APPENDIX J2

CASE 10-T-0189

HDD INADVERTENT RELEASE PLAN

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1.0 Introduction

The Champlain Hudson Power Express (CHPE) project will install a pair of HVDC electrical transmission cables with an associated telecommunications line from Canada to New York City, NY. The portion of the work addressed herein is located in the upland portion of the route from the south end of Lake Champlain to New York City along the uplands of the Hudson River Valley. This work includes approximately 126 crossings under roads, railroads, wetlands water bodies, and obstructions to be installed using horizontal directional drilling (HDD) methods to minimize interference with use or impacts to the surface environment.

This Inadvertent Release Contingency Plan (IRCP) is for Segment 8 - Package 5b which includes 4 HDD crossings. A summary of the crossings is included in Table 1, below.

Package 5b includes a total of 4 crossings, which are summarized in Table 1, below.

Table 1: HDD Locations, Lengths, and Description

HDD #	Approx. Start Station*	Approx. End Station*	Approx. HDD Length, ft	Obstruction Crossed
87B	51106+47	51120+29	1,458	S. Albany St/Route 54, water main
88	51179+50	51194+20	1,467	Coeyman's Creek
89	51201+75	51225+45	2,369	Wetland, Stream
90	51235+05	51247+40	1,238	Route 396/Stream Bank

*Project stationing shown and is approximate. Each HDD has its own independent stationing.

A primary potential environmental concern associated with HDD involves the inadvertent release of drilling fluids during the drilling process. The purpose of this plan is to establish general procedures to prevent a fluid release (sometimes referred to as a frac-out) during HDD construction and to present steps to manage, control and minimize the impacts in the event that an inadvertent release of drilling fluid occurs. The objectives of this plan are to:

- Provide an overview of the HDD process with a specific focus on the composition, management and use of drilling fluids.

- Identify controls to be implemented during construction to minimize the potential of an inadvertent release.
- Identify the planned means of monitoring to permit early detection of inadvertent releases.
- Identify planned means to protect areas that are considered environmentally sensitive (rivers, wetlands, other biological resources or cultural resources).
- Establish site-specific environmental protection measures to be utilized prior to, during, and following drilling and pipe installation activities to minimize and control erosion and sediment releases to adjoining wetlands or watercourses.
- Have site specific preplanned general response programs in place at the start of construction that is understood and can be implemented immediately by all field crews in the event of an inadvertent release of drilling fluid occurs.
- Establish a chain of command for reporting and notifying, in a timely manner, the construction management team, the Certificate Holders, and the proper authorities in the event of an inadvertent release of drilling fluid and of the preplanned actions that are to be implemented.

It is important to note that the plan in this document serves as the guiding framework for confirming that the HDD Subcontractor is adhering to the specifications and provisions to be protective of the environment. Since there are a variety of potential measures listed in this document available for preventing inadvertent releases and mitigating the effects of a release should one occur, the specifications require that each HDD Subcontractor submit to the project design team, for its review and acceptance, Subcontractor-specific means and methods plan for each HDD crossing reaffirming and detailing how the Subcontractor will conform with the requirements of this plan and the project specifications to prevent inadvertent releases and to mitigate any effects of a release should one occur. The plan by the Subcontractor shall be consistent with the site conditions and constraints, and the Subcontractor's selected means, methods, and equipment. The selected HDD Subcontractor will be responsible for incorporating specific permit conditions, applicable regulatory requirements, details from this plan, site specific environmental features and geotechnical information not available at this time into its submittal.

This IRR Plan includes specific information for each HDD in Package 5B. The site-specific IRR plan for each HDD will be provided once available, but will not be available prior to the EM&CP Submittal. Construction of the HDDs shall not commence without NYSDPS acceptance of the site-specific IRR plan for each HDD.

2.0 Description of the HDD Process

The Horizontal Directional Drilling process begins by mechanically excavating shallow (approximately 5 feet wide by 10 feet long by 4 to 5 feet deep) entry and exit pits at either end of the directional bore alignment. A small diameter (on the order of 5 to 9 inches in diameter) pilot bore is then drilled from the entry pit using directional boring methods. During the pilot bore, a drilling fluid (typically bentonite and water based with selected inert biodegradable additives to improve and modify fluid stability, carrying capacity, and drilling properties to address site-specific ground characteristics and Subcontractor preferences) is pumped through nozzles in the drill head to support the hole and to hydraulically transport drill cuttings from the drill bit back to the entry pit. Environmentally acceptable inert biodegradable additives are required by specification for use on this project and those planned for use by the Subcontractor will be checked for compliance by the design team prior to their use.

A guidance system is mounted immediately behind the drilling head to allow the crew to track and steer the path of the drilling so that it follows the preplanned alignment within the specification permitted tolerances. The drilling fluid holds the cuttings in suspension and carries the drill cuttings back through the annular space between the drill rods and the bore hole wall to the entry pit where it is collected and processed for re-used by a recycling system. The cuttings are separated from the bentonite, using screens, centrifuges, and desanding units which prepares the bentonite for re-use. Once the pilot bore reaches the exit pit, a larger diameter back-reaming head is then attached to the drill string and pulled back through the pilot hole to enlarge the hole. Depending on the size of the pipe to be installed and the ground conditions, several successively larger reaming passes may be needed. Again, a bentonite and water slurry is pumped into the bore hole during reaming to remove cuttings and to stabilize the bore hole. Lastly, the drill string is pulled back through the bore hole with the new, preassembled conduit attached to it in one continuous process until the lead end of the conduit emerges at the entry pit. Steps two and three may be combined, with the conduit being pulled back through the bore hole immediately behind the final reaming bit or swabbing pass.

Specific to this plan, it is important to have an awareness of the function and composition of the HDD drilling fluids. The drilling fluid composition and drilling fluid management are integral components of the HDD process with the following primary purposes:

- Support and stabilize the drill hole.
- Suspend and transport cuttings from drill bit through the drill hole annulus.
- Control fluid loss through the bore's side walls by forming a filter cake on the bore hole walls.

- Managing and modifying the drilling fluid mix to improve its cutting carrying characteristics, its pumpability, and its hole stabilization and support characteristics.
- Power the downhole cutting tools (e.g., via mud motors if required).
- Serve as a coolant and lubricant to the drill bit during the drilling process, and lubricant during the pipe insertion process.

The drilling fluids are composed primarily of potable water, which will likely be obtained from nearby sources selected and permitted by the Subcontractor. As mentioned above, the drilling fluid also contains bentonite clay as a viscosifier. Bentonite is a naturally occurring, nontoxic, inert substance that meets NSF/ANSI 60 NSF Drinking Water Additives Standards and is frequently used for drilling potable water wells. While bentonite is non-toxic and commonly used in farming practices, it has the potential to impact plants, fish and their eggs if discharged to waterways in significant quantities. Frequently, additives are used to: amend the drilling fluid, improve its compatibility with the ground and groundwater chemical characteristics, improve its cutting suspension and carrying characteristics, improve its hole stabilization ability, and reduce seepage loss through the ground characteristics. Environmentally acceptable (i.e. inert biodegradable) additives are required by specification for this project.

During the HDD process and subsequent conduit insertion, the drilling fluid pumped downhole will tend to flow along the path of least resistance. Generally, this will be though the annulus between the drill string and the drill hole side wall. However, the bore alignment may encounter ground conditions where the path of least resistance is an existing fracture, fissure or hole of anthropogenic origin, areas with low overburden confinement, areas of hole collapse, or coarse gravel zones in the soil or rock substrate. When this occurs, circulation can be lost or reduced. This is a common occurrence in the HDD process but does not necessarily prevent completion of the bore or result in a release to the surface or adjacent environment. However, the environment may be impacted if the fluid inadvertently releases to the surface at a location on a waterway’s banks or within a waterway or wetland. Again, additives to amend the properties of the drilling fluid may be used as necessary to prevent and limit releases and losses through such paths of lower flow resistance.

3.0 Organization and Staffing Responsibilities

The organizational chart shown below list the contact information of the principal organizations involved in this project. The remainder of Section 3 discusses the roles and responsibilities of these principal organizations.

Organizational Chart

Entity	Contact Information
Certificate Holders	Name, Title Phone Email
Construction Manager	TBD
HDD Construction Subcontractor	 TBD
Environmental Inspector	TBD
U.S. Army Corps of Engineers, New York District Office	USACE New York District Upstate Regulatory Field Office ATTN; CENAN-OP-UR, Bldg. 10, 3rd Floor North 1 Buffington Street Watervliet, NY 12189-4000 518-266-6350 cenan.rfo@usace.army.mil
New York State Department of Public Service	TBD
New York State Department of Environmental Conservation	Regional Office(s) Information Patrick Rahm New York State Department of Environmental Conservation 625 Broadway, Albany, NY 12233 P: 518-402-6594 | patrick.rahm@dec.ny.gov
New York State Department of Environmental Conservation (Spills)	NYS Spill Hotline: 1-800-457-7362

3.1 Responsibilities of Various Organizations

The principal organizations involved in this project include the Regulatory Agencies, Certificate Holders, Design Engineer, HDD Construction Subcontractor, Construction Manager, and Environmental Inspector. The roles and responsibilities of the principal organizations are discussed in the following subsections and are shown in the organizational chart included above.

3.2 Regulatory Agencies

The Certificate of Conditions issued by the NY Public Service Commission is the primary regulatory agency for the requirements associated with the project. The Champlain Hudson Power Express (CHPE) Route Project also has permits from the Department of Energy, and the US Army Corps of Engineers, and the New York Water Quality Certification. Various HDDs within this package take place within or adjacent to wetlands, underneath or adjacent to bodies of water, and underneath or adjacent to railroad tracks. Measures are discussed throughout this report to control/mitigate any potential releases before environmentally sensitive boundaries are reached or impacted.

3.3 Certificate Holders

The project Certificate Holders are TDI. TDI's Project Manager will have the overall responsibility to coordinate this project for TDI. The Project Manager, will be responsible for correspondence and coordination among all parties and will have the authority to stop work as necessary.

3.4 Design Engineer

The Design Engineer for the Package 5b HDD's Design is Brierley Associates (Brierley). During construction, the Design Engineer will be responsible for reviewing and approving required Subcontractor submittals, shop drawings, and material certificates. Brierley will also take responsibility for review and acceptance of submittals, and documenting the materials and methods used in performance of the construction work to document that the construction complies with the contract documents.

3.5 Third Party Engineer

The Third-Party Engineer for the HDD inadvertent return analysis is Brierley Associates. During construction, Brierley/Kiewit will review of the Subcontractor's Inadvertent Release Plan and provide technical assistance as needed with the HDD installation.

3.6 Construction Manager

The Construction Manager for this project has yet to be selected. The Construction Manager will be responsible for on-site management of the project for the Certificate Holders to ensure overall Subcontractor compliance with the EM&CP documents, environmental permits, and local and federal regulations.

3.7 HDD Construction Subcontractor

The HDD Construction Subcontractors (Subcontractors) for the various HDD crossings of this project have yet to be selected. The Subcontractor will be responsible for completion of the conduit installation by HDD methods in accordance with the design criteria, contract documents, environmental compliance permits and federal regulations. The Subcontractor will be expected to use the appropriate construction procedures and techniques to complete the project, including supplemental site Inadvertent Release Prevention and Contingency Plan reviewed and accepted by the design team for each crossing in accordance with the contract documents.

The HDD Drill Operator (Drill Operator) will be responsible for operating the HDD drill rig, and observing and managing changes in annular fluid pressure or loss of circulation. The Drill Operator will communicate with other members of the drill crew as needed when issues arise. The Subcontractor will be responsible for developing the specific lines of communication within their organization and shall dedicate a responsible person for communicating inadvertent releases to the Construction Management team and Environmental Inspector.

3.8 Environmental Inspector

The Environmental Inspector for this project has not yet been determined. In general, the Environmental Inspector will perform full-time observation and documentation during the HDD activities at a specific site. The Environmental Inspector will be responsible for coordination with all county, state and federal resource agencies, compliance with and changes to any environmental permits.

The Environmental Inspector shall have the authority to stop work when the environmental permit conditions are not being followed or when appropriate environmental precautions are being disregarded by the Subcontractor.

3.9 Lines of Communication and Authority

Formal lines of communication will generally follow the established lines of authority. However, open communications between all parties will be encouraged to facilitate more efficient communication and coordination.

3.10 Training

The Subcontractor will verify and document that all construction personnel have appropriate environmental training before they begin work. The Environmental Inspector will also conduct a project orientation meeting for staff assigned with specific roles during the HDD installation and will review the site-specific environmental concerns and permit conditions. The Certificate Holders and Design Engineer will also attend the orientation meeting to review the procedures that will be used to document inadvertent releases in accordance with the HDD specifications.

4.0 Fluid Release Minimization Measures

4.1 Geotechnical Investigation

The first steps taken to characterize and minimize the potential risk of an inadvertent release includes conducting a geotechnical investigation at the site to develop an understanding of the surficial soils. Test borings were conducted near the proposed cable alignment within or immediately adjacent to the HDD sites. We understand that each boring has been backfilled and sealed with a cement/bentonite grout to limit the risk of a release through an abandoned bore hole during the HDD construction.

4.2 HDD Design

The HDD crossings are being designed to reduce the potential risk of an inadvertent fluid release during construction. General design considerations for HDD include:

- Depth of cover during profile design (based on test borings) to limit the potential inadvertent release to the water body, road, railway, wetlands, or ground surface.
- Typically, potential exists for releases near the entry and exit pits of an HDD bore. The distance where there is a potential for releases at the ends depends on the soil conditions, the slope of the ground surface and the length of the bore. Generally, the longer and deeper the bore the greater the slurry pressures required to hold the borehole open and to carry the cuttings back to the entry or exit pit.

- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest and therefore requires large slurry pressures to overcome flow resistance to carry cuttings back to the entry pit.
- Adjusting the drill alignment to avoid infrastructure including existing utilities, and other obstacles.
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up and limit pull back stresses and bending stresses in the conduit, as well as being compatible with the bending capacity of the tool steel.
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures.
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment.
- Requiring that, during the performance of any HDD waterbody crossing, contractors monitor the use of inert biodegradable drilling solution and, in the event of a detected release of fluid, implement the procedures specified in the approved EM&CP. For any release occurring in a waterbody, the Certificate Holders shall immediately notify DPS Staff and NYSDEC of details of the release and the course of action they recommend taking.
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

4.3 Contingency Plan

As mentioned above, prior to construction the selected Subcontractor will be required to submit a supplemental site-and Subcontractor-Specific Inadvertent Release Contingency Plan for review and approval by design team. The project specifications require that the following major elements be addressed in detail in the Subcontractor's Plan:

- Work plan and detailed description of the drilling program (details for executing pilot hole, reaming, pull-back operations, and schedule) this plan shall include necessary procedures for addressing problems that are typically encountered during HDD installations through the anticipated subsurface for each drill location;

- Drilling fluid composition design and on-hand amendments to alter fluid properties to reduce pressures, potential for plugging, and seepage losses;
- Description of the planned drilling equipment and drill site layout;
- Safety Data Sheet (SDS) information for all drilling fluid products proposed for use;
- Procedures for drilling fluid pressure control, and fluid and pressure loss monitoring and management to aid in the detection of an inadvertent release (i.e., metering of makeup water, recording of drilling fluid product quantities utilized, fluid return volumes, fluid and cuttings disposal quantities, turbidity of river water, etc.);
- Contingency plans for addressing inadvertent releases into wetlands, or other sensitive areas, which includes the specific procedures used to halt the release and then contain, clean-up, and remove materials from the release site;
- Notification procedures and chain-of-command in the event of a release;
- Criteria for evaluating the need for a drill hole abandonment and the associated plan for sealing the drill hole if abandoned;
- Drilling fluid management and disposal procedures;
- The work plan and detailed drilling program description should include documentation regarding site restoration, vegetation management, sedimentation and erosion control, and hazardous material usage (if applicable). Intended approach shall be in compliance with those measures presented in the Project EM & CP.
- Notice shall be provided to residents, businesses, and building, structure, and facility (including underground, aboveground and underwater facilities) owners and operators within one hundred (100) feet of any HDD staging area or trenching activity with an offer to inspect foundations before, during, and after construction. Additional detail regarding this notice, associated inspections, intended benefits, proof of notice, cost reimbursements and associated construction initiation schedule is included in General Condition 154.

In addition to providing a site-specific Inadvertent Release Contingency Plan, the specifications require that the Subcontractor implement the additional necessary safeguards to minimize the likelihood of a fluid release and management/control should a release occur. This includes having a readily available supply of spill response devices (containment booms, pumps, straw bales, silt fence, sediment logs, sandbags, vacuum trucks, and storage tanks) and any other materials or equipment necessary to contain and clean up inadvertent releases. To maximize protection to sensitive environmental areas these measures shall be pre-positioned at the site, readily available and operational prior to the start of any drilling. If needed, additional spill response measures shall be employed immediately, as secondary measures, in the event of a fluid release.

The workspace layout for HDD materials and equipment will be configured to reduce the likelihood of a release.

4.4 Drill Fluids Management

As described in the Project EM&CP document, drilling fluid will be National Sanitation Foundation (NSF) certified and all recycling and reuse regulations will be followed where applicable. The drilling fluid management system and subsequent disposal is the responsibility of the subcontractor performing the HDD work. However, the drilling fluid management system and subsequent disposal will adhere to the following requirements:

- Drilling fluid will be processed through an initial clearing that separates the solid materials from the fluid.
- Solids will be sifted out by a screening apparatus/system and the solids deposited into a dump truck and periodically transported off-site and disposed of at an approved disposal facility determined by the HDD construction subcontractor.
- Drilling fluid that is deemed unacceptable to be reused during construction or left over at the end of drilling will be collected and transferred into a tanker truck for disposal at an approved disposal facility determined by the HDD construction subcontractor.
- Drilling fluid accidentally spilled during construction and operation of drilling rigs will be contained following the mitigation measures described in the SPCC (Appendix K of the EM&CP) and disposed of at an approved disposal facility as determined by the HDD construction subcontractor.

- Supply of spill containment equipment and measures shall be maintained and readily available around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system, if used, to prevent spills into the surrounding environment. Pumps, vacuum trucks, and/or storage of sufficient size will be in place to contain excess drilling fluid.
- Under no circumstances will drilling fluid that has escaped containment be reused in the drilling system.

An overview of the drilling fluid system will be submitted to the Environmental Inspector for approval once determined and prior to any HDD installation activities. The role of the Environmental Inspector is discussed in Chapter 3 of the EM&CP.

4.5 Early Fluid Release Detection

The HDD method has the potential for seepage or fluid loss into pervious geologic formations that the bore path crosses. This may occur due to the presence of fractures in the rock, low overburden confinement, or from seepage through porous soils such as coarse gravels or via prior exploratory boreholes. It is important to note that inadvertent releases of drilling fluid can occur even if the down-hole pressures are minimal. Subsurface conditions that could be conducive and lead to inadvertent releases or drill difficulties include:

- Highly permeable soil such as cobbles and gravel.
- Presence of rock fractures, solution features, or other subsurface fractures.
- Considerable differences in the elevations of HDD entry and exit points (typically greater than 20 feet).
- Disturbed soil, such unconsolidated fill.
- Soft soils that have the potential to squeeze.
- Soils that have the potential for collapse.
- Obstructions that require the use of a high flow mud motor.
- Soft soils with low confining capacity.
- Presence of archeological resources.

- Existing deep foundations.

- Existing below-grade utilities.

Our opinions regarding the risks associated with the above conditions at specific crossings are discussed in Section 9 of this report.

An experienced drill crew is the most effective approach to detect drilling fluid seepage prior to a surface release and promptly stop the drilling and they can modify the drilling fluid composition, properties, and pressures to address indications of loss of drill fluid. The HDD Subcontractor is required to utilize experienced drill crews particularly in and adjacent to environmentally sensitive areas. The following factors can be used for identifying the potential for drill fluid release:

- Spikes or loss of pressure within the drill hole utilizing a downhole pressure monitoring system; and

- A substantial reduction in the volume of return fluid (loss of circulation).

In addition to an experienced drill crew, the HDD Subcontractor will be required to perform periodic (at least twice a day) visual inspection and monitoring ground surface in the vicinity of the drill bit or reaming bit for signs of an inadvertent release. Per Article VII Condition 114(n), monitoring of the status of each HDD while construction activities are underway until the crossing has been completed. In the event of any potential or actual failure of the crossing, the Certificate Holders shall have adequate staff and equipment available to take necessary steps to prevent or avoid adverse environmental impacts. If visual monitoring indicates a potential release, additional measures such as turbidity measurements and bentonite accumulation measurements both upstream and downstream of the current active location of the drill bit are required (where applicable)

5.0 Inadvertent Release Monitoring and Notifications

The HDD Subcontractor is responsible for monitoring of the drilling operation to detect a potential inadvertent release by observing and documenting the flow characteristics of drilling fluid returns to the HDD entry/exit pits and by visual inspection along the drill path. If drilling fluid to the HDD entry/exit pits are lost, the Subcontractor shall implement the following steps:

- The Drill Operator will monitor and document pertinent drilling parameters conditions and observe and monitor the drill path for evidence of an inadvertent release, if there is evidence (typically visual) of a release, the Subcontractor will be required to stop the drilling immediately.

- The Subcontractor shall notify the lead Environmental Inspector of any significant loss of drilling fluid returns at the drill rig; and, in the event of a detected release of drilling fluid during the performance of any HDD waterbody crossing, implement the procedures specified in the approved EM&CP. The Certificate Holders shall immediately notify New York State Department of Public Service (NYSDPS) Staff and New York State Department of Environmental Conservation of details of the release and the course of action they recommend taking.
- The subcontractor will take steps to modify the drill fluid properties and pressures to reduce the potential of drill fluid loss or release; and
- The Drill Operator will take steps to restore drilling fluid circulation in accordance with the requirements of the HDD technical specifications.

If a fluid release is identified, an immediate response is necessary and the Subcontractor is required to take proper corrective actions to minimize impacts, particularly to environmentally sensitive resources (e.g. watercourse, waterbodies, and wetlands).

6.0 Inadvertent Release Response (Upland and Road areas)

A common reason for upward movement and surface release (Inadvertent Return, or IR) of drill fluid is from borehole collapse or blockage and a resulting increase in the pressure exerted by drill pumps. Lowering drill fluid pressure is a first step to limiting extent of a release and can be accomplished by stopping drill rig pumps and allowing pressure to bleed off. With no pumping pressure in the hole, surface seepage will generally stop, then the Subcontractor can trip the drill steel back a selected distance and attempt to clear cuttings from the annulus to re-establish circulation. However, it should be noted that reducing the pump rate too much may result in poor cuttings removal and clogging of the hole, which in turn can also result in an IR.

The Subcontractor will be required to contain/isolate and remove any fluid that has emanated from the surface. On land this can be done through use of berms, straw bales, shovels as needed, or silt fence to contain the release in conjunction with excavating a small sump pit and/or use of vacuum collection equipment, if needed. Sufficient spill-absorbent material will also be required on-site.

If a surface release is identified in an upland area, the Subcontractor will be required to immediately respond as described above to limit the extents of the release. After containment is established, cleanup and removal can be conducted by hand, with vacuum trucks, or other equipment. The Environmental Inspector will be present during clean up and removal activities, as they may need to be conducted outside of the pre-authorized temporary workspace areas. The Environmental Inspector, Construction Manager, and the Subcontractor will work closely to determine the best course of action for inadvertent releases occurring within upland areas.

Upon containment of the release, the Subcontractor will be required to evaluate the cause of the seepage and develop mitigation strategies to limit the likelihood of recurrence. The location of the seepage and the area around the seep will be monitored upon the re-start of the HDD operations for changes in conditions. The segments of borehole nearest the entry and exit points and other areas of low overburden cover tend to be the most susceptible to surface seepage as they have the least amount of soil confinement. These locations will generally be in areas of dry land where seepage detection is easily identified and contained. If areas of high risk for inadvertent releases are identified during the HDD design phase, they can be protected from an uncontrolled release through use of strategically placed confinement/filter beds, straw bales, silt fence, or earth berms place prior to the start of drilling or the use of conductor casings if at entry and exit areas.

7.0 Inadvertent Release Response (wetland, railroad, and open water body areas)

For any release occurring in a waterbody, the Certificate Holders shall immediately notify DPS Staff and NYSDEC of details of the release and the course of action they recommend taking. During the performance of any HDD waterbody crossing, contractors monitor the use of inert biodegradable drilling solution and, in the event of a detected release of fluid, implement the procedures specified in the approved EM&CP. If an inadvertent release occurs when working beneath the waterway, wetland, or railroad the Subcontractor will be required to cease drilling operations and reduce pressures in borehole immediately, and notify the Environmental Inspector, the construction management team and the Certificate Holders. The Environmental Inspector, with input from the Drill Operator, will evaluate the potential impact of the release on a site-specific basis and will determine the appropriate course of action. The Subcontractor is required to develop general in-stream or in-rail response methods and pre-place necessary materials and equipment at the site prior to construction. Specific response actions will be determined in consultation with the Environmental Inspector and Subcontractor and could include the following:

- Slowing the drill fluid pumps.
- Modifying the advance rate and rod/tool rpm, to match pump rate.
- Modifying the drill fluid properties, adding agents to reduce drilling fluid pressures through improved carrying capacity
- Tripping the drill steel and tool back a selected distance and attempt to clear cuttings from the annulus to re-establish circulation.
- Swabbing of the borehole, to increase sidewall stability and to remove clogging or squeezing.
- Stopping drilling activities for 24 hours to allow the bentonite in the subsurface pathways to gel and seal the pathways.
- Evaluate the current drill methods to identify site specific improvements to lower the risk of additional inadvertent releases.
- Potentially implementing a loss-control material (LCM), designed to plug fractures.
- Implementation of proper sedimentation control measures including, but not limited to hay bales, vacuum trucks, silt curtains, containment cells, turbidity curtains, or if suitable, sand bags and confinement/filter beds. These activities will require that qualified construction personnel and other support equipment, and supplies be prepositioned and readily available at or near the site.
- Use of a relief well installed at the location of the release. A well or pit equipped with a subsurface pump to control slurry pressures and future releases at that location by evacuating drilling fluid as it accumulates can also be used. The relief well can be utilized to immediately lower the borehole pressures in the event of an inadvertent release and later to control and manage the release as the drilling continues.

8.0 Drill Hole Abandonment Plan

In the event the Subcontractor must abandon the drilled hole, a plan to fill the abandoned hole will be implemented as detailed in the Subcontractor's supplemental Inadvertent Release Contingency Plan and an alternative plan/alignment for crossing shall be evaluated. If it becomes necessary to abandon a partially completed hole, the abandoned hole will be filled with a mixture of high-yield bentonite, water, and drill spoil. The first ten feet of the bore path will be compacted and filled with soil or a cement-bentonite mix to prevent future settlement. The Subcontractor submitted site-specific abandonment plan shall be approved by the Design Engineer and the Construction Manager prior to being performed in the field.

After the abandoned hole has been filled, an alternative entry and exit hole and bore path alignment will be evaluated by the Subcontractor, Construction Manager, and the Design Engineer. The new alignment shall be offset from the abandoned hole by at least 15 feet (except at the ends where a 5- foot offset may be used) to help limit the risk steering difficulties due to the presence of or hydraulic connection causing drill fluid loss to the abandoned hole.

9.0 Crossing Specific Conditions and IR Analysis

A generalized geologic profile and an annular pressure analysis for each crossing is included in Appendix A. In each case the results of the analysis are considered applicable to both HDD installations.

9.1 Analysis Method

The annular pressure analyses compares the anticipated range of downhole annular drill fluid pressures required to complete the pilot bore to the estimated confining capabilities of the surrounding geologic materials. This exercise can be useful in the evaluation of risk of inadvertent returns (IR's, or "fracout") during drilling. The potential for an IR may be considered greatest at locations where the anticipated range of downhole drill fluid pressures are close to or exceed the estimated confining capabilities of the surrounding materials. Note that the pilot hole (vs the reamed hole) is generally the most constrained, and presents the greatest risk of IR during the HDD construction process.

The following should be noted:

- HDD requires drill fluid pressures sufficient to stabilize the borehole and remove cuttings. In general, it may be possible to reduce the risk of drill fluid loss through careful drilling and drill fluid management, but IR risk cannot be completely eliminated.
- The annular pressure analysis is considered to be a tool to identify areas of potential risk. *It is not considered an exact predictor of the location or degree of an IR.*

- The annular pressure analysis does not account for existing pathways or zones of weakness in the subsurface, which may be related to existing utilities, foundations, utility poles and below-grade space. Where present, these features will *increase* the risk of drill fluid loss.
- The annular pressure analysis is not an accurate predictor of borehole leakage, where drill fluid leaks to the adjacent materials through existing porosity or fractures.
- Drill fluid loss from the borehole may not migrate to the surface. In some cases, the drill fluid may escape to the surrounding formation.

The static drill fluid pressure is a function of the density of the drill fluid at a specific location and depth below the drill entry elevation. The dynamic pressure is the pressure required to move the drill fluid (and cuttings) up the borehole annulus, and is a function of pump rates, hole geometry, fluid density, fluid velocity, and fluid rheology. The estimated annular pressures included in Appendix A are based on the API-13D method using a Power Law to model the dynamic pressure of a visco-plastic fluid.

Geotechnical parameters used in the analysis were derived through evaluation of laboratory testing and engineering judgement. The confining capability of the native materials was approximated using a variety of methods, which include the following:

- **Total Stress Model**: The Total Stress Model is based on the dead weight of the formation material above the drill path and excludes the potential strength of the formation. This method is considered *conservative* but is considered a reasonable approximation for the formation pressure capacity of bedrock and very dense soil.

- **Cavity Expansion Model (Delft Equation)**: This method considers the strength of the formation along with the total stress (above) and is based on Ko = 1 conditions. The initial equation was derived from the Mohr-Coulomb failure model adjusted by Delft University for low angle cylindrical cavity expansion in a host material when subjected to internal pressure. This method has been found more realistic in sand, silt, and stiffer cohesive formations than the Total Stress Model. However the method require assumptions of a horizontal surface with homogeneous isotropic soil. Additionally, the equations require significant property assumptions such as the Shear Modulus, G.

- **Stress plus Strength Model**: This method was initially implemented by the US Corps of Engineers to assess the damage potential to levees from the HDD fluids during drilling. This model adds the strength of the formation material to the total stress though results are generally considered to be conservative. The basis of the model, like the cavity expansion model is the Mohr-Coulomb failure approach. This model is generally appropriate for soil or bedrock.

- **Queens Model**: The Queens model was developed at Queens University. This model also adds the strength of the formation material to the total stress. The basis of this model, similar to the cavity expansion model is the Mohr-Coulomb failure approach. The difference between this model and the Delft model is that the Queens approach permits variation in the Ko of the soil and is considered more realistic in softer cohesive soils.

Additional input assumptions included:

- Jetting tools will be used for fill, lacustrine and glaciofluvial deposits.
- A mud motor will be used to complete the pilot hole for bores encountering glacial till and bedrock.
- A drill fluid pump rate of 200 gpm for pilots using jetting and a drill fluid pump rate 400 gpm for mud motors.
- An average drill fluid density of 78 pcf, and maximum drill fluid density of 94 pcf.
- An estimated drill bit diameter of 8.16 inches and a drill rod diameter of 3.5 inches.

9.2 HDD Crossing #87B

Surface conditions at HDD #87B:

HDD #87B passes below S. Albany St/Route 54 which curves from east-west to northwest-southeast in this vicinity. This roadway is supports two lanes of active traffic and is approximately 23-ft wide. The crossing also passes below a 48-in water main operated by the Albany Water Board, and numerous smaller utilities.

To the southwest of S. Albany St/Route 54 (in the vicinity of the HDD alignment) the ground surface slopes downward toward the center of the alignment, from about El. 170 to El. 155. In this area, the crossing passes below a wetland and 60-in CMP culvert. This area is covered with brush and small trees.

The HDD Entry is located to the northwest, on the south side of S. Albany St/Route 54, adjacent to a small commercial facility (single-story buildings, unpaved parking). The ground surface in this area ranges from about El. 175 to El. 178. Overhead utility poles are located on the opposite (north) side of the road.

The HDD Exits are staggered and located in a grassy area on the northeast side of S. Albany St/Route 54. A paved parking area and a brick office building operated by CSX are located to the immediate. Surface grades at the HDD exit range from about El. 175 to El. 177.

Subsurface conditions at HDD #87B:

The subsurface conditions along the HDD #87B alignment consist of a layer surficial fill overlying glacial lake deposits consisting of consisting of silt and clay (loose to medium dense and very soft to soft), with lesser amounts of loose silty sand and sand. The density/consistency of the silt and clay appears to decrease with depth. It should be noted that the glacial lake deposits contain extensive amounts of "weight-of-hammer" materials.

IR Risk at HDD #87B

In our opinion the conditions conducive to inadvertent releases that may exist this at this site may include:

- Highly permeable soil such as cobbles and gravel in the surficial fill.
- Areas of reduced soil cover.
- Existing below-grade utilities.
- Obstructions such as cobbles and boulders within the overburden soils.
- The soft glacial lake deposits, which do not provide significant capacity for drill fluid pressure containment.

It appears that there is a potential of inadvertent release at the end of the bores (as is common). These could be controlled through the use of conductive casings, haybales, silt fences, erosion control measures and vacuum trucks. There is also the potential for drill fluid loss and IR over the entire length of the crossing due to the soft soils. The drilling contractor will need to monitor drill fluid returns, drill fluid pressures and borehole behavior carefully. Reduced pump volumes and displacement-type drilling and reaming may be necessary. The drilling contractor will need to be prepared to identify and address an IR over the full length of the bore in each case. This will require full surface monitoring and access, including the wetland areas.

9.3 HDD Crossing #88

Surface conditions at HDD #88:

HDD #88 is located to the east of S. Albany St/Route 54 and passes below Coeyman's Creek and an adjacent wetland. The majority of the site vicinity is covered by trees and brush. Farmland is located to the northwest, southwest and northeast.

The HDD Entry is located to the southwest in an open field (farmland). Surface grades in this area range from about El. 163 to El. 165. The HDD exit is located to the northeast in an area covered by brush and small trees, which has been mapped as wetland. Surface grades in this area range from about El. 174 to El. 176.

Surface grades along the HDD alignment slope downward toward Coeyman's Creek at moderate grades from the northeast and southeast. The Creek is oriented approximately north-south, with a bottom elevations estimated at El. 124 to El. 125.

Subsurface conditions at HDD #88:

The subsurface conditions along the HDD #88 alignment consist of a layer surficial fill overlying glacial lake deposits consisting of consisting of silt and clay (loose to medium dense and very soft to soft), with lesser amounts of loose silty sand and sand. The density/consistency of the silt and clay appears to decrease with depth. It should be noted that the glacial lake deposits contain extensive amounts of "weight-of-hammer" materials.

IR Risk at HDD #88

In our opinion the conditions conducive to inadvertent releases that may exist this at this site may include:

- Highly permeable soil such as cobbles and gravel in the surficial fill.
- Areas of reduced soil cover.
- Existing below-grade utilities.
- Obstructions such as cobbles and boulders within the overburden soils.
- The soft glacial lake deposits, which do not provide significant capacity for drill fluid pressure containment.

It appears that there is a potential of inadvertent release at the end of the bores (as is common). These could be controlled through the use of conductive casings, haybales, silt fences, erosion control measures and vacuum trucks. There is also the potential for drill fluid loss and IR in the vicinity of Coeyman's Creek and the adjacent wetland due to the reduced cover and soft soils. The drilling contractor will need to monitor drill fluid returns, drill fluid pressures and borehole behavior carefully. Reduced pump volumes and displacement-type drilling and reaming may be necessary. The drilling contractor will need to be prepared to identity and address an IR in each case. This will require full surface monitoring and access, including the stream and wetland areas.

9.4 HDD Crossing #89

Surface Conditions at HDD #89:

HDD #89 is located to the southwest of a single CSX rail (oriented northwest-southeast), and passes below a small stream, which is generally oriented north-south. The majority of the HDD alignment is covered by brush and small trees, and has been mapped as wetland. Overhead utility poles are located immediately adjacent to and parallel the northwest portion of the HDD alignment.

In general the surface grades slope downward gently toward the south-southwest. However, moderate slopes are located on either side of the stream. The stream bottom is estimated to be at about El. El. 149.

The HDD entry is located to the southwest, with a surface grade of about El. 158 to El. 160 The HDD exit is located to the northwest, with surface grades of about El. 174 to El. 175. Both the entry and exit areas are covered by brush and small trees and have been mapped as wetlands.

The entirety of the HDD #89 alignments are located within the CSX right-of-way.

Subsurface conditions at HDD #89

The subsurface conditions along the HDD #88 alignment consist of a layer surficial fill overlying glacial lake deposits consisting of consisting of silt and clay (loose to medium dense and very soft to soft), with lesser amounts of loose silty sand and sand. The density/consistency of the silt and clay appears to decrease with depth. It should be noted that the glacial lake deposits contain extensive amounts of "weight-of-hammer" materials.

IR Risk at HDD #89

In our opinion the conditions conducive to inadvertent releases that may exist this at this site may include:

- Highly permeable soil such as cobbles and gravel in the surficial fill.

- Utility pole locations.
- Existing below-grade utilities.
- Obstructions such as cobbles and boulders within the overburden soils.
- The soft glacial lake deposits, which do not provide significant capacity for drill fluid pressure containment.

It appears that there is a potential of inadvertent release at ends of the bores (as is common). These could be controlled through the use of conductive casings, haybales, silt fences, erosion control measures and vacuum trucks. There is also the potential for drill fluid loss and IR over the entire length of the crossing due to the soft soils and areas of reduced cover. The drilling contractor will need to monitor drill fluid returns, drill fluid pressures and borehole behavior carefully. Reduced pump volumes and displacement-type drilling and reaming may be necessary. The drilling contractor will need to be prepared to identity and address an IR in each case. This will require full surface monitoring and access, including the stream and wetland areas. The adjacent railroad tracks should be monitored in close coordination with the Owner prior to, continuously throughout operations, and 1-2 weeks post installation.

9.5 HDD Crossing #90

Surface Conditions at HDD #90:
HDD #90 is located to the southwest of a single CSX rail (oriented northwest-southeast), and passes below the bank and wetland of a small stream, which is generally oriented northwest-southeast. HDD #90 also passes below Route 396 which is about 27-ft wide and oriented northeast-southwest. In this vicinity the CSX rails are elevated, and pass over Route 396 by means steel bridge with concrete wing walls to the northeast of the crossing. In general, the site grades along the alignment slope downward toward the stream to the southwest.

Two (2) separate, northeast-southwest oriented overhead power lines cross the alignment in the Route 396 vicinity. Numerous power poles associated with these lines are located along the southeast portion if the HDD alignment.

The HDD #90 entry area is located to the southeast. This area is covered by small trees and brush, and mapped wetland is locate to the northeast. Surface grades in this immediate area range from about El. 157 to 159.

The HDD #90 exit area is located to the northwest. This area is covered by small trees and brush, and has been mapped as wetland. mapped wetland is locate to the northeast. Surface grades in this immediate area range from about El. 157 to 159.

The surface grade of the adjacent CSX rail (northeast) ranges from about El. 165 to El. 166. The entirety of the HDD #90 alignments are located within the CSX right-of-way.

Subsurface conditions at HDD #90

The subsurface conditions along the HDD #90 alignment consist of a layer surficial fill overlying glacial lake deposits consisting of consisting of silt and clay (loose to medium dense and very soft to soft), with lesser amounts of loose silty sand and sand. The density/consistency of the silt and clay appears to decrease with depth. It should be noted that the glacial lake deposits contain extensive amounts of "weight-of-hammer" materials.

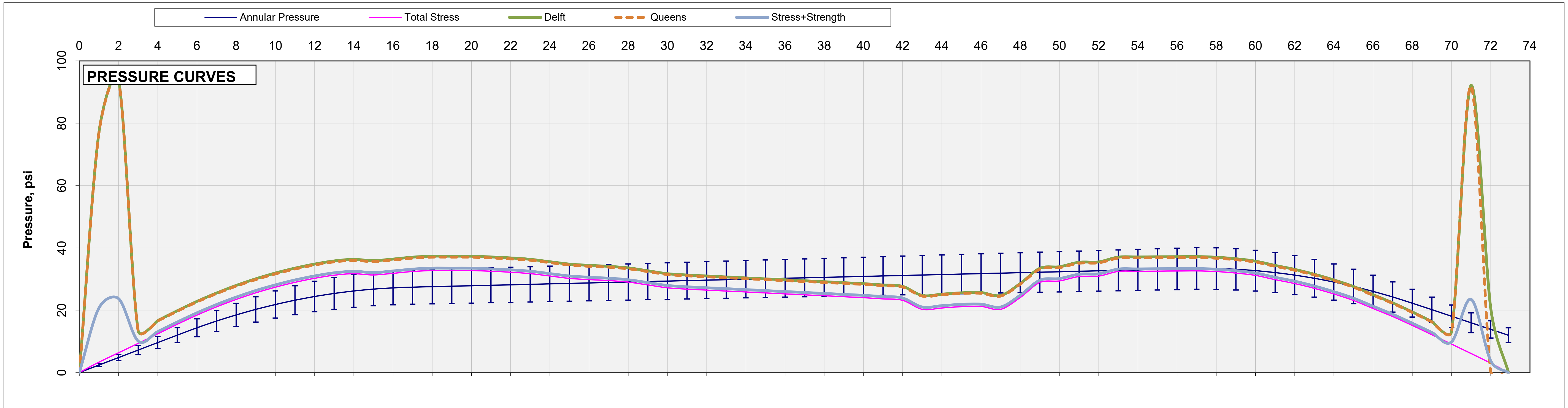
IR Risk at HDD #90

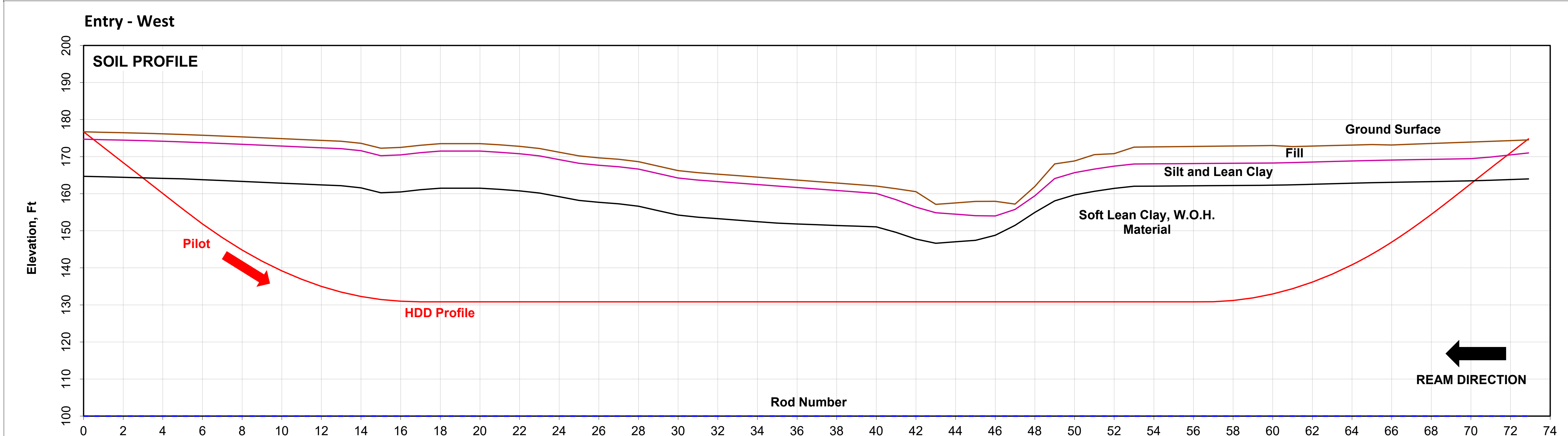
In our opinion the conditions conducive to inadvertent releases that may exist this at this site may include:

- Highly permeable soil such as cobbles and gravel in the surficial fill.
- Utility pole locations.
- Existing below-grade utilities.
- Potential deep foundations associated with overpass structures.
- Obstructions such as cobbles and boulders within the overburden soils.
- The soft glacial lake deposits, which do not provide significant capacity for drill fluid pressure containment.

It appears that there is a potential of inadvertent release at ends of the bores (as is common). These could be controlled through the use of conductive casings, haybales, silt fences, erosion control measures and vacuum trucks. There is also the potential for drill fluid loss and IR over the entire length of the crossing due to the soft soils and areas of reduced cover. The drilling contractor will need to monitor drill fluid returns, drill fluid pressures and borehole behavior carefully. Reduced pump volumes and displacement-type drilling and reaming may be necessary. The drilling contractor will need to be prepared to identity and address an IR in each case. This will require full surface monitoring and access, including the stream and wetland areas and Route 396. The adjacent railroad tracks should be monitored in close coordination with the Owner prior to, continuously throughout operations, and 1-2 weeks post installation.

APPENDIX A
ANNULAR PRESSURE ANALYSES





ISSUED: Issued for Construction

Notes:

1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

Bore Logs

K194.0-2.2A
K194.0-2.2B

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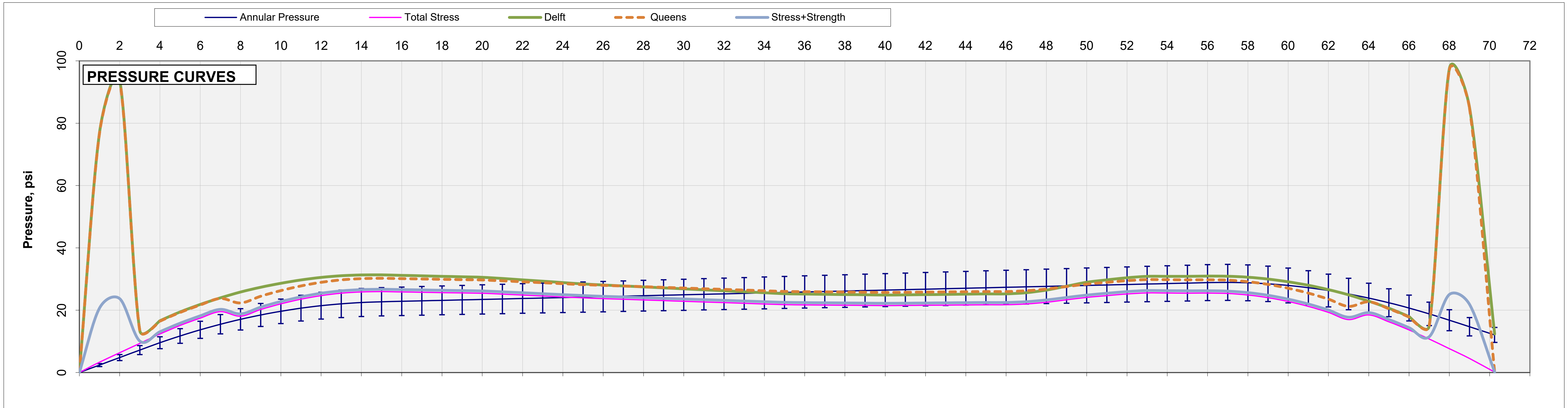
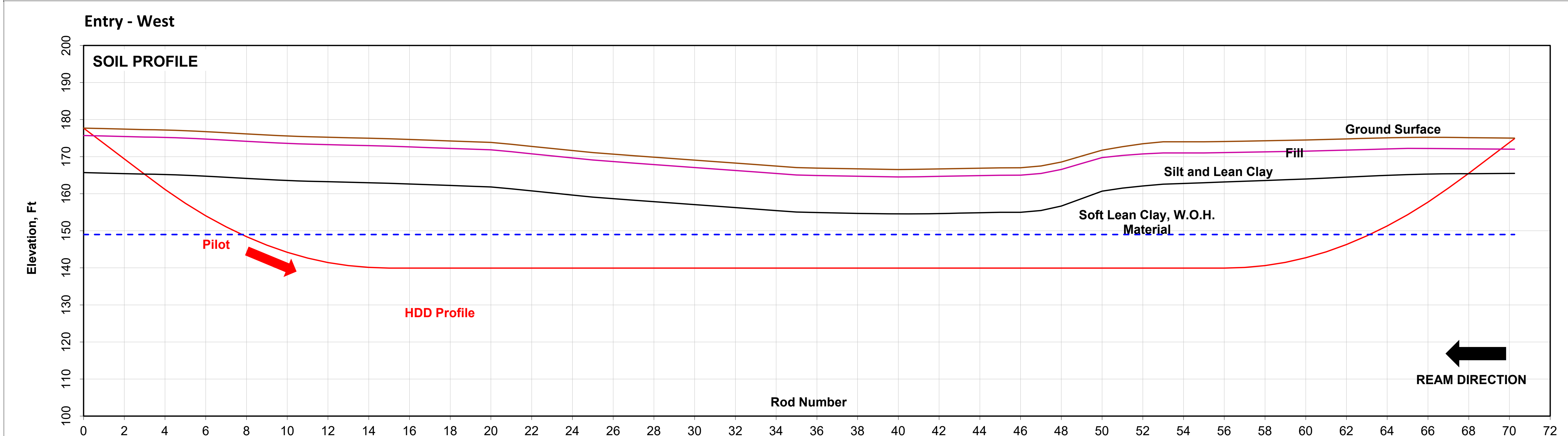
ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 87B Circuit #1
South Albany Street

Revision 1

FIGURE 1





ISSUED: Issued for Construction

Notes:

1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

Bore Logs
K194.0-2.2A
K194.0-2.2B

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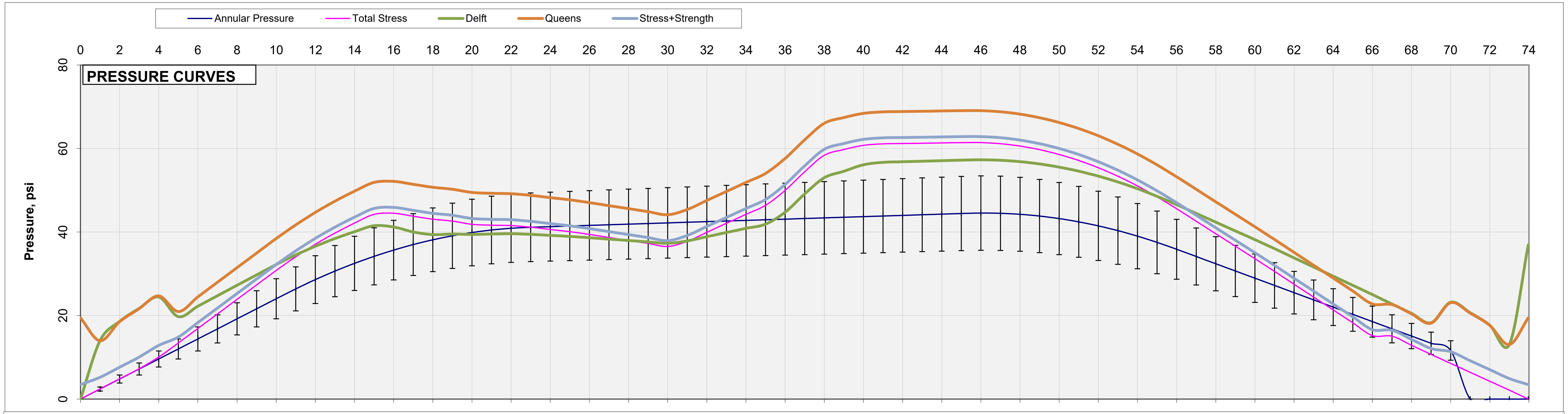
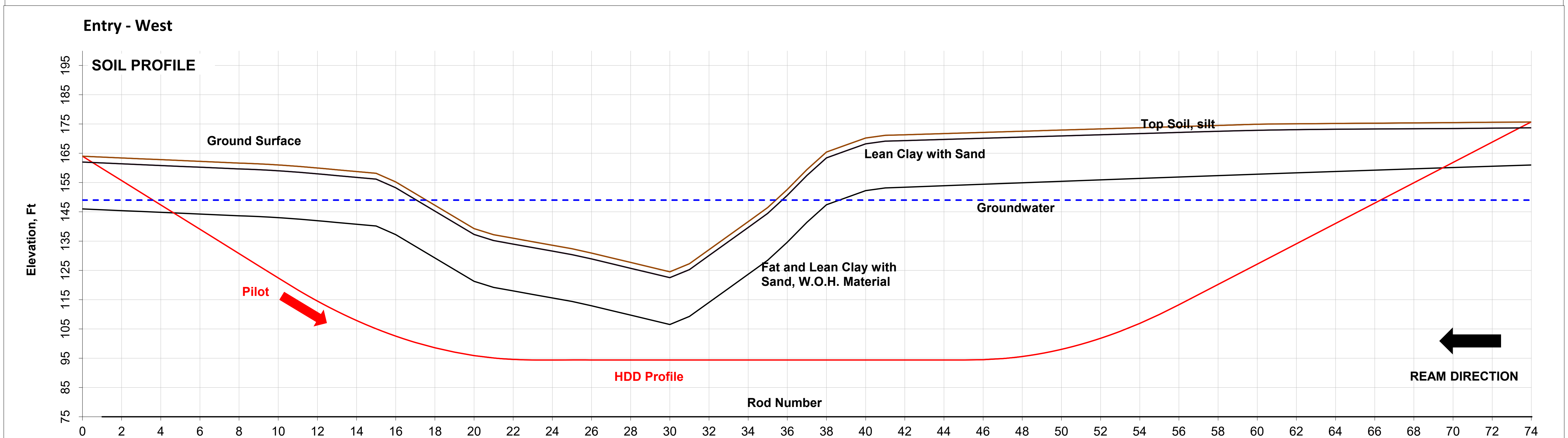
ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 87B Circuit #2
South Albany Street

Revision 1

FIGURE 1





ISSUED: Design Review

Notes:
1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

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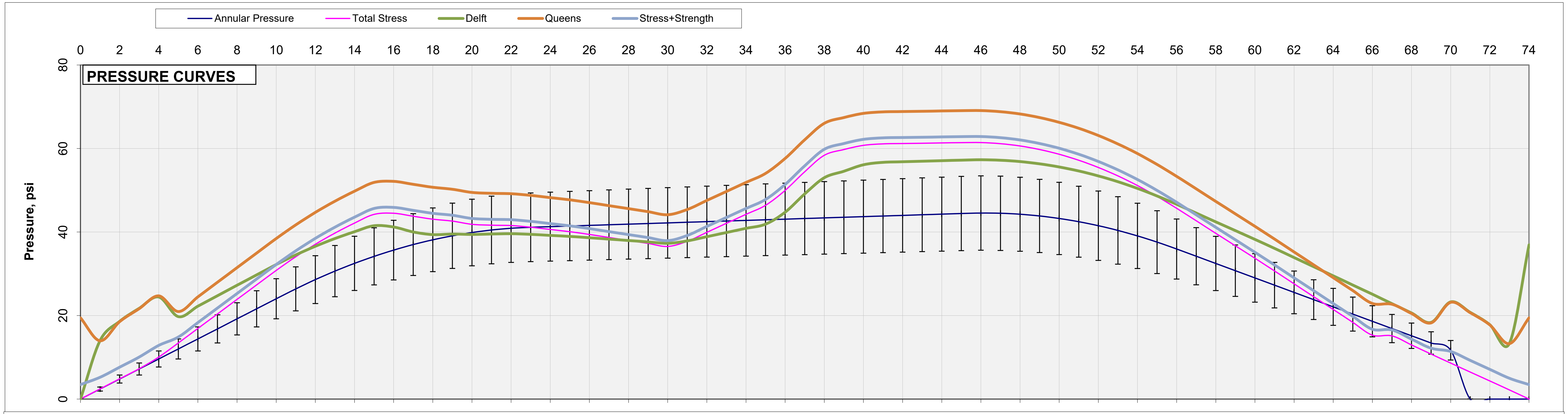
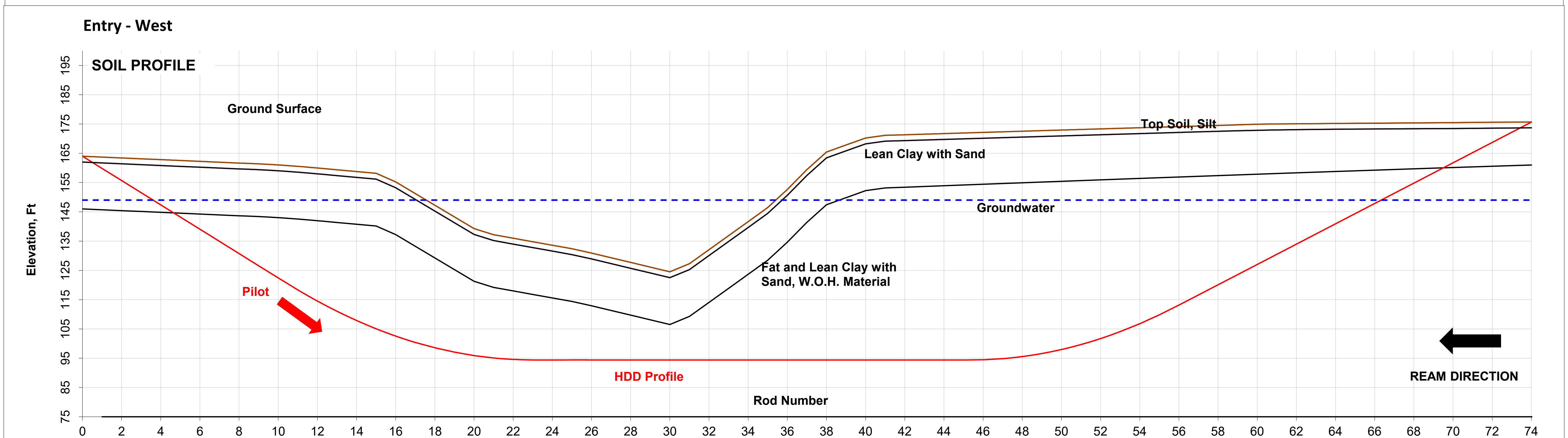
ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 88 Circuit #1
Coeyman's Creek

Revision 0

FIGURE 1





ISSUED: Design Review

Notes:

1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

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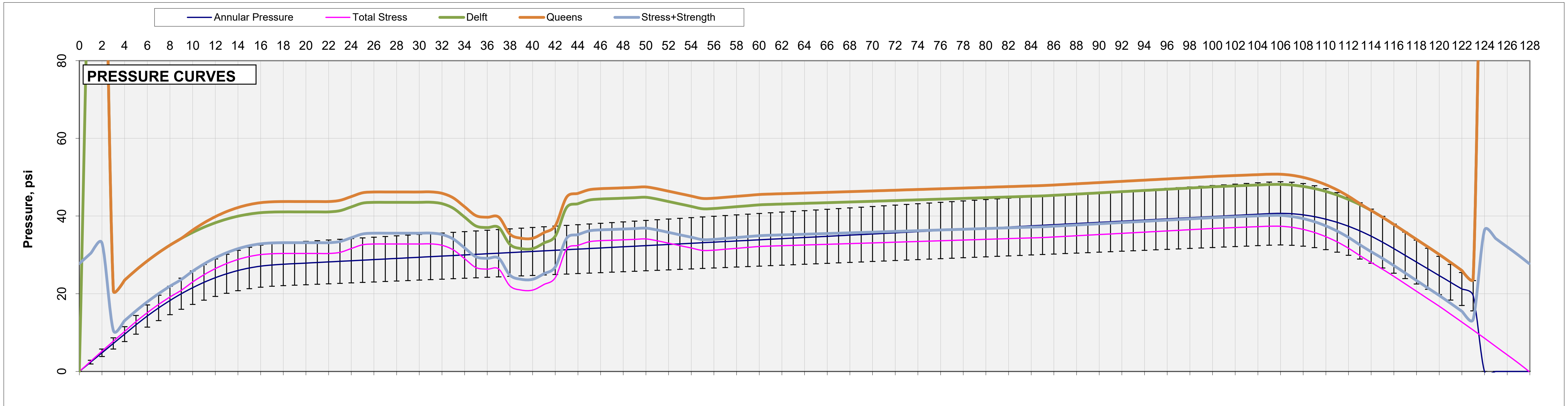
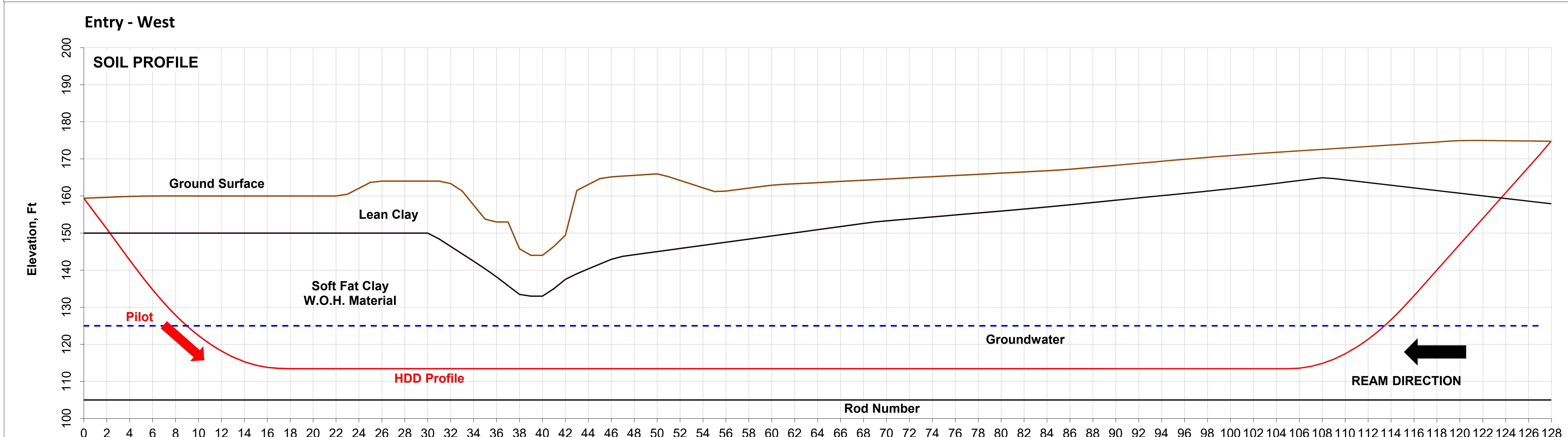
Schenectady County, NY

ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 88 Circuit #2
Coeyman's Creek

Revision 0

FIGURE 1





ISSUED: Design Review

Notes:
1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

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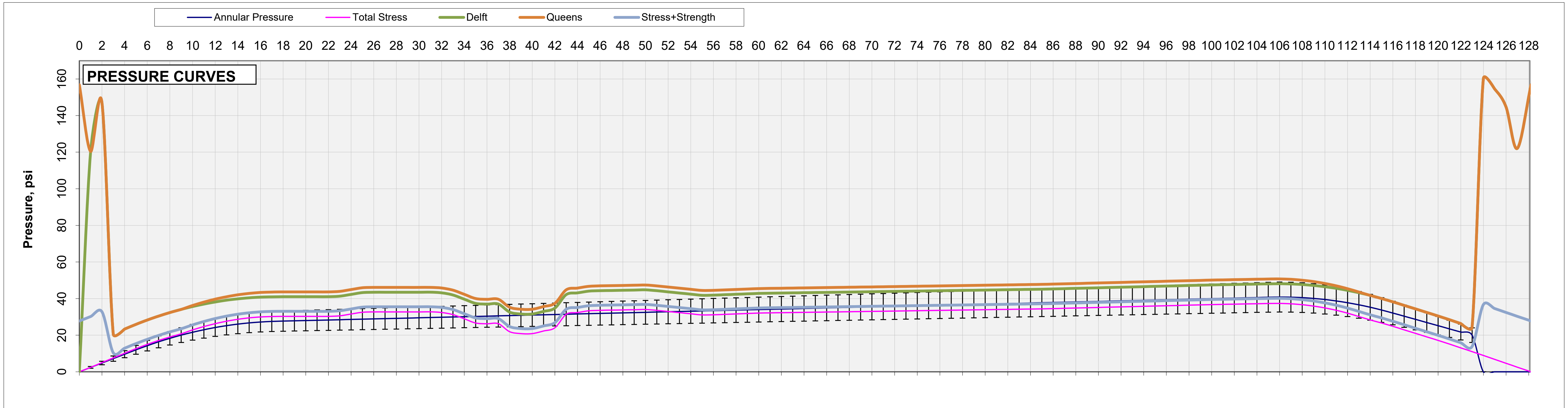
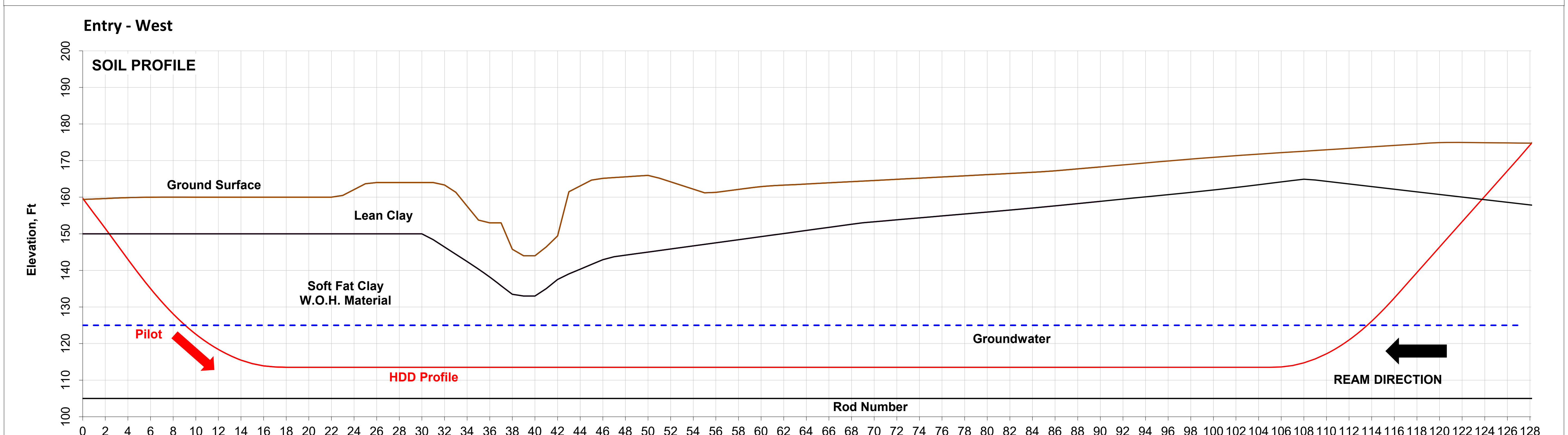
Schenectady County, NY

ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 89 Circuit #1
Wetlands Crossing

Revision 0

FIGURE 1





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Notes:

1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

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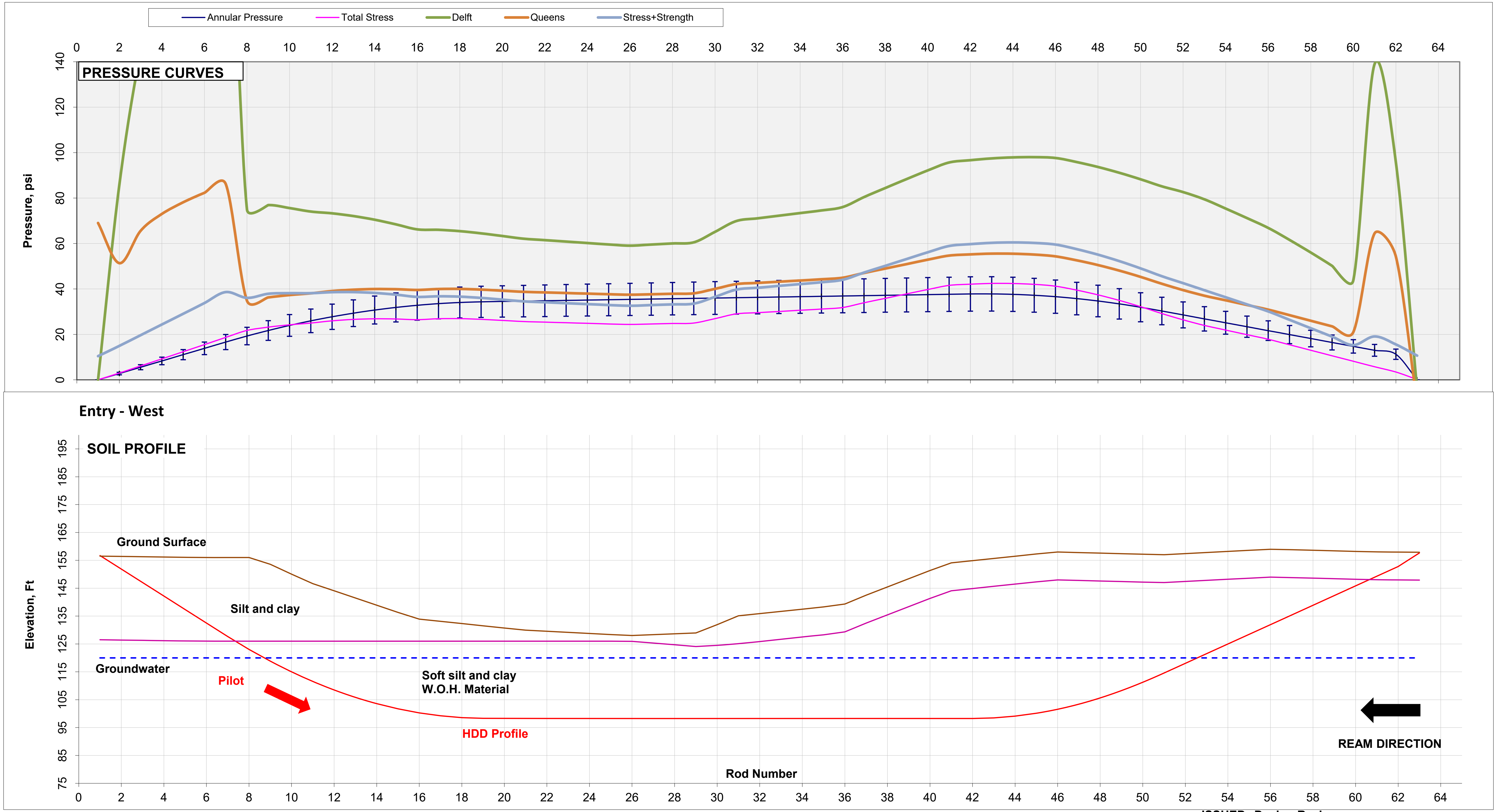
Schenectady County, NY

ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 89 Circuit #2
Wetlands Crossing

Revision 0

FIGURE 1



ISSUED: Design Review

Notes:

1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

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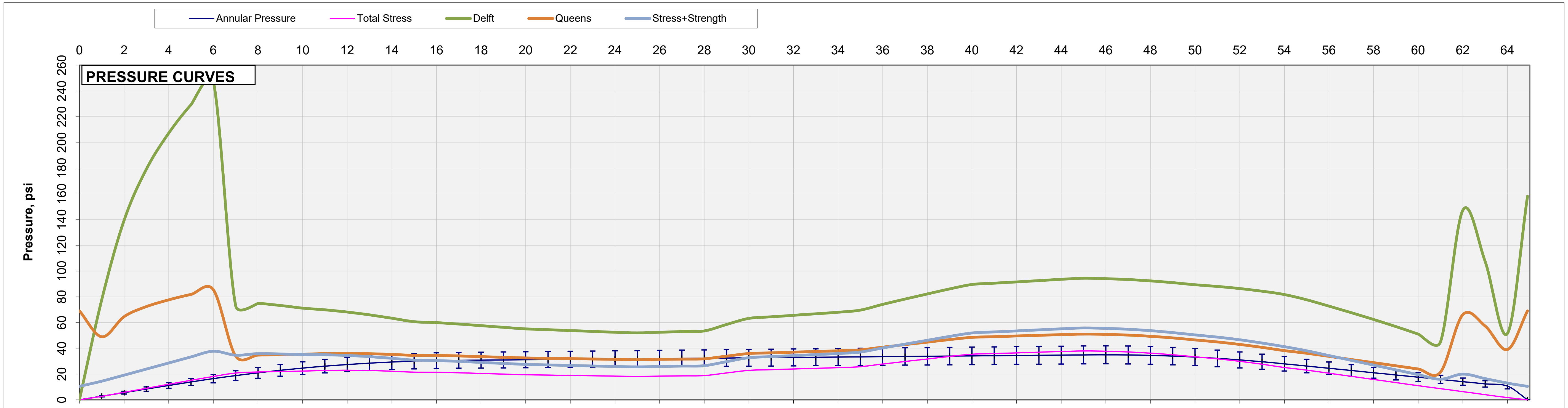
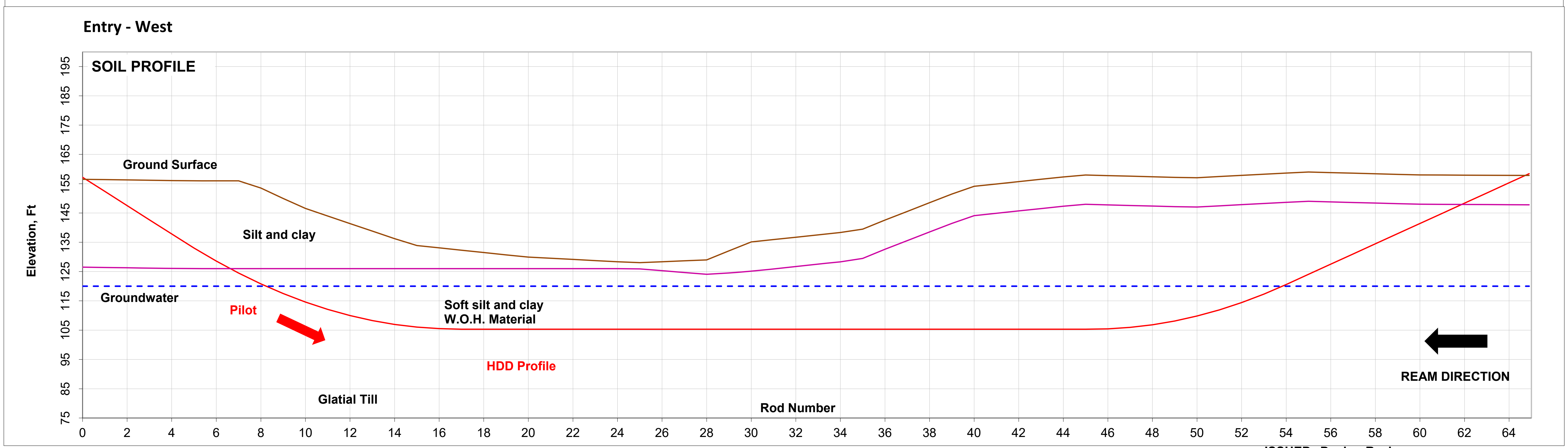
ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 90 Circuit #1
Route 396 & Stream Bank

Revision 0

FIGURE 1





ISSUED: Design Review

Notes:

1. Geology is interpreted from project data
2. Rod length: 20 feet
3. The error bars are at 20% and represent Drill Fluid low and high density range.
4. Ground surface data obtained from project survey data
5. Subsurface data from Geotechnical Report.

Basis of annulur pressure calculations

8.16 in	Pilot Hole Diameter
78.0 pcf	Unit Weight Drill Fluid
150 gal/min	Pump Rate
3.50 in	Drill Rod Diameter
20	Ft per rod
20%	for APC curve

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ANNULAR PRESSURE AND FORMATION PRESSURE CURVES
HDD 90 Circuit #2
Route 396 & Stream Bank

Revision 0

FIGURE 1