APPENDIX F

Inadvertent Release Contingency Plan

Inadvertent Release Contingency Plan for Pacific Gas and Electric Line 215 Replacement at the San Joaquin River, Patterson, CA

Overview

The proposed HDD alignment is currently approximately 7,280 feet long with a maximum cover depth of approximately 110 feet below the ground surface, as shown on the proposed HDD Profile. It is Kleinfelder's professional opinion that the current cover depth is feasible based on the hydraulic fracturing analysis of the proposed bore path if intersect bore methods are implemented. If conventional HDD techniques are used, hydraulic fracturing could become a concern within the San Joaquin River and beyond.

In general, all borings along the alignment encountered similar soil conditions. Approximately 3 to 12 feet of silts and clays was encountered at the surface of each exploration location and was underlain by sands with varying fines contents to boring termination depths ranging from 21½ feet to 131½ feet. The consistencies of the silts and clays ranged from stiff to hard and the relative densities of the sands ranged from medium dense to very dense, generally increasing with depth.

The density and consistency of soils encountered within the HDD alignments in the exploratory borings do not vary greatly. The soil units within the proposed bore path appear to consist primarily of medium dense to very dense sands except at the entry and exit points. These variations in density/consistency are not severe but could cause some difficulty steering along the bore path at the transitions.

The clean sands that were encountered in the borings along the alignment may be prone to instability in the HDD borehole. When such soils are encountered during drilling, proper drilling fluid makeup or use of conductor casing can reduce the potential for borehole caving and stuck pipe during pullback.

Hydraulic fracturing occurs when borehole pressure causes plastic deformation of the soil surrounding the borehole, initiating and propagating fractures in the soil mass. The resistance to plastic deformation and fracturing is a function of soil strength, overburden pressure, and pore water pressure. Hydraulic fracturing can result in drilling fluid inadvertently returning to the ground surface or running horizontally away from the borehole. Allowable borehole pressure was evaluated using the Delft Geotechnics equation as published in "Recommended Guidelines for Installation of Pipelines Beneath Levees Using Horizontal Directional Drilling, Appendix B, CPAR-GL-98-1," published by the Pipeline Research Council International (PRCI) and the U.S. Army Corps of Engineers, dated April 1998. The estimated allowable borehole pressure was compared to predicted borehole pressure in our analyses.

For hydraulic fracturing analysis, we assumed a pilot-hole diameter of 12 inches, a drill rod diameter of 6½ inches, and a mud pump output of up to 450 gallons per minute. Target uphole fluid velocities in the analyses range from about 100 to 125 feet per minute in our analysis. The drilling fluid density was estimated to be about 10 to 11 pounds per gallon. Changes in the drilling fluid properties and drilling equipment affect the analysis results.

Borehole instability issues and/or the contactor not maintaining a clean borehole can result in poor drilling returns and partial or complete plugging of the borehole. This will result in higher fluid pressures within the bore and can lead to hydraulic fracturing and inadvertent fluid returns to the ground surface. Depending on the contractor's means and methods, a minimum cover depth of 35 feet below the San Joaquin River should be maintained to minimize the risk of hydraulic fracturing where a relatively clean borehole is maintained with good drilling returns. A deeper bore path should be considered if the contractor determines that borehole plugging and/or poor drilling returns are likely.

This evaluation considered the intersect method of drilling from both ends with the intersect point near the middle of the alignment. If intersect drilling is not performed, the drilling fluid pressures will likely exceed the allowable value before reaching the exit point.

This drilling fluid contingency plan is in place to deal with inadvertent fluid migrations (frac-outs). A properly designed drilling fluid program can substantially reduce losses due to frac-out, stuck product pipe, or loss of tooling. This drilling fluid program considers anticipated soil conditions, fluid selection, drill bit and reamer selection, and volume calculations.

Objectives

The inadvertent release contingency plan outlined below has been developed and will be employed to meet the following objectives:

• To ensure Contractor has specific measures in place in the event of an inadvertent mud release and that potential impacts are minimized; and

• To ensure corrective action processes are in place to properly manage inadvertent releases of drilling mud.

The Rig Manager is responsible for implementing and maintaining all mitigation measures unless otherwise specified. The Rig Manager for this project will be Matt Brotherton.

Source Information

The geotechnical investigation for the proposed pipeline and extension and replacement project was conducted by Kleinfelder between April 26th and June 19th, 2018 and included a field investigation, laboratory testing, and a review of surface topography. The purpose of this study was to evaluate the subsurface conditions near the proposed trenchless crossing alignment in order to characterize the subsurface materials likely to be encountered during trenchless activities. The findings of the geotechnical investigation, including recommendations regarding the geotechnical aspects of the proposed project's design and construction are provided in Appendix B (Geotechnical Investigation Report) to this Drilling Program Plan.

An overview of the horizontal directional drilling (HDD) procedure to be implemented for the proposed project, as well as the execution plan for the proposed project, and considerations for environmental management including monitoring and direction drill mud release are included in, "|HDD Execution Plan for Barnard Pacific Gas and Electric Company Patterson, California" dated July 10, 2019, and is provided as Appendix C to this Drilling Program Plan.

Project Overview

The project consists of extending the existing 24-inch diameter pipeline to retire an existing, exposed 12-inch diameter pipeline that currently crosses the San Joaquin River using HDD trenchless technology with a maximum cover depth of approximately 110 feet below the ground surface. The proposed HDD will use an intersect method with two bores, one on the west side and one on the east side of the San Joaquin River. The proposed entrance for the HDD section is located approximately 90 feet southeast of Prune Avenue and 1,250 feet southwest of Paradise Avenue in Patterson, California. The HDD alignment runs east for approximately 7,303 feet, running underneath the San Joaquin River, before exiting approximately 745 feet east of S. Carpenter Road and 65 feet south of W. Bradbury Road.

A primary staging area will be used to string, weld and coat the pipeline before pull through. The primary staging area will be located near the exit side of the crossing and will be contained within the existing right-of-way limits or temporary workspace. Typically, an area 250 feet by 150 feet (or approximately 37,500 square feet) is sufficient in size but may vary depending on the requirements of the selected drilling contractor. The drill rig location will initially setup at this location and complete the pilot drill and reaming process.

The secondary staging area, which is to be located on the entry side of the crossing will be utilized to setup and install the drilling rig as per the drilling contractor's site plan. Typically, an area 250 feet by 150 feet (or approximately 37,500 square feet) is sufficient in size but may vary depending on the requirements of the selected drilling contractor. The drilling rig is used to pull back the inspected and tested pipe pull section from the exit side of the crossing back to the entrance side.

Risks Associated with HDD

Loss of Drilling Fluid Returns

Loss of drilling fluid returns typically occurs when the drill bit encounters large interstitial pore spaces in coarse soil materials (i.e. gravels and cobbles). Loss of returns is recognized by a decrease of drilling fluid returns, or a drop in drilling fluid pressure.

If interstitial pore spaces are small or discontinuous, they may fill with solids contained in the drilling fluid returns as drilling progresses beyond them. Once the pore spaces are filled, fluid will return up the bore hole again and fluid pressure will increase until another gravel layer is encountered. If gravel/cobble layers are continuous to the surface, drilling fluid may inadvertently return to the surface. Based on the soil conditions encountered in the borings, drilling fluid losses due to fractures or interstitial pore spaces is minimal.

Drilling Fluid Program

Borehole Slurry Density

The density of the slurry in the borehole directly affects the buoyancy force and therefore the normal force between the pipe rand the wall of the borehole. The density of drilling returns is a function of ground conditions, penetration rate, mud flow rate, drilling fluid composition, and efficiency of the mud cleaning system. In general, drilling return density varies between 9 and 11 pounds per gallon. In coarse gravel and cobbles, drilling fluid densities may approach 13 pounds per gallon.

For this project we anticipate drilling fluid return density will be on the order of 10 to 11 pounds per gallon where good returns are achieved, and drilling is performed in accordance with the HDD Good Practices Guidelines (2008).

Soil Conditions for Drilling Fluid Design

For the purpose of drilling fluid design, earth materials are divided into two categories: Inert, including sand and gravel; and reactive, including clay. Information regarding subsurface conditions likely to be encountered at the site is provided in the Subsurface Conditions section of the project's Geotechnical Investigation Report, as well as in the boring logs contained in Appendix A and Laboratory Testing contained in Appendix B of that report, which is provided as Appendix B to this Drilling Program Plan.

Drilling Fluid Selection

Drilling fluid program base fluid should be designed for site specific soil conditions. The base fluid may consist of either a bentonite or polymer and water, with additives to achieve specific fluid properties.

The drilling contractor should submit a base fluid design with a list of additives, loss of circulation materials, and grouting materials that may be used on the project and MSD sheets for approval at least two weeks prior to mobilization. Assistance with drilling fluid selection can be obtained from reputable drilling fluid suppliers.

Drilling Fluid System

During the drilling operations, Brotherton will have a Vermeer 9x12T Reclaimer at the entry and exit side of the bore location. These Vermeer shakers will support the reclaiming of drilling fluid to be recirculated downhole during the pilot, reaming and swabbing passes. The entry and exit pits will be excavated to an approximate dimension of 10'W x 20'L x 5'D. This will allow sufficient room for the 36" reamer to enter and exit each pit location. A mixture of bentonite and water will be pumped through the reclaimer at a rate 450 GPM and 150 PSI downhole.

Drill Bit and Reamer Selection

Drill bits and reamers should be selected based on anticipated subsurface conditions and experience. The drilling contractor should be prepared with a variety of bits and reamers that have worked well in similar soil conditions.

Soil and Fluid Volume

The volume of soil to be removed can be estimated as follows:

(Hole Diameter in Inches)^2 /25 = Volume in Gallons per Foot

Enough fluid should be pumped during drilling and reaming operations to maintain flow. Drilling rates and drilling fluid flow rates may be adjusted in the field to match varying site conditions. However, an estimate of drilling fluid demand is useful when sizing drilling equipment, mud pumps, and solids removal systems, and can be particularly helpful in determining realistic drilling rates. Drilling fluid demand can be estimated based on the bore hole volume and the following ratios:

Fluid Volume: Soil Volume	Ratio
Sand, Gravel, Cobble, Rock	1:1
Above, mixed with Clay	2:1
Clay or reactive Shale	3-5:1

Drilling rates can be estimated based on the drilling fluid demand and the pump output at the design base fluid viscosity.

Solids Separation Plant

Fine grained silts and clays are generally the most difficult to remove from drilling fluids. Depending on their extent, the presence of these soils along the proposed bore path may require use of desilters/centrifuge in order to remove the fine soils from the drilling fluids.

Fluidic Drag Coefficient

A fluidic drag coefficient of 0.050 psi (345 Pa) was recommended in the original Pipeline Research Council International (PRCI) design guidelines and is still routinely used by pipeline designers. Recently it has been suggested the coefficient could be decreased to 0.025 psi (172 Pa) for a stable borehole with good solids removal (Puckett, 2003). The higher value (0.050 psi) is recommended for routine calculations. The lower value (0.025 psi) may be appropriate for long bores in stable formations where significant cost saving could be realized by using a lower grade of steel or thinner pipe wall.

Borehole Friction Factor and Abrasion

A large portion of the pullback load is generated from friction between the pipe and the wall of the borehole. The pipe rubs against the borehole as it goes around sharp curves and is pushed against the top of the borehole by buoyancy and capstan forces. The friction factor is an expression of the ratio of the normal force between the pipe and the borehole wall and the axial force needed to drag the pipe along the wall. The PRCI Guidelines recommend friction factors of 0.2 to 0.3 for steel pipe. ASTM Standard F1962-99 recommends a friction factor of 0.3. Due to the presence of gravels, an abrasion resistant coating is recommended for steel pipes and generally required for natural gas pipelines. Recommended friction factors for abrasion resistant polymer concrete coating were not found in the above literature. The coating material is similar in texture to smooth, formed concrete. NAVFAC DM 7.02, Chapter 3, Table 1 reports friction factors for formed concrete against various soils types as presented in Table 1, below. The friction factors reported below do not account for the presence of a drilling fluid filter cake.

Table 1: Ultimate Friction Factors

Interface Material	Friction Factor (tanδ)	Friction Angle δ(deg.)
Clean gravel, sandy gravel, coarse sand	0.55 to 0.60	29 to 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	0.45 to 0.55	24 to 29
Clean fine sand, silty or clayey fine to medium sand	0.35 to 0.45	19 to 24
Very stiff and hard residual or pre-consolidated clay	0.40 to 0.50	22 to 26
Medium stiff and stiff clay and silty clay	0.30 to 0.35	17 to 19

Drill Pad Support

Surface soils in the vicinity of our exploratory boring near the HDD entry points may consist of clays and are not likely to provide adequate support for HDD drilling equipment. When these soils become wet, they may be slippery and unstable. Soil stabilization is likely to be required to provide a stable platform for the HDD drill rig and surrounding area. Use of a gravel surface course underlain by a geotextile is recommended where heavy truck and equipment traffic is planned. This may also be needed for a storm water pollution prevention plan (SWPPP).

Drill Continuance Plan

In the event of a frac-out Brotherton Pipeline along with the consultant and designated contact will determine an appropriate drill continuance plan, which will include the following.

1. Fracture Plugging (Bridging) Agents

In certain types of formations or conditions, fracture plugging agents (non-toxic) have been utilized with limited success. These agents shall be approved by the Environmental Field Specialist and include MAGMA-FIBER, MULTI-SEAL and MACRO-FILL. Walnut husks, sealant or other commercially available products. These are pumped down the drill hole left undisturbed for a predetermined length of time where upon drilling is restarted. If positive circulation is restored, drilling is continued using the same principles and contingency plans, if not drilling is halted.

2. Down Hole Cementing

If the fracture zone is determined to be too large for the use of plugging agents, the drill string may be inserted to a predetermined depth to allow a quick setting cement or thermal resin (nontoxic - See CETCO SDS Sheets) to be pumped down-hole in sufficient quantities to seal off the problem zone. If no further fracturing occurs, drilling is continued using the same principles and contingency plans; if, not drilling is halted.

3. Contain and Control

If the inadvertent release is on land, determined not to be causing an adverse effect, and the surface migration of the drilling mud can be adequately contained and controlled, then drilling can continue with the following conditions:

- There are no impacts to the environment or other adverse effects (i.e. no potential to contaminate surface or ground water, third party property damage or safety risks to the landowner, public or animals.)
- The area affected by the inadvertent release is minor and limited to only one location.
- The surface migration of the drilling mud is adequately contained (bermed with subsoil or a catch pit excavated).
- The contained free drilling mud is adequately controlled (any free drilling mud migrating to the surface is immediately and continually removed for the duration of the remaining drilling phase.
- The site is monitored at appropriate periods during the drilling cycle and the drilling contractor reduces pump/hole pressure accordingly in order to maintain control of the amount of mud being contained.

• The affected landowner is notified and permission for continued drilling is granted.

• The plan is discussed with appropriate regulatory agencies and their approval is obtained; and

• The affected site is remediated and reclaimed to meet approved criteria.

4. Relief Well Installation

In the event of a frac-out, if the above procedures are unsuccessful, a relief hole will be installed along the bore path to relieve drilling pressure and allow for drilling fluid to be contained at specific locations. A vertical well will be installed directly over the bore path, and outside of the waterway. This relief well will need to be at a location that is accessible to vacuum trucks and\or pumping equipment. Drilling fluids shall be extracted and re-circulated back to the entry pit. The relief well will require a secondary containment source to prevent any possibility of drilling fluids exiting the relief well.

5. Partial Hole Recovery

If of the above procedures are unsuccessful, down-hole cementing could be used to seal off a substantial portion of the existing hole back to a point where a “kick-off” can take place. The drilling would then be advanced along a different bore path, usually at a lower elevation. Again, careful monitoring of drilling fluids and drill path will be carried out using the same principles and contingency plans, if not drilling is halted.

In the event that none of the above procedures are successful or considered feasible, the hole will be abandoned and filled with cement, which will be batched on site using best management practices. A re-drill will be considered at a second location. Prior to determining the location of a second bore path, a geotechnical evaluation would be conducted to thoroughly evaluate subsurface conditions. All permissions, lease obligations, and the necessity for a subsurface utility investigation would be determined as part of the location selection for a second bore path.

6. Post-Construction Frac-Out Report

Following any frac-out event, a post construction report will be developed to document the event for submittal to USACE. The post-construction frac-out report would include, but not limited to the following information:

- A map that shows the frac-out locations
- Date and time of frac-out events
- Details of mitigation measures taken
- The “Before” and “After” photographs confirming the clean-up.

Directional Drill Mud Release Contingency Plan

Cleanup Plan

The Brotherton drill rig manager will report to the PG&E staffed Construction Manager, who will report directly to USACE. In addition to USACE, all applicable agencies shall be immediately notified of any frac-out incident. Please refer to Table 2: Agency Contact Information, which includes the agencies and agency contact information for the agencies pertinent to this project. Table 3: Exploration Team, includes the project team’s names, titles, and affiliations as they relate to the project.

Agency Contact Information

Table 2: Agency Contact Information

Agency	Contact
California State Lands Commission (CSLC)	(562) 590-5201
California Governor's Office of Emergency Services (Cal-OES)	(800) 852-7550
US Army Corps of Engineers – Sacramento District - Emergency Management	(916) 557-6911

Exploration Team Information

Table 3: Exploration Team

Name	Organization	Title	Registration	Years of Experience
Alex Li, PE	PG&E	Pipeline Engineering and Design, Senior Gas Engineer	Professional Engineer (PE) Mechanical, No. 35578	11
Kelvin Qiu	PG&E	Gas Transmission Project Manager	N/A	9
Tyler S. DeSouza, PE	Kleinfelder	Trenchless Engineer/ Field Inspector	Professional Engineer (PE) Civil, No. 88355	6
Romeo Shiplee, PE	Kleinfelder	Lead Trenchless Engineer/ Field Inspector	Professional Engineer (PE) Civil, No. 81127	14
Vanessa Welsh	Kleinfelder	Project Manager	N/A	15
Jim Brotherton	Brotherton Pipeline	President and Owner	N/A	56
Matt Brotherton	Brotherton Pipeline	Rig Manager	N/A	28

Specific Measures for Directional Drill Mud Release - TO BE IMPLEMENTED WITH AN IMMEDIATE RESPONSE

• Shut down the drilling operations and access the significance of the frac-out area with visual monitoring.

• Mobilize a vacuum truck or 3” trash pump (with leak free hose) to the frac-out area if necessary. A pump would be required every 300’ back to the entry pit.

• Frac-out area will be cleaned up using brooms, shovels, or mechanized equipment (skid steer) if possible.

• With Owner permission, a small hole may be excavated over the frac-out area to install a 3” trash pump for expediting the cleanup of the inadvertent fluid release.

• Filter fencing will be installed around the affected area to isolate, contain and prevent any further spreading.

• Drilling fluid will be evaluated for the possible implementation of lost circulation material.

• A swabbing pass may be required to clean the drill hole prior to the resumption of the pilot\reaming pass.

• An approved cleanup plan will be a necessity prior to resuming drilling operations.

Surface Casing

Surface Casing will only be used if the entry location cannot provide a stable geological formation for fluid to return to the pit. The casing would help minimize the risk of inadvertent returns near the entry location with the assumption of the bore eventually entering a solid or satisfactory formation.

3. Install surface casing at the entry point to a depth that extends beyond the coarsest material, if warranted.

4. Install surface casing at the exit point, after completion of the pilot hole if coarse textured near surface deposits could interfere with drilling mud circulation.

Mud Composition

5. The composition of drilling fluid will be limited to fresh water and high yield bentonite conforming to or exceeding American Petroleum Institute specifications. Other additives or substitutes will require approval from the project Planner/EFS/Biologist before being used in the drilling fluid.

Drilling Sumps

6. Construct subsoil berm(s) or sump(s) down slope from the entry point and proposed exit point with a capacity adequate to capture anticipated volumes of drilling mud that could be release during pullback and other drilling operations.

Contingency Plan Equipment and Supplies

7. Certain equipment will be required onsite in sufficient quantities during drilling operations to contain any inadvertent drilling mud releases. This equipment and supplies may include:

• (20) Sandbags;

• (100’) filter cloth (e.g., silt fence);

• (12)T-bar posts;

• (4) shovels;

• (1) 55 Gallon Barrel;

• (2) 6 mil rolls polyethylene or equivalent; and

• (2) 3” trash pumps c/w sufficient lengths of leak free hose and suction heads.

All of the HDD equipment on site is available to affect an emergency containment of seepage of drilling fluid, and will be directed by the Rig Manager.

Manpower

8. All of the HDD contractor manpower are available to affect an emergency containment of seepage of drilling fluid, and will be directed by the Rig Manager.

Monitoring

9. Supervisory personnel will be onsite during drilling, reaming and pullback operations to ensure that contingency plan measures will be implemented immediately and effectively.

10. Monitor and record the amount of fluid return to the mud tank/pit and the amount of makeup drilling fluid required in the mixing tanks during drilling of the pilot hole and reaming.

Water Quality Monitoring (by others)

11. Ensure the water quality sampling program is in place before drilling and includes the following information:

- Sample locations (both an upstream control site as well as appropriate downstream sites).
- Frequency of sampling; and
- Sampling procedures.

12. Increase the sampling frequency if monitoring of drilling mud returns indicate that a release may have occurred.

Response

13. Where seepage of drilling fluid into a water body or riparian area is detected as possibly occurring, all drilling operations must stop. Rig Manager will initiate emergency response plan if seepage of drilling fluid into a water body or riparian area is confirmed.

14. The observation of a reduction in flow of drilling fluid will constitute a detection of a possible occurrence of seepage, and thus, if a reduction in the return flow of drilling fluid should occur, the Rig Manager will:

• Stop the advancement of the drilling assembly, pull the drive carriage to the top of the derrick, and shut off the drilling fluid pumps

• Conduct a survey of the ground surface and water body for evidence of seepage of drilling fluid to surface.

- The Brotherton drill rig manager will report to the PG&E staffed Construction Manager, who will report directly to USACE. Any incident will be reported immediately to USACE, and the relevant agencies listed in Table 2 of this plan.

- Assemble measurement data such as annular and/or standpipe pressure, forward thrust pressure, and observations such as the behavior of the return flow. Evaluate the measurement data and observations with the drill rig manager and PG&E staffed Construction Manager, who will report directly to USACE, if warranted.

Seepage

15. If seepage of drilling fluid to surface does occur, the Rig Manager will:

- Stop all drilling operations.

- Contain the seepage by erecting a sandbag and polyethylene berm (or other fit- for-purpose material), or by digging a pit, or a combination of both.

- The Brotherton drill rig manager will report to the PG&E staffed Construction Manager, who will report directly to USACE. Any incident will be reported immediately to USACE, and the relevant agencies listed in Table 2 of this plan.

- Assemble measurement data such as annular and/or standpipe pressure, forward thrust pressure, and

observations such as the behavior of the return flow.

- Evaluate the measurement data and observations with the Owner Representative.

- Document the incident according to company procedures.

Pilot Hole Deviation

16. If the pilot bore encounters conditions that interfere with steering accuracy, the drill rig manager will report to the PG&E staffed Construction Manager, who will report directly to USACE. Any incident will be reported immediately to USACE, and the relevant agencies listed in Table 2 of this plan. The Rig Manager will then take the appropriate action to complete the crossing.

These actions could include:

- Accepting the new drill path; and/or

- Adjusting the depth of the borehole path so the drill can avoid the problematic stratum; or

- Pulling out, moving over and drilling a new pilot hole

Loss of Circulation

17. If loss of circulation is encountered during the HDD, then the drill rig manager will report to the PG&E staffed Construction Manager, who will report directly to USACE. Any incident will be reported immediately to USACE, and the relevant agencies listed in Table 2 of this plan. The rig manager will need to assess the extent of fluid loss, determine its likely cause and take the best remedial action. These actions may include:

- Determining the fluid loss acceptable and continuing to drill/ream/pull; or

- Stopping the operation, re-establishing circulation and restarting the operation; or

- Abandoning the hole, moving over, and boring a new crossing path

Given that there are many factors to consider in determining if the HDD fails, a full evaluation of all relevant data will be made, and all reasonable options will be considered prior to seeking approval to use the contingency plan.

Waste Management

18. The Contractor and the Rig Manager will put in place the following measures in place to maintain the cleanliness of the work site.

• Store deleterious substances used in the operation and maintenance of equipment in approved containers, and store containers in a location and in a manner that protects them from being punctured, crushed and leaked into the watercourse.

• Provide segregated waste disposal containers for all general waste and dispose of such waste.

• Provide sanitary facilities for crew.

• Backfill and stabilize any pits excavated for anchoring or containment.

• Dispose of all waste drilling fluid and drilled solids according to and in conformance with regulatory requirements.

Waterway Inadvertent Return Management

If an Inadvertent Return would occur in the waterway, the following procedures will be implemented for mitigation.

• Immediately shut down of drilling operations and pull out pilot bore stem.

• Install turbidity curtain to assist in containment of any drilling fluids that may be released into the waterway (see Turbidity Curtain Specifications, below).

• In the rare event that drilling fluids reach the waterway, they will be removed as soon as feasible with the use of a Vactor truck by a contracted Vactor truck operator, or by using a boat and vacuum equipment, which would be staffed by the selected contractor.

• Forward ream down to enlarge the bore hole. By enlarging the bore hole diameter, it will assist in relieving the pressure as the drilling advances to a more suitable shoreline location.

• Continue advancing across the river until reaching a suitable location to install a vertical well that will relieve the pressure of the bore hole.

• Continue drilling operations while using a vacuum truck or pump system to remove the excess drilling fluids from vertical relief well location.

Turbidity Curtain Specifications

ACF Type I Silt Curtain effectively isolates silts and sediments in standing water. Protecting the environment from the harmful effects of turbid pollutants produced by disturbance of soils in and around bodies of water.

Flotation: 4”x4” marine grade expanded polystyrene foam, with 5.13 lb./ft lifting capacity (5:1 overall buoyancy factor). Foam is encased in RB88-X reinforced, hydrocarbon resistant High-Density Polyethylene with fold points 6’oc for ease of storage and deployment.

Curtain: 315 lb. tensile strength woven polypropylene fabric, Propex Geotex 315ST, provides superior strength and UV resistance. Standard depth of 7’, custom depths available.

Ballast: 1⁄4" galvanized steel chain in double stitched hem of curtain. Provides 0.70 lbs./ft ballast to maintain vertical orientation of curtain.

Groundwater Intrusion Management

• Over-excavate entry pit to dimensions of 8'x 8' by 5' deep pit.

• Collect Groundwater flowing into bore pit and pump out into 20,000 gallon frac tank using 6" pump.

• Hauled off and dispose of excess groundwater at approved dump site with vacuum trucks.

Fluid Flush Management Plan

• Over-excavate entry pit to dimensions of 8'x 8' by 5' deep pit.

• Collect drilling fluid flowing into bore pit and pump out into 20,000 gallon frac tank using 6" pump.

• Hauled off and dispose of excess groundwater at approved dump site with vacuum trucks.

Environmental Considerations

Planning

Brotherton Pipeline will adhere to all acts, regulations, Codes of Practice and best management practices that will guide the HDD process to ensure that there are no adverse environmental impacts as a result of the proposed intersect bore procedure. The HDD management plan has been developed to avoid any harmful alteration, disruption, or destruction of fish and fish habitat due to the possibility of any drilling fluids and additives entering a water body. The following mitigation measures will be implemented during the HDD crossing:

Monitoring

• The HDD contractor will monitor, by visual and electronic means:

• The return flow of drilling fluid from the borehole. A reduction in return flow shall be taken as indicating a possible seepage of drilling fluid.

• The annular and / or standpipe pressure. An unplanned reduction in pressure shall be taken as indicating a possible seepage of drilling fluid.

• The tank and pit volumes.

Any unplanned losses or gains will be reported, and increased diligence of upland and in-stream monitoring will be conducted.

• The HDD contractor will inspect all HDD equipment once every 12-hour shift to prevent the deposition of hydrocarbons onto the ground, or into a water body.

• Water Quality Monitoring is not part of Brotherton's scope of work.

• Monitoring during drilling via transect walk or other means of continuous mobility. Monitors may not be stationed in one location only, unless it can be demonstrated that the monitors can see frac-outs as they occur in the entire vulnerable area of the riverbed from each monitor's locations. This type of monitoring will be provided by the Client.

• The number of monitors will be determined by the Client's ability to monitor the vulnerable are of the riverbed. A minimum of one with a maximum of two monitors would be adequate to have onsite depending upon drilling and site conditions.

• All drilling will take place during daylight hours unless there is an unlikely event or unforeseen circumstance that may arise. This event will be communicated immediately to the Client and Owner for assurance that proper monitoring is available during evening\early morning hours.

Response

• The Rig Manager is the on-site authority for the HDD contractor. The Rig Manager has the authority to direct the rig crew, and the materials and equipment towards the protection of the environment.

Brotherton Pipeline will adhere to all acts, regulations, Codes of Practice and best management practices that will guide the HDD process to ensure that there are no adverse environmental impacts as a result of the water crossings. The HDD management plan has been developed to avoid any harmful alteration, disruption, or destruction of fish and fish habitat due to drilling fluids and additives entering a water body. The following mitigation measures will be implemented during the HDD crossing.

General Provisions

• The HDD contractor will comply with the plan prepared for the works, except where measures must be taken to deal with an emergency.

Deleterious Materials

The site prep subcontractor will:

• Provide the HDD contractor with a level work pad, and will construct a dirt berm around the work pad no less than1 foot in height.

• Be responsible for managing any dewatering procedures.

• Ensure that effective sediment and erosion control measures are in place along the HDD work-space access route, right-of-way and appurtenances and that they are functioning properly and are maintained and upgraded as required to prevent sediment from entering fish habitat.

• Limit use of hazardous materials.

• MSDS for fuel, lubricants, and mud products will be onsite.

Equipment

• All HDD equipment arriving on location is free from engine oil, hydraulic oil, fuel, and coolant leaks.

• All HDD equipment arriving on location is free from dirt, mud, vegetative debris, and other substances that may impact the water quality or the fish or fish habitat values of the water or land productivity.

• All equipment is maintained and serviced at least 100 feet from a water body. If it is not possible to conduct such activities greater than 100 feet from the watercourse, these activities will occur within a containment area that is capable of preventing the accidental release of a deleterious substance from entering a water body or contamination of soils or vegetation.

• Restrict all equipment to the cleared Right-of Way and work space.

• All portable equipment using fuels, hydrocarbon lubricants, coolants such as electrical generators and pumps used off of the bermed entry or exit work pad will be positioned inside of a sandbag berm (or equivalent) lined with leak free polyethylene or other containment structure that serves to prevent deleterious substances such as fuel from entering the soil or aquatic environment or contamination of soils or vegetation;

• All fuels, lubricants, coolant, and other substances are contained, controlled, and handled according to Occupational Health Safety regulations and Brotherton Pipeline's safety policy and procedures.

Work Areas

• All spoil materials from construction activities will be deposited, whether temporarily or permanently, above the high-water mark of the water body and in such a manner that does not allow its entry into the riparian zone or the channel of the water body.

• All work areas used by HDD crews have adequate run-off control structures in place to prevent wash materials or exposed or disturbed sediment from entering a water body.

Aquatic Resources

• All water intakes shall be screened in accordance with the Freshwater Intake End-of-Pipe Fish Screen Guideline published by the federal Department of Fisheries and Oceans and screens shall be maintained clear of debris.

• Ensure generators and pumps used for water intake have secondary containment, when stationed, operated or refueled within 100 ft of a watercourse. Additionally, no vehicle or equipment re-fueling shall occur with 250 ft from the edge of vernal pools, and 100 feet froth edge of other wetlands, streams or waterways.

Waste Management

• The composition of the drilling fluid will be limited to fresh water and high yield bentonite conforming to or exceeding American Petroleum Institute specifications. Other additives or substitutions will be submitted for approval before being used in the drilling fluid.

• An MSDS sheet is maintained on the work location for all drilling fluid additives.