



UPSTATE NY POWER CORP

UPSTATE NY POWER TRANSMISSION LINE

EXHIBIT E-3

UNDERGROUND CONSTRUCTION



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EXHIBIT E-3 UNDERGROUND CONSTRUCTION

This Exhibit describes the proposed underground and subaquatic sections of the 230 kilovolt (kV) alternating current transmission line in accordance with Public Service Law 122 and 16 New York Codes, Rules and Regulations §88.3.

Upstate NY Power Corp (Upstate) proposes to construct and operate a single-circuit 230 kV electric transmission line approximately 50.6 miles in length between the collector substation of a wind-powered electric generation facility on Galloo Island (Hounsfield Wind Farm) located on the eastern end of Lake Ontario, in the Town of Hounsfield, New York, to a new interconnect substation in the Town of Mexico, New York where the line will connect to the regional power grid (Project; Proposed Route).

Approximately 41.7 miles of the Proposed Route is upland and approximately 9 miles are subaquatic. On Galloo Island, approximately 2.6 miles of the Proposed Route is aboveground and 0.19 miles is underground. On the mainland, approximately 39 miles of the Proposed Route is aboveground and 0.34 is underground. The line segment between the landing of the submarine cable and the mainland transition station in Henderson, New York will consist of approximately 0.15 miles of 230 kV underground cable. This circuit will either be installed via horizontal directional drilling (HDD) technology or open cut trench, depending on several factors including environmental impacts, subsurface conditions and cost consideration. The line segment between Station Number 41 and the Mexico substation will consist of approximately 0.19 miles of 230 kV underground cable. The circuit will be installed in a duct bank. Alternatively, an equal distance of overhead transmission lines crossing under the existing 765 kV and 345 kV transmission lines may be an option as described in Exhibit E-1. If a second circuit is installed in the future a second duct bank would be installed based on reliability as well as constructability.

E-3.1 Cable System Installation

E-3.1.1 Upland Cable Description

The proposed cable for the underground sections of the transmission line are an extruded dielectric cable (XLPE), with insulation consisting of cross linked polyethylene; a metallic shield and moisture impervious sheath and jacket insulation (Figure E-3.1). Among its advantages as compared to other systems are excellent reliability history, lack of dielectric fluid and pressurization plant, higher current ratings, and relative simplicity of the system (which is a very important consideration).

E-3.1.2 Upland Cable Installation

Each XLPE cable system will consist of four 6- inch PVC conduits per circuit. Three of the conduits will contain a cable representing one phase of the three-phase circuit and the last conduit will be designated as a spare. Five additional 2-inch PVC conduits will be installed: two will contain copper cables (ground continuity conductor which is analogous to the shield wire in the overhead design); one for the fiber optic cable; and the other two will be designated as spares. They all will be encased in concrete with controlled thermal properties. The conduits will be arranged to meet Institute of Electrical and Electronics Engineers spacing standards which will balance capacity and construction costs.

The single-circuit duct bank typical dimensions are 34 inches by 34 inches with a proposed minimum cover of 36 inches (Figure E-3.2).

The extent of the civil work would include trenching, duct installation, backfilling, and restoration of the affected surfaces, excluding the cable-pulling. Splicing vaults are not deemed to be necessary at this time due to the total length of the underground section of line.

E-3.1.3 Overhead to Underground Transition

The transition station from overhead to underground configuration in both Mexico and on Galloo Island consist of a 230 kV riser structure with surge arresters, current transformers (CT), outdoor CT/relay/battery cabinets, and a 55-foot tall (nominal) galvanized or weathered steel pull off H-frame structure (Figure E-1.6). The riser structure consists of a self-supporting full dead-end structure with jumper insulator assemblies, surge arresters, cable terminations and terminator supports (Figure E-1.8). The typical riser structure will accommodate only one circuit. The riser structure inside the Mexico interconnect substation will consist of a low profile structure with surge arresters to accommodate the transition of the underground conductor from the duct bank to the overhead portion of the substation (Exhibit E-2).

E-3.1.4 Subaquatic Cable Description

The cable for subaquatic installation is anticipated to be three 1-core 2,000 thousand circular mills (kcmil) copper conductor, 230 kV cables construction that will be bundled together during the installation process. The cable is anticipated to be XLPE with insulation consisting of cross-linked polyethylene; a metallic shield and moisture impervious sheath and jacket insulation with an integral fiber optic cable.

E-3.1.5 Landfall Transition

The transition to the subaquatic cable configuration is anticipated to utilize HDD technology to bore underneath the nearshore-shore environment and to install the cable below the nearshore area where winter ice scour could affect the cable. Open cut trench methodology may also be considered, depending on several factors including environmental impacts, subsurface conditions and cost consideration. The HDD will be staged at undeveloped locations on Galloo Island and the landfall in Henderson and will involve the land-based drilling of a borehole under to the HDD exit point in Lake Ontario, which will be located within a temporary submerged cofferdam approximately between 800 feet and 1600 feet offshore. The HDD should allow the cable to be installed underneath a linear target identified by the geophysical survey close to the Henderson end of the cable route that may be a 15 kV cable to Stony Island based on the information provided by the New York State Office of General Services (Appendix C of the Application). The cofferdam is intended to facilitate installation of the subaquatic transmission cable and to help contain sediments suspended by the air/water lift operation or dredging and jet plow operations in the nearshore area. After completing the HDD bore, a high density polyethylene (HDPE) conduit will be placed in the borehole, which will ultimately house the subaquatic transmission cable. Depending upon the constructability of the area it is estimated that the borehole could be

approximately 20 inches to 24 inches in diameter. Detailed information on the HDD including the borehole will be presented in the Environmental Management and Construction Plan (EM&CP).

The length of the horizontal drilling is anticipated to be approximately between 1000 feet and 2000 feet. The exact length and vertical profile of the HDD bores will be determined during final design and construction and provided in the EM&CP. The offshore end will terminate in a pre-excavated pit within the temporary cofferdam. The HDD operation will include an upland based HDD drilling rig system, drilling fluid recirculation systems, residuals management systems, and associated support equipment.

The upland HDD staging area will be approximately 120 feet long by 75 feet wide. An HDD/bentonite pit approximately 8 feet wide, by 12 feet long, by 6 feet deep will be constructed to accommodate horizontal directional drilling operations. After HDD operations are complete, the pit can be utilized for the construction of the underground transition vaults between the subaquatic cable termination and the underground cable. Excess soils from these pits will be disposed of off-site in accordance with applicable regulations. Erosion and sedimentation controls will be installed as necessary on the site prior to the initiation of construction activities. Once construction is completed, all equipment and construction materials will be removed from the site and the area will be returned to its original condition.

A drill rig will be set up behind the HDD/bentonite pit where drill pipe will be set in place to begin the horizontal drilling. A bentonite and freshwater slurry will then be pumped into the pit to form a soft shell lining of the tunnel wall during the drilling process. When the drill bit advances through the temporary cofferdam, the bit is replaced with a series of reamers to widen the borehole. Once the desired borehole diameter is achieved, a pulling head is placed on the end of the drill pipe and then the pipe is used to pull back the HDPE conduit into the bored hole from the offshore end. It is possible that an optional technology may be used that would allow the conduit to be pushed into place from the shore side. This will be determined during the detailed design of the cable installation and HDD. Once the internal cable conduit(s) have been inserted into the HDPE conduit pipe, a clay/bentonite medium will be inserted into the outer pipe to fill the void between the cable and the pipe, and the pipe ends will be sealed.

The upland HDD operation will be a self-contained system combined with a drilling fluid recirculation system. This re-circulation system will recycle drilling fluids and contain and process drilling returns for offsite disposal to minimize excess fluids disposal and residual returns. None of these materials will be directly discharged or released to Lake Ontario. The HDD construction process will involve the use of bentonite drilling fluids in a water slurry in order to transport drill cuttings to the surface for recycling, aid in stabilization of the in situ sediment drilling formations, and to provide lubrication for the HDD drill string and down-hole assemblies. This drilling fluid is composed of a carrier fluid and solids. The selected carrier fluid will typically consist of water (approximately 95%) and inorganic bentonite clay (approximately 5%).

The HDD operation will include monitoring of potential fracture or overburden breakout to minimize the potential of drilling fluid breakout into waters of Lake Ontario. The design drilling

depths should be sufficiently deep to avoid pressure-induced breakout of drilling fluids. Nevertheless, a visual and operational monitoring program will be implemented during the HDD operation to detect fluid loss. This monitoring program will be developed in detail during the EM&CP but would typically include the following:

- Visual monitoring of surface waters in Lake Ontario by drilling operation personnel on a daily basis to observe potential drilling fluid breakout points.
- Drilling fluid volume monitoring by technicians on a daily basis throughout the drilling and reaming operations for each HDD conduit system.
- Development and implementation of a fluid loss response plan and protocol by the drill operator in the event that a fluid loss occurs. These response plans include drill stem adjustments, injection of loss circulation additives that can be mixed in with drilling fluids at the mud tanks, and other mitigation measures as appropriate.
- Use of bentonite drilling fluids that will gel or coagulate upon contact with marine water.

In the unlikely event of a drilling fluid release, the bentonite fluid density and composition will cause it to remain as a cohesive mass similar to the consistency of gelatin on the seabed in a localized slurry pile. This cohesive mass can be quickly cleaned up and removed by divers and diver-operated vacuum equipment.

It is possible that some residual volume of bentonite slurry will be released into the temporary cofferdam. The depth of the dredged area within the temporary cofferdam and the U-shaped temporary cofferdam perimeter will contain any bentonite slurry that may be released. Prior to drill exit and while the potential for bentonite release exists, diver teams will install a water-filled temporary dam around the exit point to act as an underwater "silt fence". This dam will contain any bentonite fluid that escapes as it sinks to the bottom of the temporary cofferdam; this will allow easy clean-up using high-capacity vacuum systems.

The temporary cofferdam will remain in place until jet plow embedment installation of the subaquatic transmission cable is complete. The shape and depth cofferdam will contain and minimize bentonite releases. The cofferdam will be approximately 100 feet wide and 50 feet long and will be open at the lakeside end during installation to allow for manipulation of the HDD conduits and access for the jet plow device. Approximately 1,700 cubic yards of sediment are anticipated to be dredged from the cofferdams using mechanical dredging methods to expose the seaward end of the borehole.

The top of the cofferdam will extend above mean high water to contain suspended sediment. After removal of any surface sediment is complete, the top of the cofferdam will be cut off approximately 5 feet above the lake bottom and the water end of the cofferdam will be removed to facilitate the HDD operation and installation of the subaquatic transmission cable. The marking of the cofferdam and noting its presence in Local Notice to Mariners as necessary will be coordinated with United States Coast Guard. After installation of the submarine transmission

cable is complete, the temporary cofferdam will be removed. No removal of sediment outside of the cofferdam will be required.

On the either end of the subaquatic cable at the upland extremes of the HDD holes, the cable will continue underground as described in Section 3.1.5 up to the transition station. At the transition station, the underground cable will change to an overhead configuration.

E-3.1.6 Subaquatic Cable Installation

This section provides the sequencing and detail for the installation of the subaquatic cable.

E-3.1.6.1 Pre Lay Grapnel Run

Prior to cable installation, measures are taken to determine that the cable route is clear of debris prior to the cable installation by towing a de-trenching grapnel along the route.

E-3.1.6.2 Initial Cable Landing

Each cable shall be landed in its respective conduit. The following describes a typical cable landing through a bore pipe and terminating in a manhole. Prior to the landing, the condition of the conduits will be assessed.

A pulling winch will be located at the landfall at or near the exit of the conduit installed during the HDD operation. A barge with a dynamic positioning system loaded with the cable will position over the desired lakeside conduit and maintain this position.

Prior to the start of any work the contractor will ensure that all vital personnel have VHF communications including the beach master, dive station, cable engine, cable tub and bridge. Once the main lay barge is positioned over the conduit, divers will prepare the end of conduit a winch wire will be pulled from the landfall through the conduit and onto the barge. Upon direction of the main lay barge the cable will be hauled through the conduit and ashore. The cables will be secured and the cable lay operations may commence.

E-3.1.6.3 Jet Plowing Operations

Once the cable has made landfall the main lay barge will maneuver such that cable is laid along side the cable plow. Divers will load the cable in the plow and connect the jet hoses and instrumentation umbilical.

The subaquatic cable will be jetted (buried) into the lake bottom to a target depth of 6 feet below the present bottom except in areas where an existing cables are crossed or where geologic or topographic features prevent burial to the planned minimum target burial depth. In the event that a burial depth has not been achieved in an area other than a cable crossing due to geologic or topographic features, Upstate will report the actual cable depth, propose a plan for achieving an adequate protection level given the location (e.g., placement of concrete mattresses over the cable), submit it to New York State Department of Public Service and New York State Department of Environmental Conservation (NYSDEC) for review

and approval, and commit to a reasonable schedule for implementation of the approved plan. Although not detected during the subaquatic survey, National Oceanic and Atmospheric Administration Chart 14802 for the area shows a possible underwater cable (believed to be a non-operational telephone cable) generally northeast of Stony Island at station 301+00 (Appendix H of the application). Prior to installation, this cable would be verified and to the extent it was not abandoned and still in service, concrete pillows placed over the crossing location. The new cable would be floated with buoys and placed by divers or a remotely operated vehicle at the location of the concrete pillows.

Jet plow embedment methods for subaquatic cable installations are considered the most effective and least environmentally damaging compared to traditional mechanical dredging and trenching operations, and have been recently authorized by the New York State Public Service Commission, NYSDEC, New Jersey Department of Environmental Protection, and United States Army Corps of Engineers for similar projects (e.g., Cross Sound Cable Project, PSEG Cross Hudson Project, Neptune Regional Transmission System, and Long Island Replacement Cable Project). This method of laying and burying the cables simultaneously provides for the placement of the subaquatic cable at the target burial depth with minimum bottom disturbance and with the majority of fluidized sediment settling back into the trench to provide cover for the cable (Exhibit 4, Sections 4.4 and 4.5). Jet plow equipment uses a pressurized water pump system onboard the cable vessel to fluidize sediments, creating a trench approximately 24 inches wide into which the submarine transmission cable settles through its own weight. The temporarily fluidized sediment settles over the submarine transmission cable to bury the cable.

A dynamically positioned barge equipped with an integrated navigation system will be used as the Cable Laying Vessel (CLV). Coupled with Differential Global Positioning System, this system will ensure that the subaquatic cable route is followed in real time and that all cable lay data is gathered and recorded in digital format for as-built drawings and final report generation. The CLV will be mobilized from Port Elizabeth, New Jersey, which is where the cable will be loaded onto the CLV after it is transported from a manufacturing facility, potentially in Europe.

The jet plow device that will be used to install the subaquatic cable will be a towed jetting sled with a pivoting blade. The blade pivots near the bell mouth. Hydraulic rams raise and lower the blade, and can hold the blade fixed at any angle through its range of motion. The plow is typically 15 feet wide with 36-foot-long skids. The 8-foot blade is designed with high-pressure water nozzles on the leading edge, so that the plow jets a trench through the seabed, minimizing the amount of force required to tow the plow. The jet pumps, hydraulic pump, and controls for blade adjustment are located on the CLV. The CLV will tow the jet plow along the subaquatic cable route with a wire towline. In addition to the tow wire, a jet pump hose, a pair of hydraulic hoses, and an umbilical cable for the electronics are connected to the plow. Seawater will be pumped from the CLV to the jet plow device. The jet plow device is shown in Figures E-3.3 through E-3.7.

The hydraulic pressure nozzles create a direct downward and backward “swept flow” force inside the trench. This provides a down and back flow of re-suspended sediments within the trench, thereby “fluidizing” the *in situ* sediment column as it progresses along the predetermined route such that the subaquatic cable settles into the trench under its own weight to the planned depth of burial. The jet plow’s hydrodynamic forces do not work to produce an upward movement of sediment into the water column since the objective of this method is to maximize gravitational replacement of re-suspended sediments within the trench to bury or “embed” the cable system as it progresses along its route. As the jet plow progresses along the route, the water pressure at the jet plow nozzles will be adjusted as sediment types and/or densities change to achieve the required minimum target burial depth.

E-3.1.6.4 Final Cable Landing

At the landfall, the CLV will tow the plow into the temporary cofferdam. The cable will be unloaded from the plow and the plow recovered to deck. The CLV will then turn perpendicular to the transmission cable route. A measurement will be taken from the CLV to the final termination point. A measured bight of cable will be floated within Lake Ontario, and the cable will be cut and sealed. The cable end will be rigged with a swivel and transferred to the landfall winch wire. Small craft will maintain the floating bight of cable in position. Upon direction from the CLV, land-based crews will commence winching the cable through the temporary cofferdam and the bulkhead. Divers will remove cable floats and assist with the positioning of the cable as needed during the cable landing operation. Once the cable is ashore, it will be secured. The lay barge will be towed to the dock for demobilization of equipment and spare cable offload.

E-3.1.6.5 Air and Water Lift Operations

Air or water lift methodology may be used to augment the cable burial or in the cofferdam excavation. An airlift is designed to provide the controlled removal of seabed material. The airlift operates on a differential density principle. High-pressure air is introduced at the lower end of a submerged pipe, when the air combines with the water in the pipe a mixture forms that is less dense (lighter) than the water outside the pipe. The lower density mixture in the pipe rises causing suction at the inlet. The amount of material lifted depends on various factors such as size of the pipe, air pressure, air volume and discharge head (Figure E-3.6).

The water lift system may also be employed individually or to augment air lift operations where necessary. The water lift will remove seabed material and place it on the sea floor away from the site (Figure E-3.7).

E-3.2 Environmental Controls during Construction

Environmental controls employed during the construction of the underground and subaquatic segments of the transmission line are present in the EM&CP, which is Appendix C of this application.

Figures

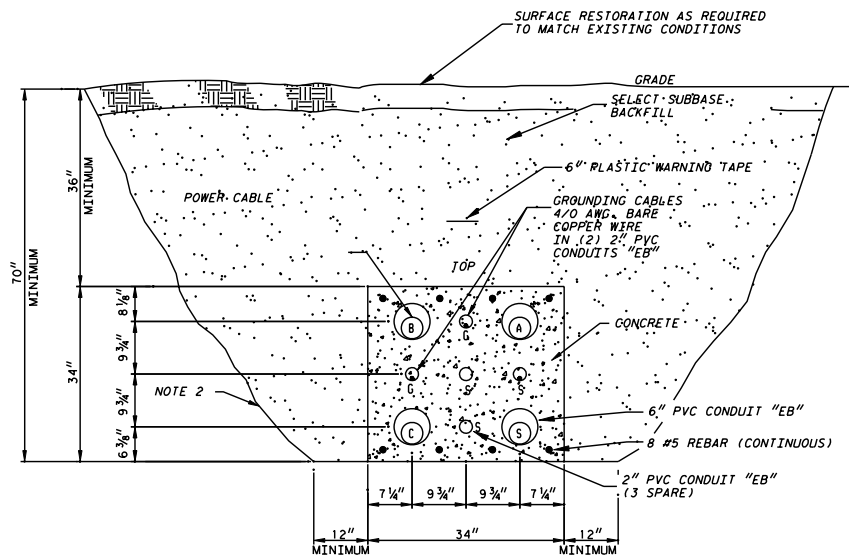


Typical design for single-core XLPE submarine cable – 230 kV

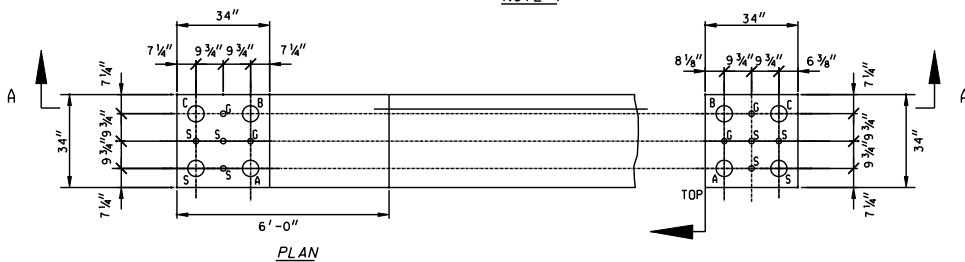


Conductor Type/material Longitudinal water sealant	round compacted copper polymer compound
Conductor shield Material	semi-conductive PE
Insulation Material	triple extruded, dry cured XLPE
Insulation shield Material	semi-conductive PE
Longitudinal water barrier Material	swell able tape
Metallic sheath Type/material	lead alloy
Core jacket Type/material	semi-conducting extruded PE
Bedding Type/material	polymeric tapes
Armor Type/material	Copper wires
Outer cover Material	Polypropylene yarn (2 layers)

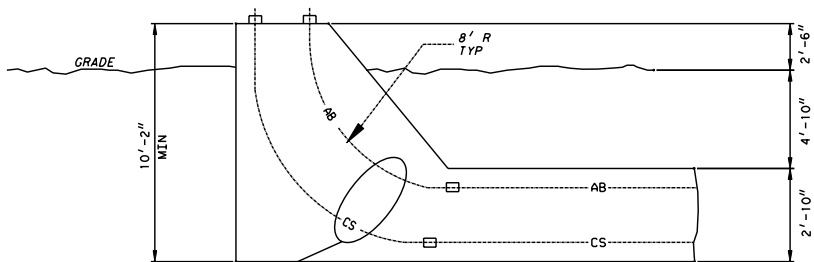
Figure E-3.1 ABB 230kV Submarine Cable, Outer Diameter ~ 5.5 inches



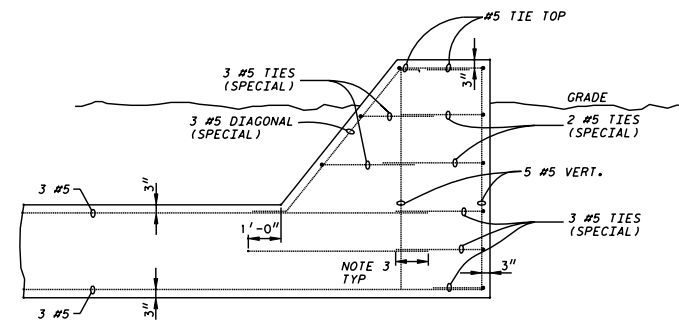
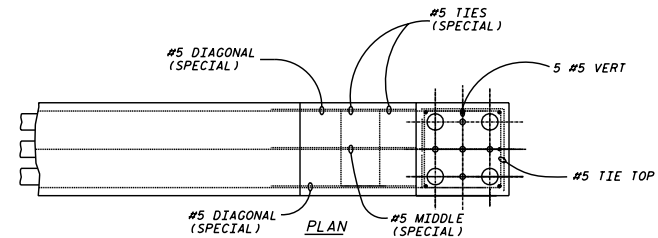
TRENCH DETAIL
OPEN AREA (TYP)
NOTE 1



PLAN



SECTION A
TYPICAL CONCRETE RISER



TYPICAL RISER REINFORCEMENT

GENERAL NOTES:

1. TRENCH DETAILS ARE CUT LOOKING NORTH.
2. TRENCH EXCAVATION & SHORING SHALL CONFORM TO OSHA STANDARDS. SLOPE PER OSHA REQUIREMENT BASED ON SOIL TYPE IF TRENCH BOX NOT USED.
3. STANDARD REINFORCEMENT LAP PER ACI-318.
4. USE SCH. 40 PVC FOR 2" AND 6" RISER BENDS & FITTINGS.
5. INSTALL SPACER ASSEMBLIES AT 8' INTERVALS.

08/27/2008

230 kv Transmission Line Underground Duct Bank Figure E-3.2

UPSTATE NY POWER CORPORATION
230KV TRANSMISSION LINE
UNDERGROUND DUCT BANK

DRAWN BY	MJS	PROJECT NO.	-
DATE	07/23/08	SCALE	NONE
CHECKED BY	JFAP	DRAWING NUMBER	0005
DATE	07/28/08		

Figure E-3.3 - Cable burial plow with 5 meter blade fully retracted



Figure E-3.4 Cable burial plow with 5 meter share fully extended.



Figure E-3.5 Cable burial plow with jet pumps connected and running.



Figure E-3.6- Air Lift System

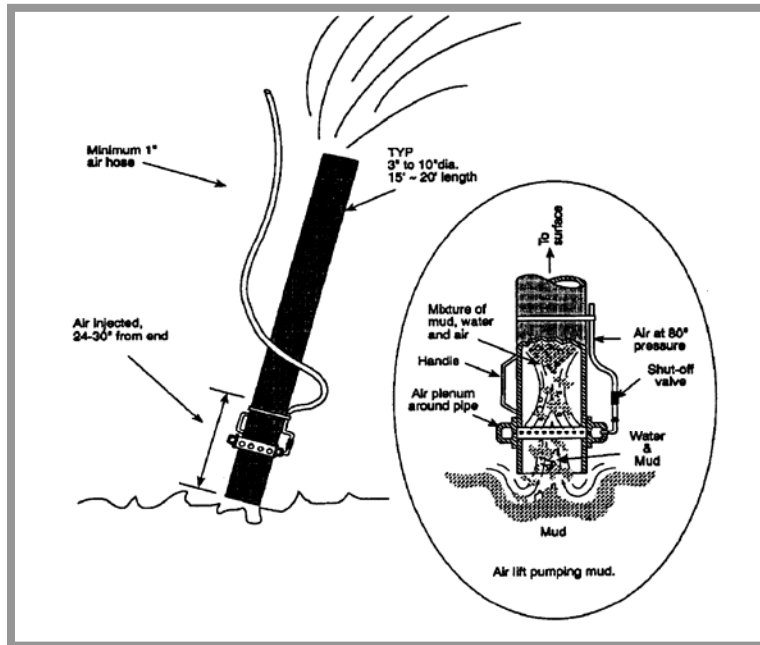


Figure E-3.7 - Water Lift System

