Municipal Advisory Board

Established May 1, 2008 at the University of Texas, Arlington

MAB Model Specifications for Installation of PE4710 Water Service, Distribution, and Transmission Pipes by Horizontal Directional Drilling

(MAB-11 2024)

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FOREWORD. This model specification was developed by the Municipal Advisory Board (MAB) and published with the help of the members of the Plastics Pipe Institute, Inc. (PPI).

This model specification is intended as a guide for engineers, users, contractors, code officials, and other interested parties for use in the design, construction, and installation of high-density polyethylene (HDPE) pressure water piping systems. The local utility or engineer may need to modify this model specification to adapt the document to local conditions, operations, and practices.

This model specification has been prepared by MAB members and associates as a service to the water industry. The information in this document is offered in good faith and believed to be accurate at the time of its preparation but is offered "as is" without express or implied warranties, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Any reference to a specific manufacturer's product is merely illustrative, and not intended as an endorsement of that product. Reference to or testing of a proprietary product should not be construed as an endorsement by the MAB or PPI, which do not endorse the proprietary products or processes of any manufacturer. Users are advised to consult the manufacturer for more detailed information about the specific manufacturer's products. The information in this document is offered for consideration by industry members in fulfilling their own compliance responsibilities. MAB and the PPI assume no responsibility for compliance with applicable laws and regulations.

The MAB serves as an independent, non-commercial adviser to the Municipal & Industrial (M & I) Division of the PPI. Once adopted, MAB will consider revising this specification from time to time, in response to comments and suggestions from users of the model specification. Please send suggestions of improvements to Camille George Rubeiz, PE, F. ASCE, at crubeiz@plasticpipe.org

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MAB-11: MAB Model Specifications for Installation of PE4710 Water Service, Distribution, and Transmission Pipes by Horizontal Directional Drilling

1. GENERAL

1.1 The scope of this model specification is for installation of high-density polyethylene (HDPE) water pipes installed by horizontal directional drilling.

1.2 DESCRIPTION

Large diameter (24 in. or greater) horizontal directional drilling (HDD), sometimes referred to as "maxi-HDD," is capable of drilling holes of up to 10,000 ft in length, and placing pipes of up to 60-in. diameter, at depths of up to 200 ft. Guidelines for the placement of such pipe are provided in ASTM F1962-22.

Small diameter (12 in. or smaller) horizontal directional drilling (HDD), sometimes referred to as "mini-HDD," is capable of drilling holes of up to 600 ft in length, and placing pipes of up to 12-in. diameter, at depths of 15 ft. Guidelines for the placement of such pipes are provided in MAB-7.

"Midi-Horizontal Directional Drilling" (midi-HDD) is a category that is intermediate to mini-HDD and maxi-HDD, with regards to equipment capabilities and planning and engineering effort. Guidelines for the use of midi-HDD machines and practices may be obtained from ASTM F1962 or MAB-7, depending upon the particular application and the judgment of the Contractor or Engineer. An appropriate specification for a particular midi-HDD application may be either the maxi-HDD or mini-HDD specification provided herein, or a possible combination of these alternatives, based on discussions between Owner and the Contractor and/or Engineer, as appropriate.

2. CONTRACTOR QUALIFICATIONS

MAXI-HDD	MINI-HDD
The directional drilling operation, including pipe installation, shall be performed by an HDD Contractor, with experience using the guidelines in ASTM F1962, or equivalent. Such contractors (or their drill rig operator) shall have a minimum of three years field experience and completed a minimum of 30,000 ft of construction in similar type projects, using HDD, including the placement of HDPE pipe in sizes and lengths comparable to the present work project. The experience shall include installations with and without the use of internal water ballast. The Contractor shall be supported by a knowledgeable Engineer (e.g., the Engineer of Record, EOR, as required by the project's specifications with similar experience, based on similar projects. The EOR shall be capable of determining the minimum required pipe strength, or wall thickness (maximum DR value) for successfully completing the project. See Section 3 (Materials).	The directional drilling operation, including pipe installation, shall be performed by an HDD Contractor, with experience using the guidelines in MAB-7, or equivalent. Such contractors (or their drill rig operator) shall have a minimum of two years field experience and completed a minimum of 20,000 ft of construction in similar type projects, using HDD, including the placement of HDPE pipe in sizes and lengths comparable to the present work project. The Contractor shall be capable of determining the minimum required pipe strength, or wall thickness (maximum DR value) for successfully completing the project. See Section 3 (Materials).
The Contractor shall also demonstrate evidence of proper training for its crew, including related courses and field experience for the primary personnel. The crew shall be trained in the proper safety procedures per the HDD equipment manufacturer as well as applicable OSHA rules.	The Contractor shall also demonstrate evidence of proper training for its crew, including related courses and/or field experience for the primary personnel. The crew shall be trained in the proper safety procedures per the HDD equipment manufacturer as well as applicable OSHA rules.

3. HDPE MATERIAL (PE4710)

MAXI-HDD

The pipe shall be consistent with the products as specified in MAB-3 Part 2 or MAB-3 Part 3 when installing large bundles of smaller size pipes. The size(s), including diameter and sizing system (IPS or DIPS), shall be as specified in the work order and project drawings provided by the Owner/EOR.

Although the Owner/EOR will initially specify the proposed dimension ratio (DR) of the product pipe, based on its intended internal operational pressure or other criteria, the Contractor (or EOR) shall confirm the DR value (wall thickness) is able to safely withstand the HDD installation and post-installation, loads. The corresponding DR shall be determined per ASTM F1962 (see also PPI Boreaid®). Internal water ballast may be used, as necessary. The final DR shall be the minimum of the latter value and that initially selected by the Owner/EOR.

The pipe may be fully assembled prior to the beginning of the drilling operation, in the length required to extend throughout the borehole and beyond, as specified by the Owner/EOR, or as consistent with ASTM F1962. Individual pipe segments shall be joined by butt-fusion, as specified in MAB-3, Part 4. The assembled pipe may be hydrostatically tested for leakage before, as well as after (see Section 11), pullback, consistent with ASTM F1962, Section 10.1.1. See MAB-3, Part 6 for pressure testing requirements.

MINI-HDD

The pipe shall be consistent with the products as specified in MAB-3 Part 2 or MAB-3 Part 3. These size(s), including diameter and sizing system (CTS, IPS, or DIPS), shall be as specified in the work order and project drawings provided by the Owner.

Although the Owner will initially specify the proposed dimension ratio (DR) of the product pipe, based on its intended internal operational pressure or other criteria, the Contractor (or Engineer of Record if required by the project's specifications) shall confirm the DR value (wall thickness) is able to safely withstand the HDD installation, and post-installation, loads. The corresponding DR should be determined using MAB-7. The final DR shall be the minimum of the latter value and that initially selected by the Owner.

If provided on a reel, a line tamer may be employed, to improve handling or reduce pull force, as desired, or to reduce ovality, if specified by the Owner. If not provided on a reel, the pipe may be fully assembled prior to the beginning of the drilling operation, in the length required to extend throughout the borehole and beyond, as specified by the Owner, to reduce the possibility of borehole collapse (see MAB-7, Section 9.7.1). Individual pipe segments shall be joined by butt-fusion, as specified in MAB-3, Part 4.

4. SITE INVESTIGATION

MAXI-HDD

For the site and path configuration specified by the Owner/EOR, the Contractor shall review and verify the results of any available relevant site investigations, including both surface and subsurface, as may be provided by the Owner/EOR. The Contractor shall perform supplementary investigations, as necessary, to help ensure a successful HDD operation, including long term reliability of the installed pipeline. If these investigations indicate that the site initially selected by the Owner/EOR is not appropriate for the specified HDD installation, the Contractor shall inform the Owner/EOR, prior to any actual construction activity, and discuss possible alternative sites.

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For the site and path configuration specified by the Owner, the Contractor shall review and verify the results of any available relevant site investigations, including both surface and subsurface, as may be provided by the Owner. The Contractor shall perform supplementary investigations, as necessary, to help ensure a successful HDD operation, including long term reliability of the installed pipeline. If these investigations indicate that the site initially selected by the Owner is not appropriate for the specified HDD installation, the Contractor shall inform the Owner, prior to any actual construction activity, and discuss possible alternative sites.

The use of HDPE may not be appropriate in areas contaminated with a significant concentration of low-molecular-weight petroleum products or other organic solvents or related vapors. Refer to TR-19, Chemical Resistance of Plastic Piping Materials for assistance.

4.1 Surface Investigation

The surface investigation should confirm that the areas at both ends of the borehole are consistent with the space required for the equipment and for the performance of the associated operations. The space at the rig side must be sufficient for the rig itself and its auxiliary equipment. There must be access to an appropriate water supply, acceptable for achieving the proper drilling fluid characteristics, but the Owner's approval is required to connect to a potable water line. Space must be available for mixing, storing, and pumping the drilling fluid. Although most drilling fluids are not generally considered to be hazardous, local regulations must be followed regarding its disposal. If it is intended to recirculate the drilling fluid, to reduce material and disposal costs, there should be a means to transport any fluid exhausted from the opposite (bore exit / pipe entry) end to the drill rig end. There must be no accidental discharge during the transport process.

The pipe side must accommodate the entire assembled length of pipe to be installed, either on a reel(s), or fused as necessary. If the pipe(s) is not on a reel(s), there must be space for roller supports or other equipment such as cranes and excavator.

If the pipeline crosses a major waterway, an investigation should be conducted to characterize the bottom contours and the stability of the waterway, considering the design life of the pipeline.

4.2 Subsurface Investigation

Consistent with the scope and potential difficulty of the HDD operation, a geotechnical investigation should be performed by a qualified engineer, including a review of available information, test drillings, and soil analysis, as provided in ASTM F1962. The Contractor shall select appropriate tools and methods for the drilling and reaming operations, based upon the results of the investigation.

The use of HDPE may not be appropriate in areas contaminated with a significant concentration of low-molecular-weight petroleum products or other organic solvents or related vapors. Refer to TR-19, Chemical Resistance of Plastic Piping Materials for assistance.

4.1 Surface Investigation

The surface investigation should confirm that the areas at both ends of the borehole are consistent with the space required for the equipment and for the performance of the associated operations. The space at the rig side must be sufficient for the rig itself and its auxiliary equipment. There must be access to an appropriate water supply, acceptable for achieving the proper drilling fluid characteristics, but the Owner's approval is required to connect to a potable water line. Space must be available for mixing, storing, and pumping the drilling fluid. Although most drilling fluids are not generally considered to be hazardous, local regulations must be followed regarding its disposal.

The pipe side must accommodate the entire assembled length of pipe to be installed, either on a reel(s), or fused as necessary.

4.2 Subsurface Investigation

Consistent with the scope and potential difficulty of the mini-HDD operation, a geotechnical investigation may be performed by a qualified engineer. The Contractor shall select appropriate tools and methods for the drilling and reaming operations, based upon the results of the investigation.

A major consideration in typical mini-HDD applications is the presence of existing utilities in the vicinity of the planned bores. Damage prevention practices must be followed, as indicated in Section 6 of MAB-7.

5. EQUIPMENT AND SUPPORTING SYSTEMS

MAXI-HDD

The major equipment items for the drilling and pipe placement operation include:

- Drill rig
- Drill rods
- Drill head/bit, mud motor
- Reamers
- Other, such as swivel or breakaway link

The major supporting, or auxiliary, systems include:

- Drilling fluid provision, recirculation
- Grouting
- Tracking

5.1 Equipment

The drill rig equipment must be capable of applying the thrust and torque required to perform the drilling, reaming, and pullback operations. The pipe pullback force should be considered as the minimum pullback capacity of the drill rig, which must also retract the steel drill rods, and possibly simultaneously perform a reaming operation. This force may be determined with the aid of industry accepted procedures, such as the methodology provided in ASTM F1962 (see PPI Boreaid®). The required torque during the initial drilling or subsequent reaming operations will depend upon the soil conditions, which may be determined from the subsurface investigation. The Contractor shall select the drill bit(s), or mud motor if necessary, and reamers, consistent with the soil characteristics.

The drill rig shall be capable of monitoring the hydraulic pressure applied during the pullback operation. Although the hydraulic pressure observed at the drill rig is not a direct indication of the pull force applied to the product pipe, a record of the applied pressure, and the relationship to the force applied at the rig to the drill rods, shall be provided to the Owner/EOR.

The swivel attached to the pulling end of the product pipe should have a capacity somewhat greater than the allowable (safe) pull strength of the pipe(s) to be installed, but not greater than the pull capacity that of the drill rig. An unnecessarily large capacity swivel should be avoided. See MAB-3, Appendix C.1 for safe pull strengths of HDPE pipe.

The product pipe shall be protected from rupture by fusing a one-foot section of weaker (next available DR size) HDPE pipe to the leading (pulled) end.

MINI-HDD

The major equipment items for the drilling and pipe placement operation include:

- Drill rig
- Drill rods
- Drill head/bit
- Reamers
- Other, such as swivel or breakaway link

The major supporting, or auxiliary, systems include:

- Drilling fluid provision, recirculation
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The product pipe shall be protected from rupture by fusing a one-foot section of weaker (next available DR size) HDPE pipe to the leading (pulled) end.

The use of a breakaway link, or equivalent, with a rating within the safe pull strength, may also be used to ensure the pipe is not stressed beyond its allowable tensile load.

5.2 Supporting (Auxiliary) Systems

5.2.1 Drilling Fluid (and Grouting)

The drilling fluid shall be selected and adjusted during drilling and pullback as appropriate for the soil conditions, which may be determined from the subsurface investigation. The drilling fluid must be capable of suspending and removing the soil cuttings from the borehole, as well as maintaining a stable borehole during the drilling, reaming and pipe placement operations.

The most common drilling fluid is a mixture of water with bentonite (a naturally occurring clay). The bentonite material used shall be certified by the National Sanitation Foundation (NSF). Polymer additives may also be used, as appropriate for the soil conditions. MSDS (Material Safety Data Sheet) information shall be provided, as appropriate.

5.2.2 Tracking and Guidance

The tracking/guidance system used to track and guide the initial pilot drilling operation may be of any proven type, including magnetic or gyroscopic, with which the Contractor and crew has a minimum of one year experience in its application, and the placement of 15,000 ft of pipe using HDD.

The position of the borehole path must be recorded in an electronic format and provided to the Owner/EOR as a permanent record.

The use of a breakaway link, or equivalent, with a rating within the safe pull strength, may also be used to ensure the pipe is not stressed beyond its allowable tensile load.

5.2 Supporting (Auxiliary) Systems

5.2.1 Drilling Fluid

The drilling fluid shall be selected as appropriate for the soil conditions. The drilling fluid must be capable of suspending and removing the soil cuttings from the borehole, as well as maintaining a stable borehole during the drilling, reaming and pipe placement operations.

Although water may sometimes be sufficient, the most common drilling fluid is a mixture of water with bentonite (a naturally occurring clay). The bentonite material used shall be certified by the National Sanitation Foundation (NSF). Polymer additives may also be used, as appropriate for the soil conditions. MSDS (Material Safety Data Sheet) information shall be provided, as appropriate.

5.2.2 Tracking and Guidance

The tracking/guidance system used to track and guide the initial pilot drilling operation may be manual walkover, or of any type with which the Contractor and crew has experience in its application.

The position of the borehole path must be recorded and provided to the Owner as a permanent record.

6. REGULATIONS

MAXI-HDD

Prior to initiating construction, the Contractor should confirm that all relevant permits and approvals have been obtained, including from the Federal, state, or local jurisdictions or other agencies that may be affected by the work. When required, the Contractor will submit an environmental, health, and safety plan, including, as appropriate, MSDS information for materials being used, and emergency telephone numbers of various parties (e.g., police, fire department, medical, sanitation, industrial).

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7. SAFETY

MAXI-HDD

The Contractor must comply with all applicable regulations, including OSHA, state, and local, as well as industry accepted practices. The Contractor shall ensure that appropriate safety education and training has been provided to every person that works on, or in the vicinity of the HDD equipment and operation, and that each person has demonstrated proficiency in their required tasks. Such rules apply at both ends of the operation, including at the drill rig and at the opposite end where the pipeline is inserted. Every person must understand the procedures to be followed in case of emergencies.

To the extent practical, any possible underground utilities in the immediate vicinity, including cables or other pipelines, must be located and exposed, to the extent practical, prior to drilling, especially where the bore path crosses such facilities. Mechanized equipment should not be used to dig or excavate in close proximity to cables, pipelines or other buried utilities.

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8. ENVIRONMENTAL (CONTAINMENT AND DISPOSAL OF DRILLING FLUID)

MAXI-HDD

Pits or berms must be created and located at both ends of the drilling operation to collect exhausted drilling fluid/slurry and prevent spills into the surrounding environment. The pits should be emptied, as necessary, using vacuum trucks or pumps. The drilling fluid/slurry should be disposed of consistent with local regulations, and/or recycled, and must not be placed in storm drains.

Appropriate precautions should be taken to avoid escape of drilling fluid, especially if the preliminary site investigation indicate the existence of pre-fractures or other conditions conductive to fluid migration. A contingency plan must be available, and submitted in advance of the drilling operation, to address the cleanup of any spills or uncontrolled escape of drilling fluid, in the event of such escape.

In general, special precautions should be made in environmentally sensitive habitat areas. The local Department of Natural Resources shall be notified 24 hours prior to initiating the drilling operation. The Contractor must also designate an individual(s) to closely monitor the operation along the entire route, to rapidly identify any problematic escape or leakage and allowing for an immediate shutdown of equipment as necessary. The Contractor shall have all

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In general, special precautions should be made in environmentally sensitive habitat areas. The local Department of Natural Resources shall be notified 24 hours prior to initiating the drilling operation. The Contractor must also designate an individual(s) to closely monitor the operation along the entire route, to rapidly identify any problematic escape or leakage and allowing for an immediate shutdown of equipment as necessary. The Contractor shall have all

necessary equipment on site, including sufficient number of sandbags, pumps, vacuum excavators, and any other facilities or staff that may be required to contain escaped drilling fluid immediately upon identification especially in environmentally sensitive areas such as waterways. The Contractor shall determine the cause of the problem and adjust the procedures accordingly, including reduced drilling fluid pressure as appropriate or use a method as such Conductor Barrel™. If necessary, the borehole should be abandoned, and plugged or grouted at both ends.

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9. EXECUTION

MAXI-HDD

9.1 Reaming/Pre-reaming

Following the initial pilot bore, pre-reaming operations shall be performed, as necessary, prior to the final pullback operation. In general, pre-reaming should be used for placing pipe greater than 20 in. For smaller sizes, and depending on project site and conditions, pre-reaming may not be necessary, and the reaming and pipe pullback may be performed simultaneously. Increments should be restricted to a maximum of 10 in. during a single pass. In general, the final hole diameter should be 50% greater than the outer diameter of the pipe (or bundle), but a maximum of 12 in. oversize. The 12 in. oversize is applicable for the present application, which is for installation of pipes (or bundles) of 24 in. minimum diameter.

9.2 Pipe Pullback

The assembled pipe shall be supported with cranes, excavators, and/or low friction rollers, of sufficient number to prevent excess sagging and gouging.

The pipe must be sealed at the leading (pulled) end of the pipe, to prevent entry of drilling fluid or other contaminants into the pipe. If internal water ballast is to be used, such as to reduce the pulling tension or increase the resistance to collapse at depth (see ASTM F1962), the submerged portion of the pipe shall be filled with clean water as it is pulled into the borehole. The EOR shall determine if the use of ballast is necessary or desirable, based on the specified path geometry.

If grouting has been specified, it may be pumped during the pullback operation, serving as drilling fluid. In some cases, it may only be required to seal the entry and exit points of the bore, using an appropriate mixture.

MINI-HDD

9.1 Reaming/Pre-reaming

Following the initial pilot bore, pre-reaming operations shall be performed, as necessary, prior to the final pullback operation. In some cases, and depending on project site and conditions, reaming may not be necessary, or reaming and pipe pullback may be performed simultaneously. However, care must be exercised to avoid humps at the surface due to lack of pre-reaming.

In general, the final hole diameter should be 50% greater than the outer diameter of the pipe (or bundle)

9.2 Pipe Pullback

The pipe must not be supported on a surface that may cause abrasion during pullback. The pipe must not be pulled around sharp bends that may cause pipe collapse (kinking), and the back tension should be minimized to prevent escalating effects at the pulling end.

During pullback, the pipe must be sealed at the leading (pulled) end of the pipe, to prevent entry of drilling fluid or other contaminants. An additional 3 - 4% length at pipe exit shall be pulled to allow for temporary elongation (stretch) and subsequent recovery.

Tracer wire shall be installed, as appropriate or feasible. The wire shall be solid #12 AWG (or like #10), copper-clad steel or braided stainless steel (A316), Extra High Strength with a minimum 1,150 lb. break load, and with minimum 45 mil HDPE insulation thickness. The Contractor shall verify tracer wire continuity prior to acceptance. A sacrificial anode that conforms to the requirements of ASTM B843 shall be provided at the dead end locations for cathodic protection of the tracer wire.

9.3 As-Built Records and Drawings

The Contractor must submit a record of the actual ("as built") bore path, relative to the specified or planned path, including any deviations. The information shall be provided in the format requested by the Owner/EOR.

Information regarding the pilot drilling and subsequent reaming operations should also be recorded and provided to the Owner/EOR. This should include drilling fluid details and usage, grouting information, type and size drill head and reamer(s), final borehole diameter, and information regarding the pull back forces, as well as the size and rating of the breakaway link, or equivalent.

Tracer wire shall be installed. The wire shall be solid #12 AWG (or like #10), copper-clad steel or braided stainless steel (A316), Extra High Strength with a minimum 1,150 lb. break load, and with minimum 45 mil HDPE insulation thickness. The Contractor shall verify tracer wire continuity prior to acceptance. A sacrificial anode that conforms to the requirements of ASTM B843 shall be provided at the dead end locations for cathodic protection of the tracer wire.

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The Contractor must submit a record of the actual ("as built") bore path, relative to the specified or planned path, including any deviations. The information shall be provided in the format requested by the Owner.

10. CONNECTIONS

MAXI-HDD

If the installation of connections or fittings is specified as part of the project, they shall comply with the requirements of MAB-3, Part 2 (pipes 4 inch and larger) or MAB-3, Part 3 (pipes 3 in. and smaller) for bundles of pipe.

MINI-HDD

If the installation of connections or fittings is specified as part of the project, they shall comply with the requirements of MAB-3, Part 2 (pipes 4 inch and larger) or MAB-3, Part 3 (pipes 3 in. and smaller).

11. INSPECTION AND ACCEPTANCE

MAXI-HDD

There should be no signs of damage to the pipe as it exits the borehole, including yielding or necking down of the pipe, or gouges or scratches in excess of 10% of the wall thickness. If such defects are present, the Owner/EOR shall decide if the pipe is acceptable for service. If accepted, the installed pipe shall be hydrostatically tested for leakage, as described in MAB-3, Part 6.

The pipe shall not be cut at either end prior to achieving mechanical and thermal equilibrium with its surroundings, to avoid the ends retracting into the borehole. The pipe may be cut following any

MINI-HDD

There should be no signs of damage to the pipe as it exits the borehole, including yielding or necking down of the pipe, or gouges or scratches in excess of 10% of the wall thickness. If such defects are present, the Owner shall decide if the pipe is acceptable for service. If accepted, the installed pipe shall be hydrostatically tested for leakage, as described in MAB-3, Part 6.

The pipe shall not be cut at either end prior to achieving mechanical and thermal equilibrium with its surroundings, to avoid the ends retracting into

12-hour interval during which there has been no discernible motion of the far (free) end of the pipe, and there is negligible residual tensile load at the lead (drill rig) end.	the borehole.
If specified by the Owner/EOR, the pipe shall be cleaned and disinfected, as described in MAB-3, Part 4.	If specified by the Owner, the pipe shall be cleaned and disinfected, as described in MAB-3, Part 4.

12. SURFACE RESTORATION

MAXI-HDD	MINI-HDD
After inspection and approval by the Owner/EOR, the surface area at both ends of the bore shall be restored to its original condition and all related equipment, tools, and spoils must be removed. All drilling fluid at the surface must be properly disposed of, consistent with local regulations (see Section 8).	After inspection and approval by the Owner, the surface area at both ends of the bore shall be restored to its original condition and all related equipment, tools, and spoils must be removed. All drilling fluid at the surface must be properly disposed of, consistent with local regulations see Section 8).

13. SUBMITTALS

MAXI-HDD

The Contractor shall provide the Owner/EOR information consistent with the above requirements and specifications, initially or subsequently, as indicated below.

13.1 Initial

Prior to construction, the following submittals, among others, shall be provided to the Owner for approval:

- Description of the overall procedure, the equipment and crew to be employed, and a drawing of the overall bore path, consistent with the basic geometry specified by the Owner (Section 4), including the site layout and borehole entry and exit points.
- Materials, including supporting calculations or information for selection of pipe size (DR value).
- Necessary permits.
- Inventory of the drilling equipment to be employed (such as rig, drill bit, back-reamer, drilling fluid, guidance system).
- Calibration records for guidance system.
- MSDS information for drilling fluids and other utilized materials.
- Details for disposal of waste drilling fluids.
- Contingency plan in the event of inadvertent fluid escape.

MINI-HDD

The Contractor shall provide the Owner information consistent with the above requirements and specifications, initially or subsequently, as indicated below.

13.1 Initial

Prior to construction, the following submittals, among others, shall be provided to the Owner for approval:

- Description of the overall procedure, the equipment and crew to be employed, and a drawing of the overall bore path, consistent with the basic geometry specified by the Owner (Section 4), including the site layout and borehole entry and exit points.
- Materials, including supporting calculations or information for selection of pipe size (DR value), as appropriate.
- Necessary permits.
- MSDS information for drilling fluids and other utilized materials.
- Details for disposal of waste drilling fluids.
- Contingency plan in the event of inadvertent fluid escape.

13.2 Subsequent

The following items shall be provided to the Owner during or following installation of the pipe, as appropriate:

- Daily reports and operator logs
- As-built records, including significant deviations from the initial plans.
- Results of final inspection, and pressure testing.

13.2 Subsequent

The following items shall be provided to the Owner during or following installation of the pipe, as appropriate:

- Daily reports and operator logs
- As-built records, including significant deviations from the initial plans.
- Results of final inspection, and pressure testing.

14. CLOSEOUT (PAYMENTS)

MAXI-HDD

The Contractor will be compensated at the agreed fee, based on the agreement in place with the Owner.

MINI-HDD

The Contractor will be compensated at the agreed fee, based on the agreement in place with the Owner.

REFERENCES

ASTM F1962, Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles Including River Crossings

ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fitting

Handbook of Polyethylene Pipe, second Edition

Charleston Water System Directional Drilling Requirements

MAB-7, MAB Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of HDPE (PE4710) Pipe in Municipal Applications

ODOT Draft Specification for Horizontal Directional Drilling

PPI BoreAid™, www.ppiboreaid.com

Section 216, Horizontal Directional Drilling, Regional Transportation Commission (RTC) of Southern Nevada

Solano Irrigation District, SID Standard Specifications 02246-1, Horizontal Direction al Drilling