC Plan, permit conditions, and DEP's expectations detailed in this guidance document 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 guidance document.

☐ 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 guidance document.

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

☐ 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 guidance document.