



MD–DC Utilities Association

Patuxent River – HDD Crossing

October 5, 2017

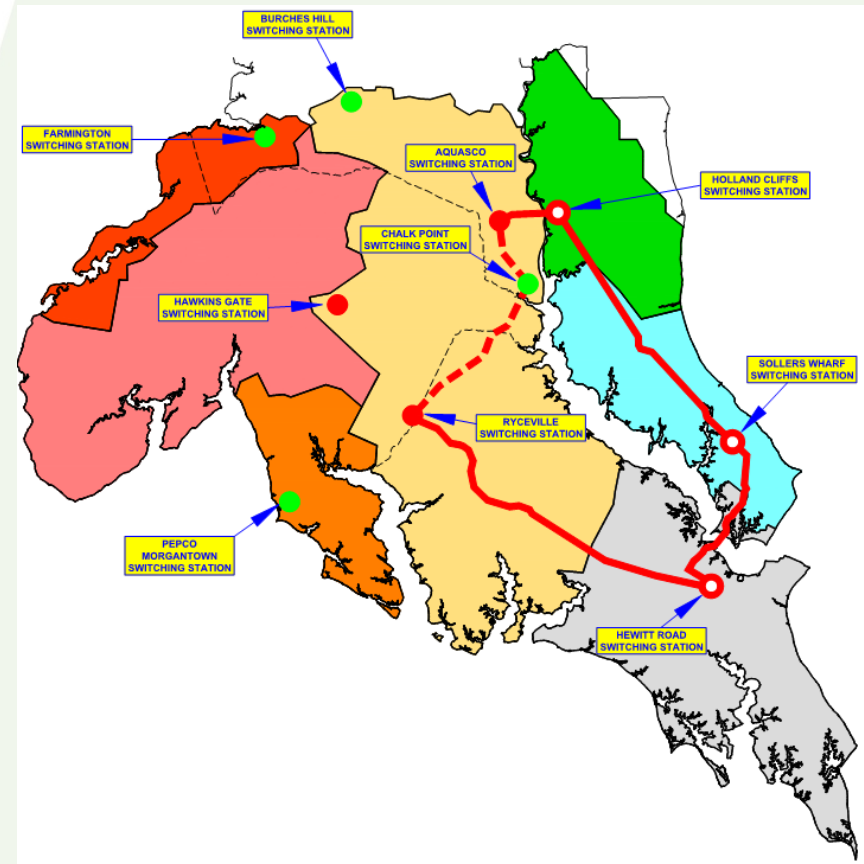
Proprietary and Confidential

Agenda – Successful HDD Project

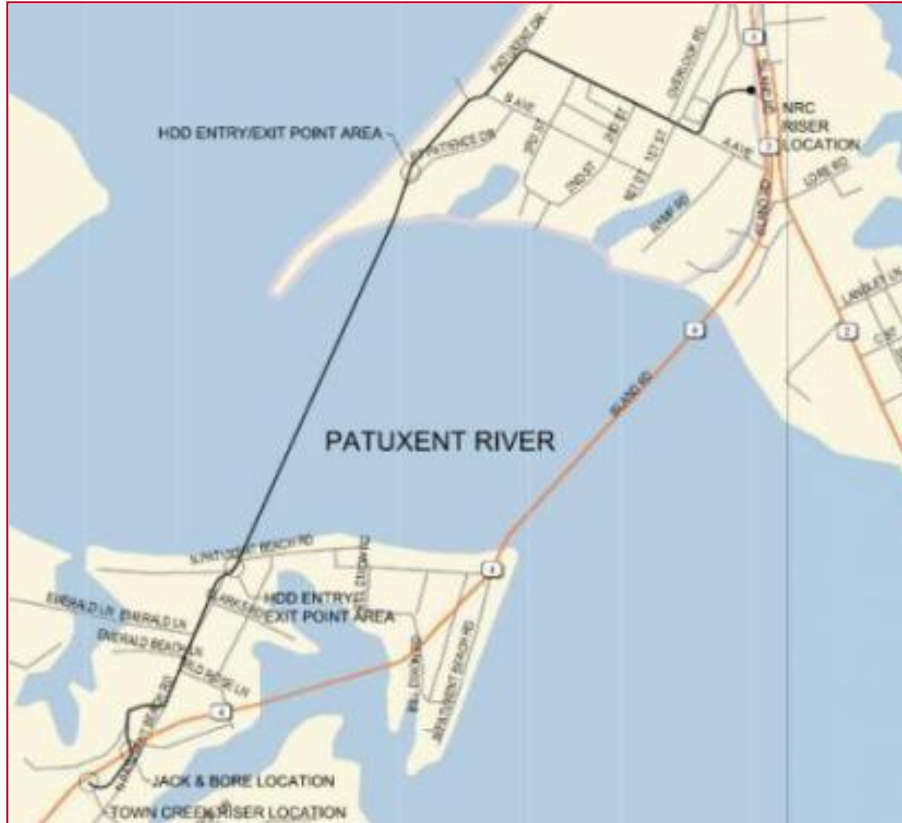
- Who is SMECO?
- What Do We Know about HDD? “Patuxent River Crossing”
- What is HDD – Horizontal Directional Drill?
- How can You Be Successful at HDD Projects?
- How can Permitting Influence Your Project?
 - Inadvertent Return
 - Drilling Fluid Monitoring and Operations Plan
 - Water Supply
 - Erosion & Sediment Control
 - Noise Reduction Plan
 - Schedule Restrictions
- Do Not Forget About Pipe Assembly and Handling

SMECO Service Territory and Statistic

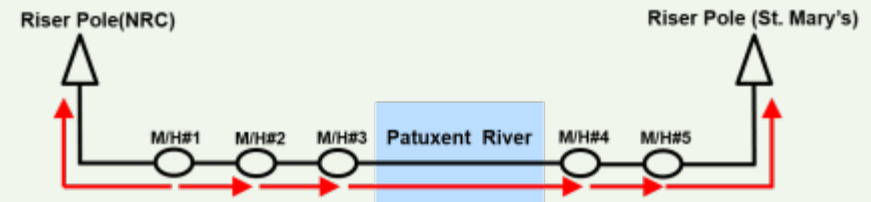
- Serve Four Counties in SOMD separated by the Patuxent River
- 12,301 Miles of Line
- 71 Substation – Seven Electrical Sources
- 162,823 Total Customers
- 497 Full Time Employees
- \$980,730,772 in Plant
- \$437,087,895 in Annual Revenue



Patuxent River Crossing Overview



- 2.1 miles of double circuit duct bank
- Provisions for future circuit
- 4600' Slick Bore HDD
- 230kV, 3200kcmil XLPE lead sheath cable
- 5 manholes
- 2 riser structures



Patuxent River Crossing Aerial View



Bore Hole Entry

Bore Hole Exit

Pipe Laydown

Patuxent River Crossing HDD Fun Facts

- ▶ Two – 4600 Feet HDD's
- ▶ 9 miles (46,000 feet)
DR14 Fusible PVC Pipe
- ▶ 3,300 Cubic Yards of
Soil Removed
- ▶ 2.5 Million Gallons of
Water Needed
- ▶ One Helicopter and
Several Boats

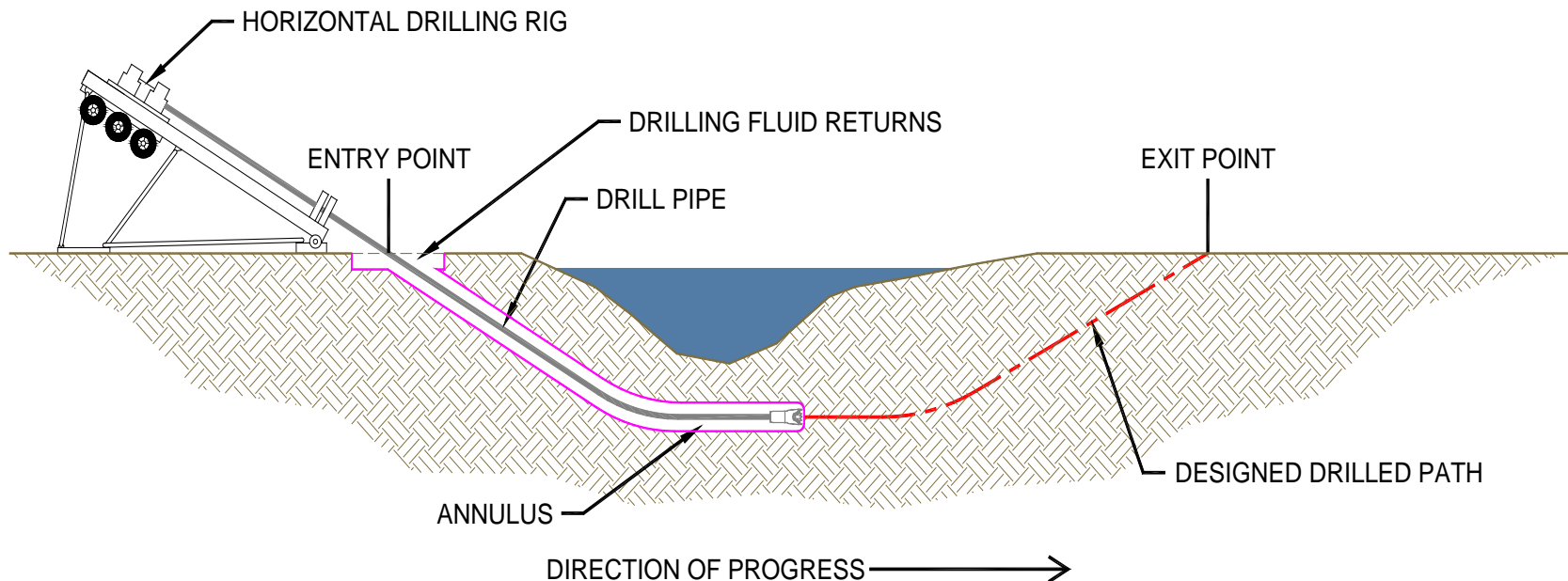


HDD – Horizontal Directional Drill Process

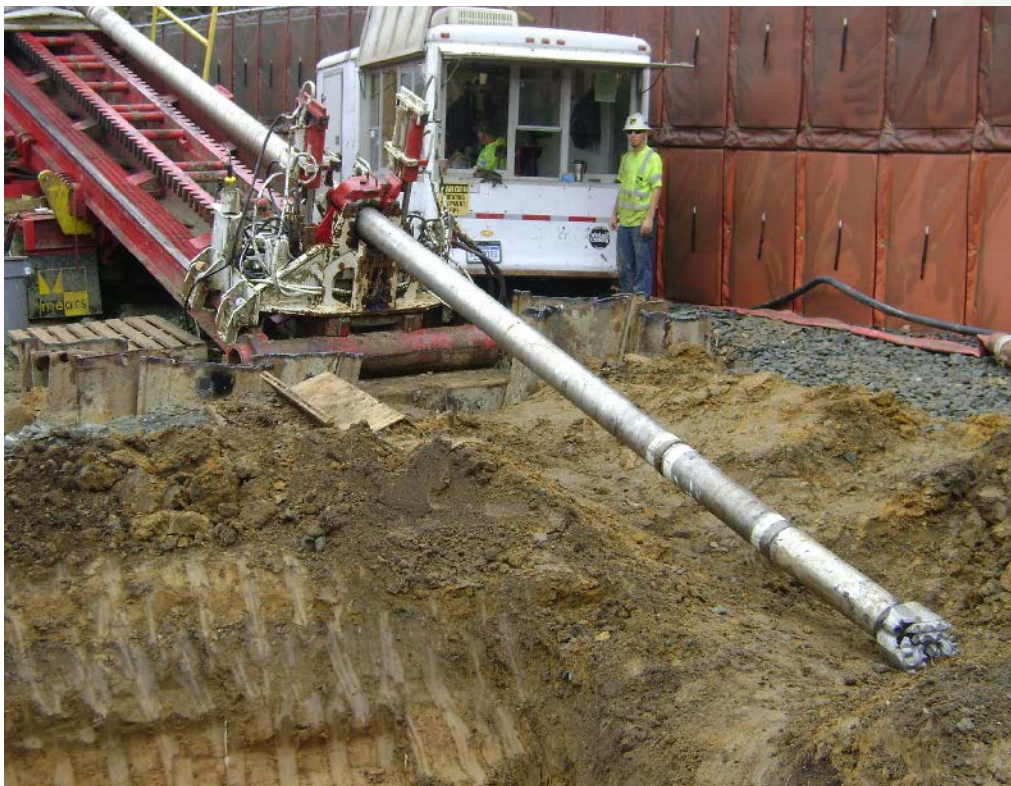
1. Pilot hole - a small diameter hole is drilled along a designed directional path
2. Prereaming - the pilot hole is enlarged to accommodate the conduit or bundle
3. Pullback - the conduit or bundle is pulled into the enlarged hole

Pilot Hole

- A small diameter hole is drilled along a designed directional path.
- Tri-Cone Drill bits commonly used in the HDD industry range from 8.75 to 12.25 inches.
- The location of the pilot hole is tracked using sophisticated tracking systems.

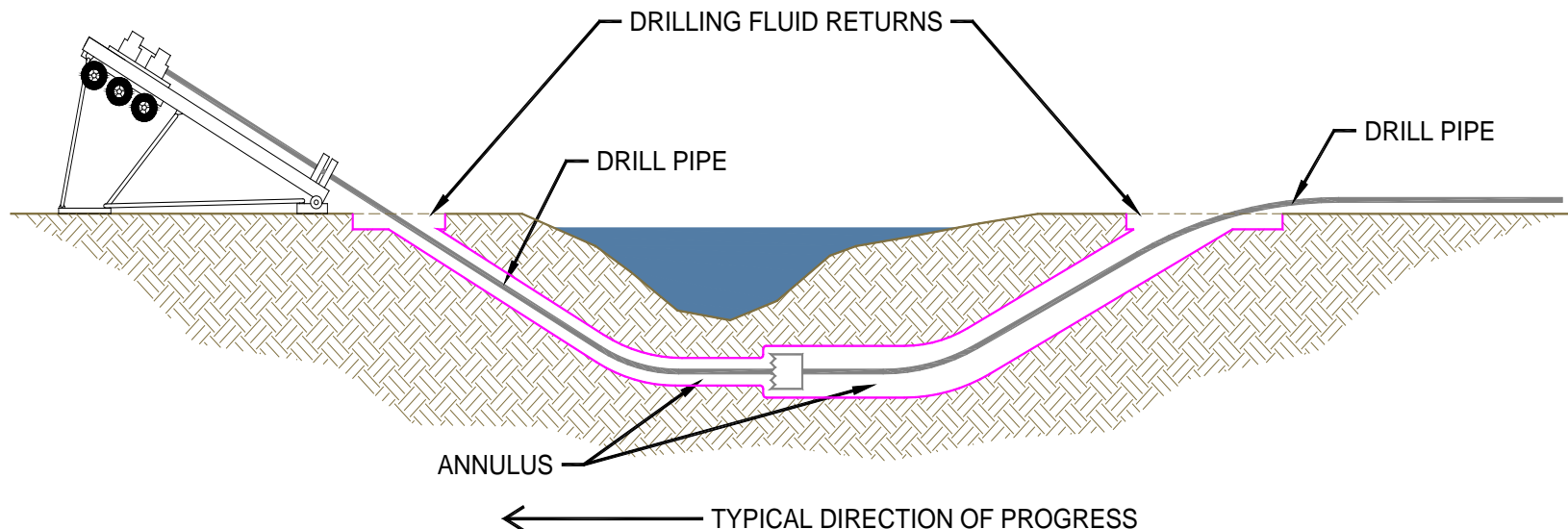


HDD - Pilot Hole

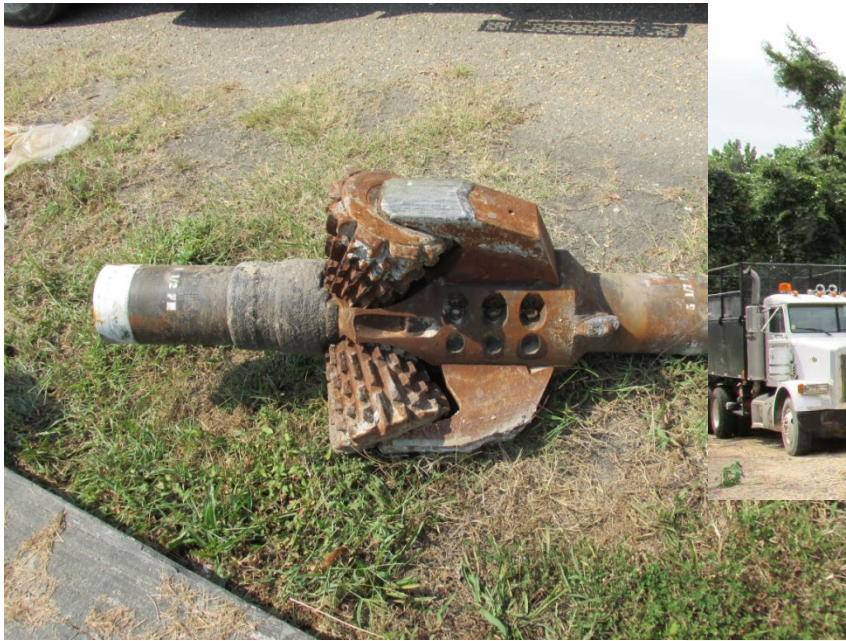


Prereaming

- The pilot hole is enlarged in one or more passes to a size that will accommodate the cable conduit bundle.
- Reamers are typically attached at the exit point then rotated and pulled towards the rig to enlarge the hole.
- Ream the hole to 42 inches in diameter to accommodate the cable conduit bundle.



HDD - Reaming

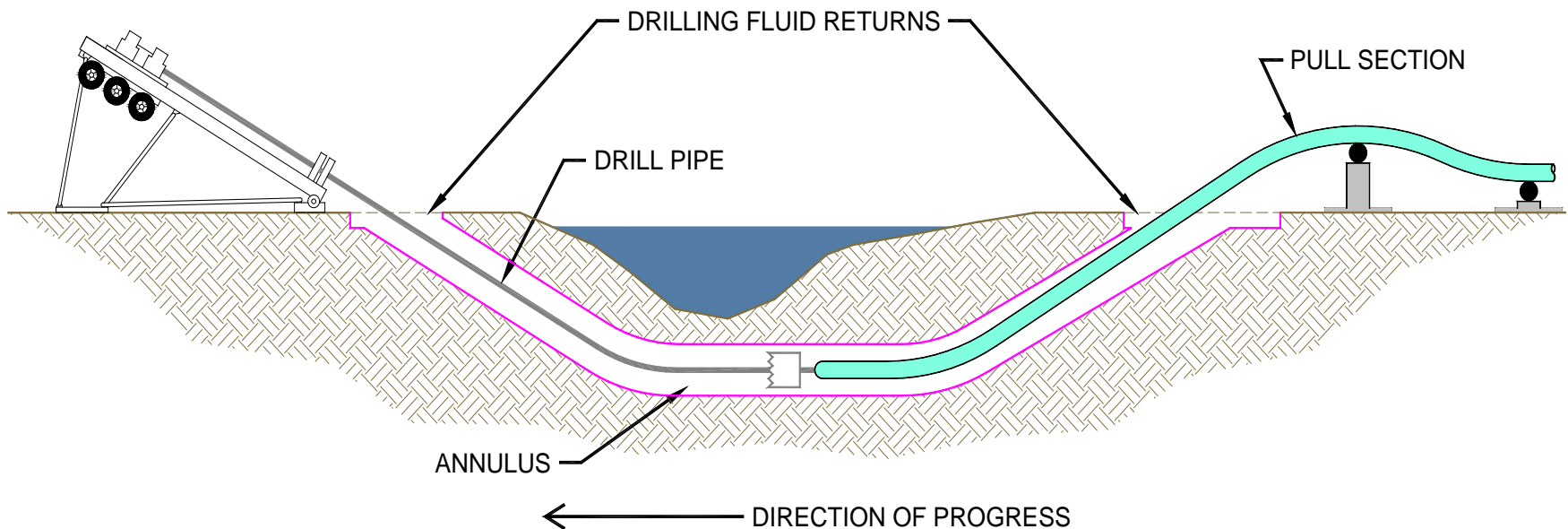


Drilling Pipe Stem - Joint

Reamer – First Pass

Pullback

- Pull section is attached behind reamer at exit point and pulled toward rig.
- Swivel is placed between pull section and reamer to minimize torsion.
- Pull section is supported using combination of roller stands and conduit handling equipment (sidebooms, cranes, roller cradles).



HDD – Pipe String Layout



HDD Pipe PullBack

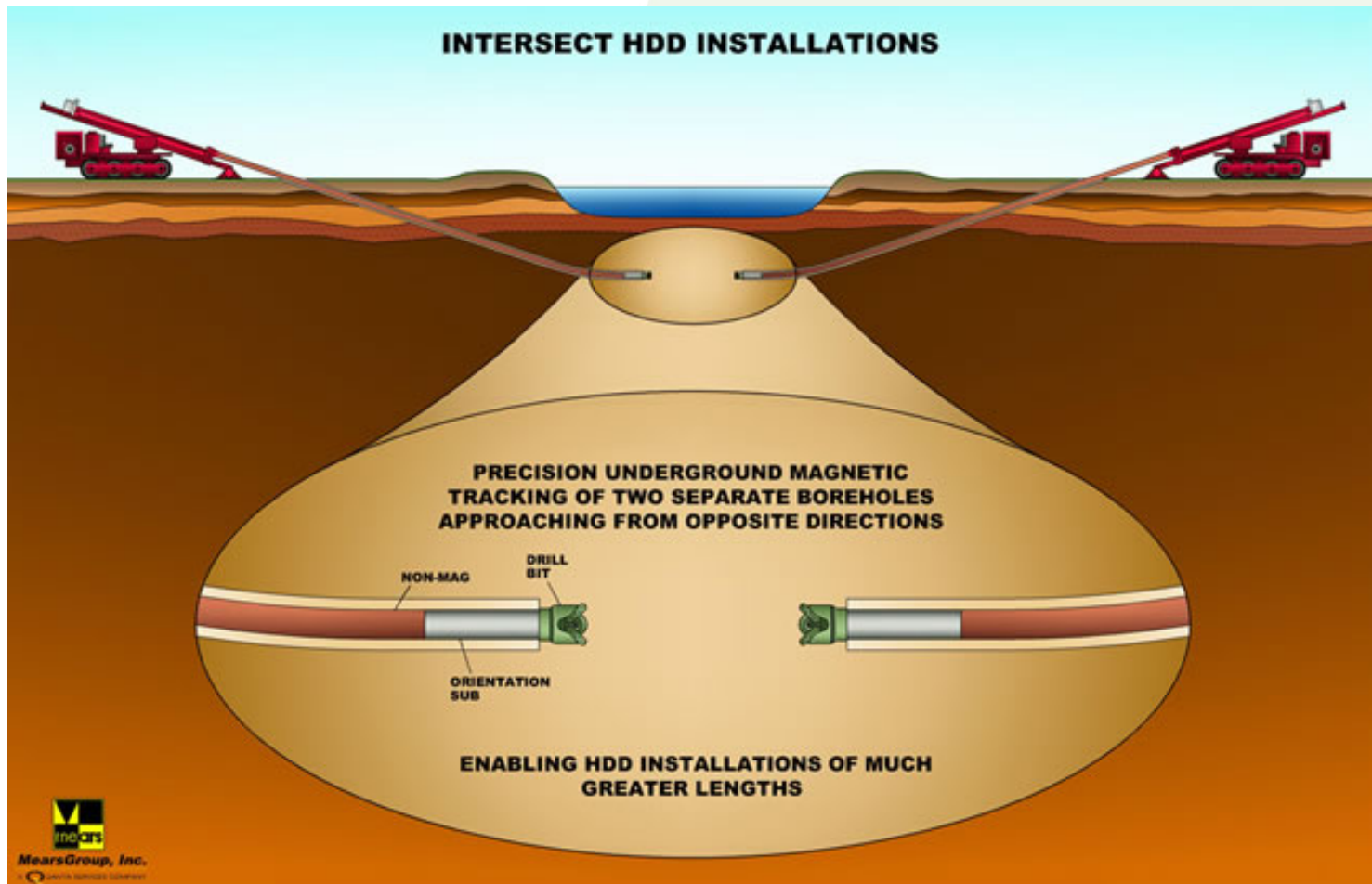


Start



Finish

HDD – Intersect Method



How Can You Be Successful at HDD Projects

- Management Support - Important Project
- Dedicated Team - Leadership
- **Environmental Best Management Practices – Permitting**
- ***Quality Engineering - Outstanding Planning & Design***
- Project Management - Contracting/Risk Mitigation
- Quality Material Suppliers and Contractors - Partnerships
- Construction Management - Execution
- Defined Expectation – Good Communications
- Realistic - Budgets and Schedules

Permitting Influence - Agency Requirements



- Certificate of Public Convenience and Necessity (CPCN)
- National Environmental Policy Act (NEPA)
- Maryland Public Service Commission (MD PSC)
- Maryland Department of Environments (MDE)
- Army Corp of Engineers (ACOE)
- Maryland Power Plant Research Project (MD PPRP)
- Multiple Agency meetings – Full transparency
- Full Blown Public Relations Campaign Required

Permitting Primary Concerns

- Turbidity (Jet plow option)
- Inadvertent Return (HDD option)
- Natural Oyster Bars located on both shorelines
- HDD was the only installation method that the Agencies would support for the Patuxent River Crossing; however,
 - Must Minimize Risk of Inadvertent Return and provide Hydro Fracturing Analysis
 - Must provide Drilling Fluid Monitoring Plan
 - **Must provide Independent Monitoring Personnel**

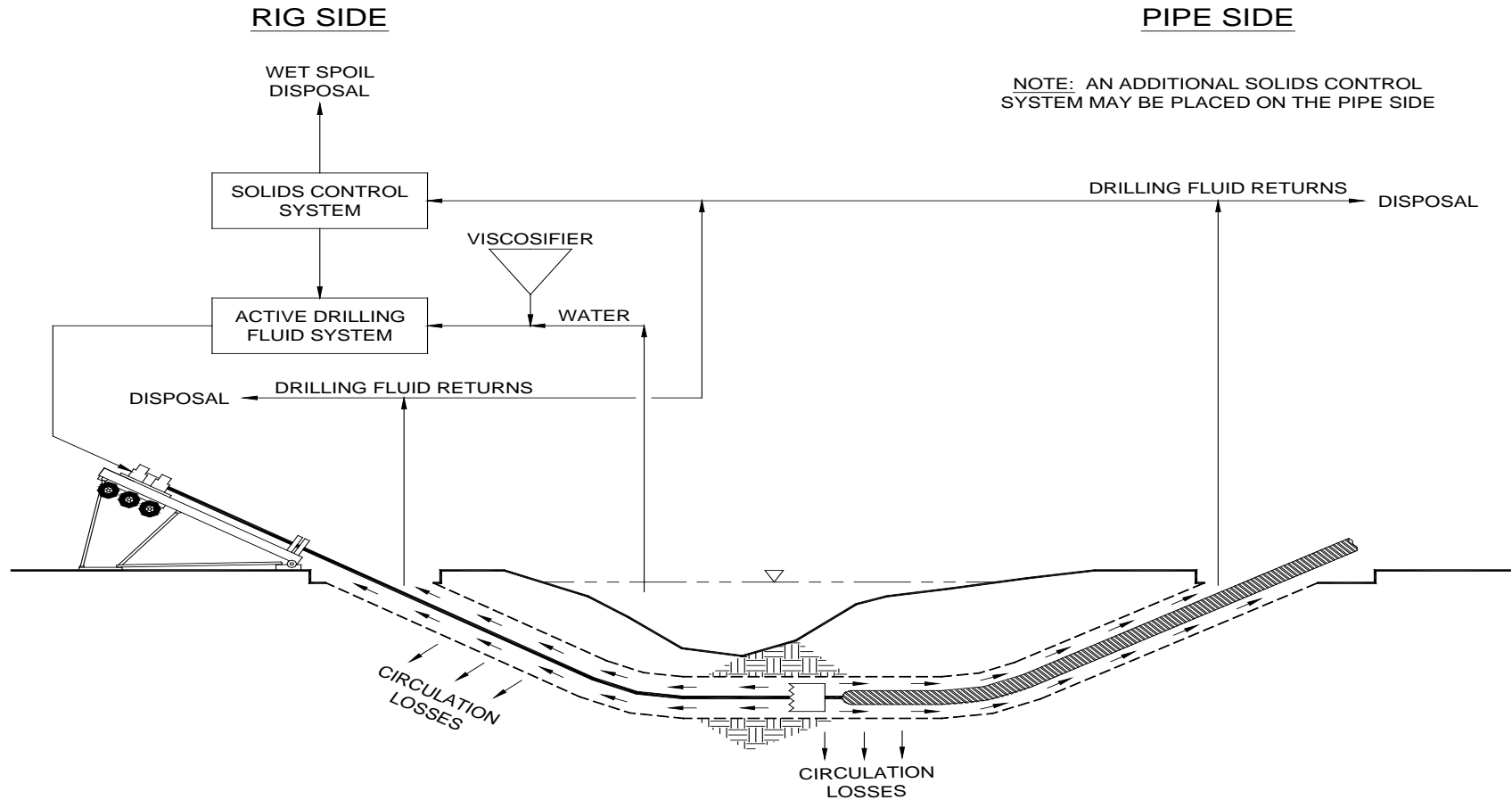


Inadvertent Return – Drilling Fluid

- Drilling fluid is used to lubricate and cool the drill head and to return the cuttings through the annular opening around the drill stem.
- Drilling fluid is non-toxic and benign, the fluid contains approximately 1 – 3% of a naturally occurring clay mineral called bentonite.
- The clay mineral properties of Bentonite make it an excellent material to seal the bore hole by filing in the cracks along the hole to minimize an inadvertent return.



Drilling Fluid Handling System



HDD – Drilling Fluid Handling System



Cleaning Plant



Catch Rig

Drilling Fluid - Inadvertent Return

- Bentonite however cannot seal a frac-out due to existing fissures in the soil or other natural seepages along loose rock, piers, piles, or other substructures.
- Bentonite also cannot prevent a hydrofracture which is a specific event in non-fissured cohesive soils when the pressure of the drilling fluid in the annular space of the bore hole exceeds the strength and confining stress of the surrounding soil resulting in plastic deformation, cracking, and fracturing.

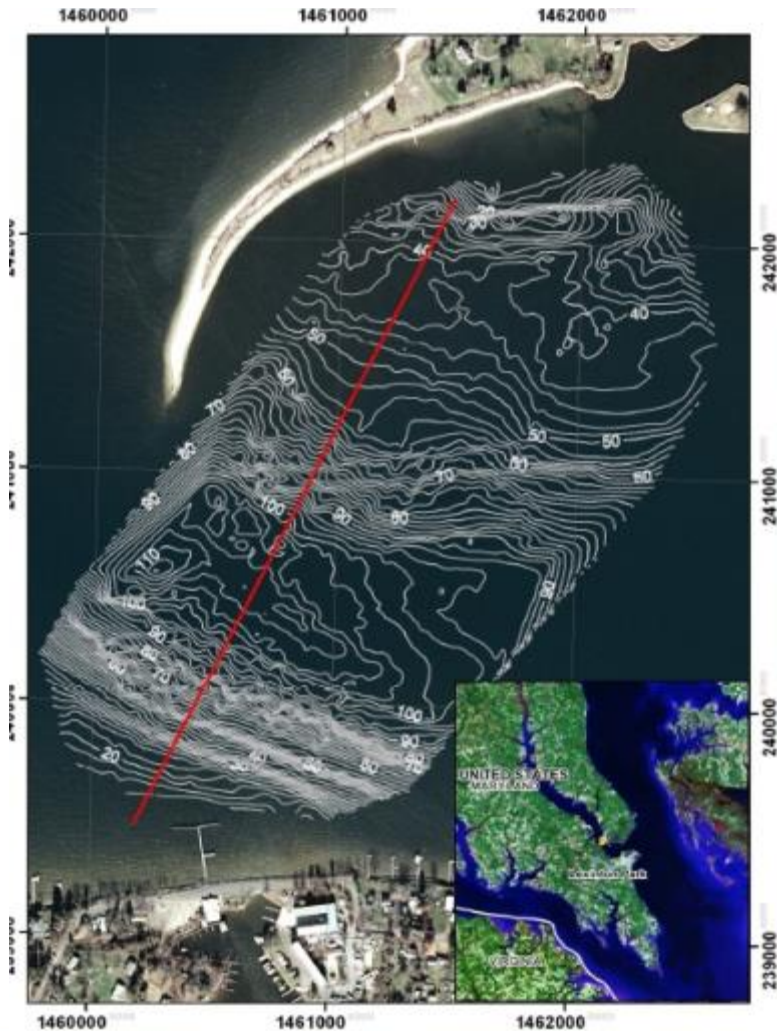


Minimize the Risk of Inadvertent Drilling Fluid Returns

– During the Design Phase

- Design Precautions
 - Conservative Design Depth
 - 50 feet under the river bottom
 - Hydrofracture Analysis
 - Used methods outlined in an Army Corp of Engineers publication titled *Recommended Guidelines for Installation of Pipelines beneath Levees using Horizontal Directional Drilling* to predict the annular pressure at which hydrofracture will occur.
 - Used methods described in Section 2 of Drilling Fluids in *Pipeline Installation by Horizontal Directional Drilling* to calculate annular pressure necessary for HDD operations.
 - Conducted site-specific geotechnical drilling and laboratory testing to determine soil properties.

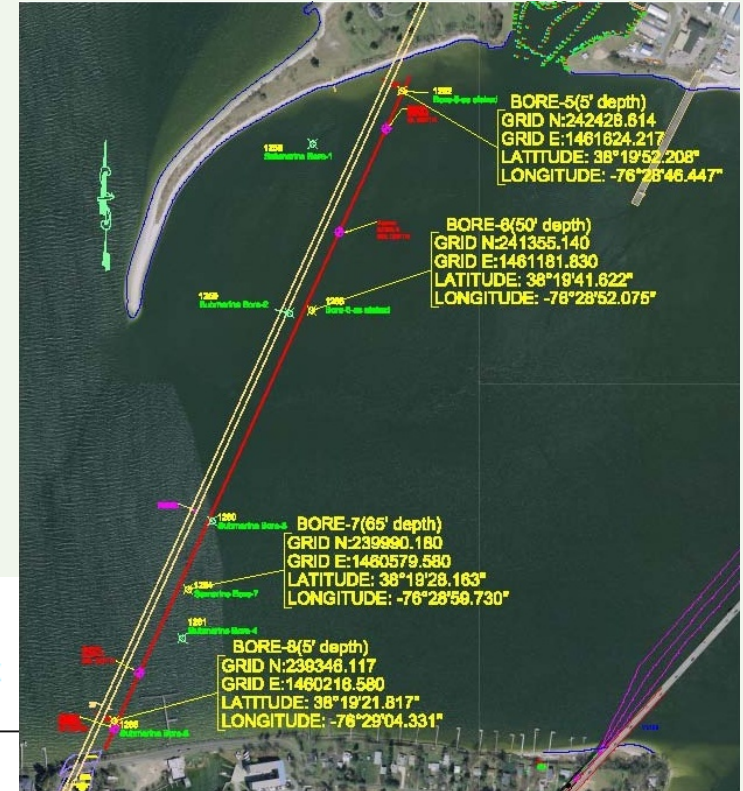
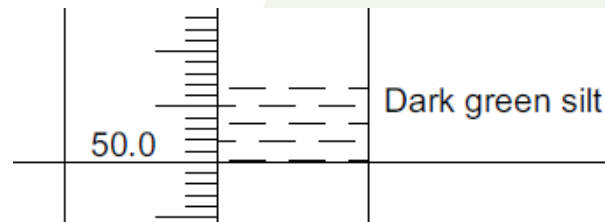
Surveying to support HDD design



- Geophysical
 - Sidescan
 - Multibeam bathymetry
 - Subbottom profiling
 - Magnometer
- Post installation survey
 - Only required if fluid is release.

Inadvertent Return – Risk Mitigation

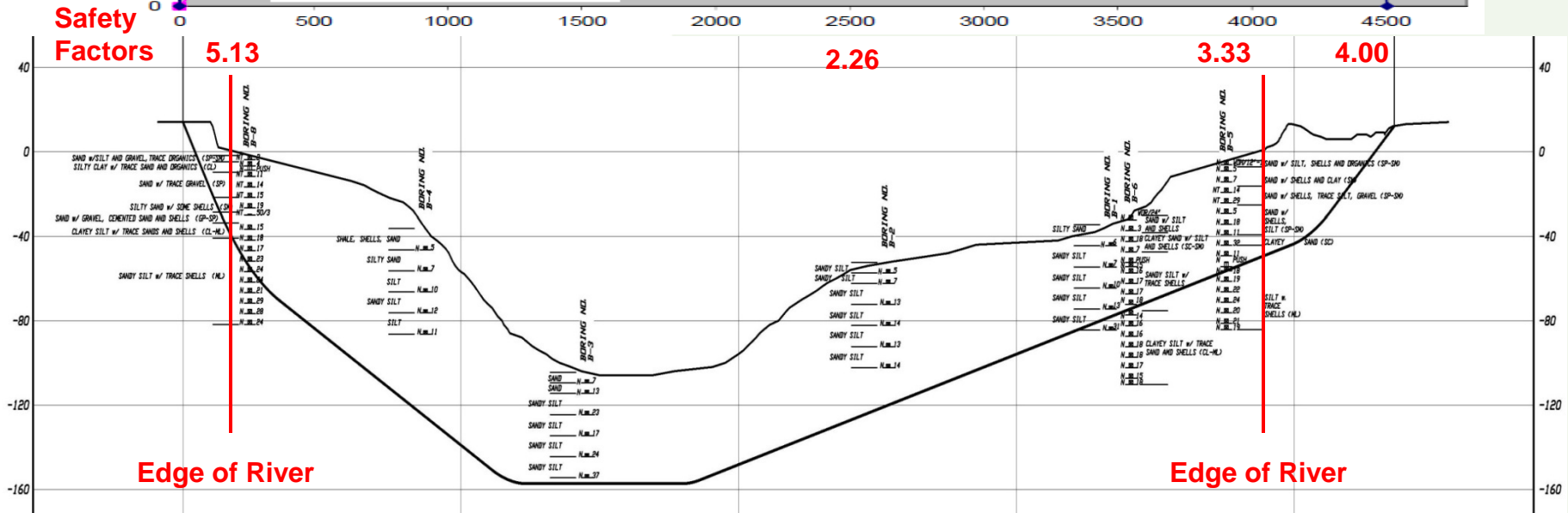
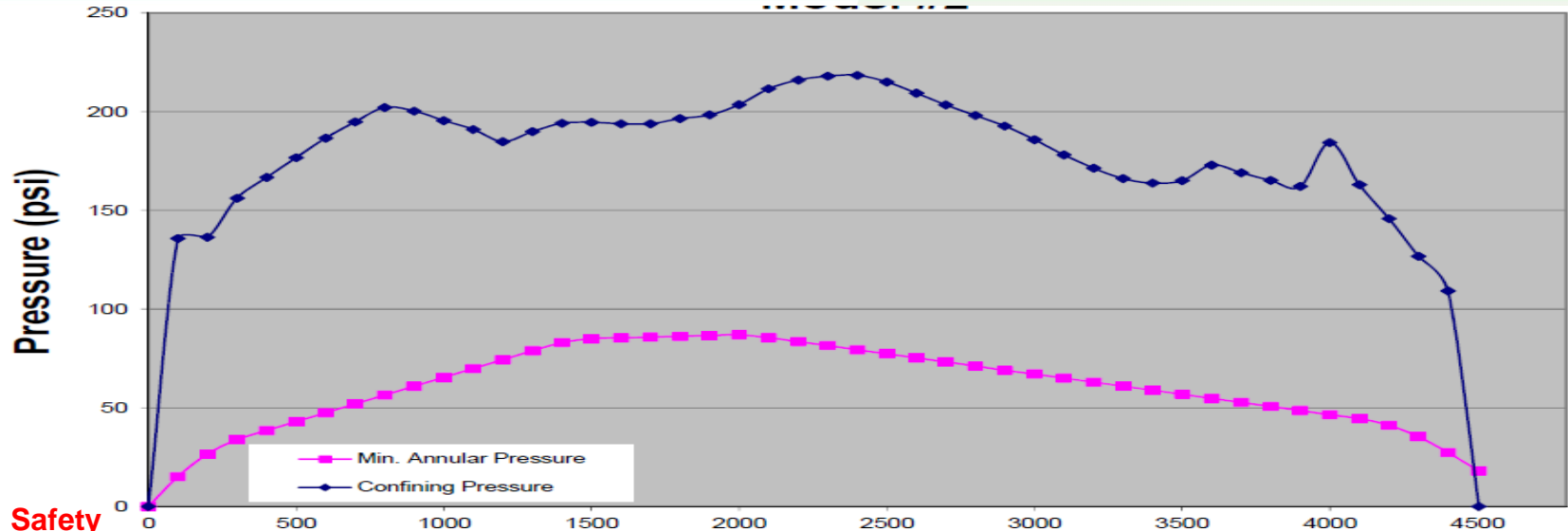
- Bore holes were located approximately 100 feet from the route.
- The soils along the planned route are a uniform dense sandy silt mixture thus reducing the chance of a frac-out due to an existing fissure.
- There are also no piers, piles, or other substructures located along the planned HDD alignment.



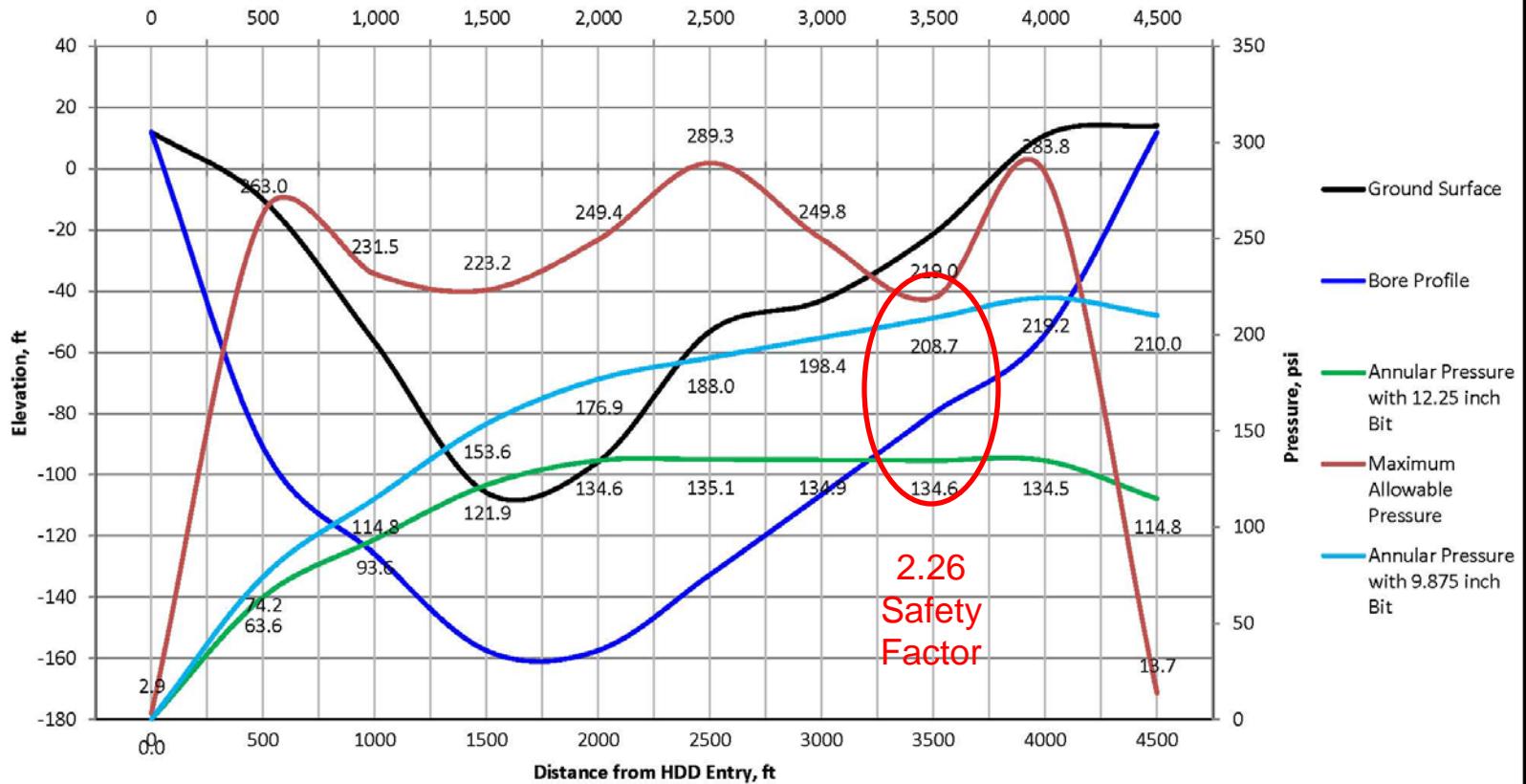
Inadvertent Return – Risk Mitigation

- J.D. Hair and Associates, which specializes in HDD design, was hired to do the HDD drill path design and a corresponding Hydraulic Fracturing Analysis.
- The Hydraulic Fracturing Analysis indicated that the anticipated pressures in the bore hole will be less than the limiting pressure of the soil overburden.
- The soil mass should withstand the drilling fluid pressures consistent with normal drilling operations.
- The Hydraulic Fracturing Analysis indicates that a successful HDD can be made.

❖ *There is Always a Risk for a Hydrofracture*



SMECO Patuxent River Crossing Annular Pressure Estimate with Different Drill Bit Sizes



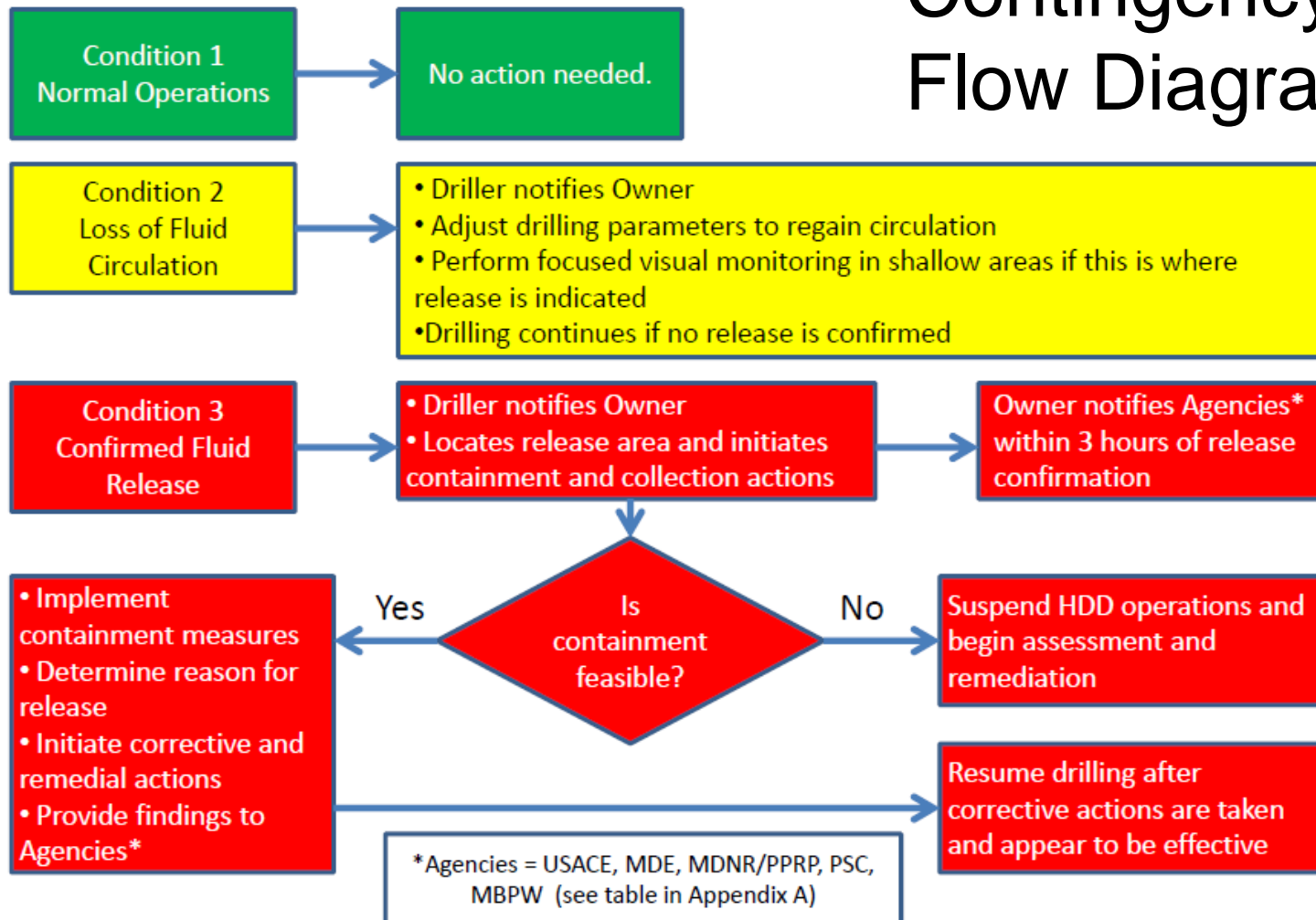
Drilling Fluid Monitoring Plan

- Implement a Drilling Fluid Monitoring & Operations Plan to establish clear procedures to:
 - Monitor for fluid loss
 - Identify inadvertent fluid release
 - Identify contacts in case of fluid release
 - Contain and control released drilling fluids
- HDD contractor develops the final plan based on equipment being used and site specific requirements.
- Loss of fluid may not indicate fluid release
- Drilling operations continue unless fluid release can NOT be controlled.

Drilling Fluid Monitoring and Operations Plan

- Draft Drilling Fluid Monitoring and Operations Plan was submitted to the Permitting Agencies as part of the overall SMRP permitting package.
- Final Drilling Fluid Monitoring and Operations Plan is submitted by HDD contractor:
 - Includes Results from the River Sampling Plan
 - Includes project specific input from the HDD Contractor
- Plan has three (3) Stages:
 - Condition 1 – Normal Drilling
 - Condition 2 – Loss or Reduction of Circulation
 - Condition 3 – Drilling Fluid Release and Mediation

Contingency Plan Flow Diagram



Inadvertent Return Risk Mitigation

- Soils along planned alignment are a uniform dense sandy silt mixture
- No piers, piles, or other substructures located along the planned alignment
- Specialized design firm was hired to do the HDD drill path design and a corresponding Hydraulic Fracturing Analysis
 - Confirmed anticipated pressures in the bore hole will be less than the limiting pressure of the soil overburden
 - Soil mass was calculated to withstand the drilling fluid pressures consistent with normal drilling operations
 - Confirmed that a successful HDD could be made
- Annular pressure estimates were also calculated with various drill bit sizes
- Inadvertent return contingency plan was developed

Fresh Water Supply

- Fresh water will be required at the drill entry site to makeup the drilling fluid.
- Fresh water will also be required at the drill exit site to ballast the pipe bundle during pullback to reduce frictional forces.
- Fresh water supply sources:
 - Utilize public water supply.
 - Haul fresh water from offsite via tanker trucks.
 - Use river water being crossed
- Permits required for any of the water sources.
- Natural water supply requires treatment prior to use.

Remember - Lots of Water is Needed - Millions of Gallons!

Erosion and Sediment Control

- HDD is a Muddy Process
- Drill entry and exit site requires an excavated pit to return and collect drilling fluid and cuttings.
- Cuttings will be disposed of off site.
- Need Lined Dump trucks for Cuttings



Noise Abatement

- Goal was to Meet USEPA recommendation for daytime noise at the two (2) closest residences R1 and R2
- Installed plywood sound barriers around HDD equipment
- Installed a 12 foot chain link fence around site
- Installed acoustical fabric material on chain link fence
- Fence enclosure designed for High Winds



Predicted Worst Case Noise With Mitigation



Acoustical Fabric Material

Schedule Restrictions

- Access Restrictions Imposed by NRC
 - Can only start after Labor Day.
 - Must be complete by Memorial Day.
- Work Restriction Imposed by MDE
 - No hydraulic dredging (HDD) between December 16th and March 14th.
 - SMECO received a Waiver on the HDD time restriction based on the results of the first HDD – No Inadvertent returns.
- Work was Planned around Restrictions
 - HDD Installation: Fall, 2013
 - Cable Installation: Fall, 2014.

Pipe Assembly

- Each of the two (2) planned HDDs for the Patuxent River crossing had a bundle of five (5) individual pipes.
- The entire five (5) pipe bundle had to be pre-assembled and tested in a continuous, monolithic length prior to the completion of the HDD.
- FPVC pipe comes in 40 foot lengths and needed to be fused together in one continuous length by heat fusion.
- The fusion process was performed by pipe supplier technicians.
- The pipe bundle had to be assembled from one end only in order to de-bead the fusion joint.
- Testing of each joint was performed in accordance with ASTM F1674 and D638.



Pipe Assembly



Pipe Fusing Machine (Six)



Pipe Rollers

Pipe Assembly



Pipe Fusing Station



Delivered Pipe

Pipe Handling



Pipe Handling



Pipe Entry



Pipe String

Pipe Handling – Ballasting

- Pipe bundle was ballasted (completely filled with water) during pullback.
- Ballasting the pipe bundle will cause it to float near the bottom of the bore hole which reduces the frictional forces on the uphill side of the pullback operations.
- A clean water supply hose was installed into each individual pipe prior to pullback.
- The pipe bundle was pulled into the bore hole to the point where ballasting is required.
- A pipe ballasting station was set up with a clean water supply.

Pipe Handling - Ballasting



Mobile Pipe Ballasting



Ballasting Header

Pipe Pull Back

- A pulling head will be attached to the pipe bundle with a swivel between the HDD back reamer and pulling head.
- Rotation of the pipe bundle will be reduced by the swivel head to minimize the tensile stress during pullback.
- The pipe bundle pullback needs to be completed without stoppage.
- Stopping the pullback may cause the pipe bundle to get stuck in the bore hole.



Pipe Cleaning and Proofing



Pipe Cleaning Pigs



Pipe Proofing Mandrel

Project Team

- SMECO
 - John Bredenkamp – Project Manager
 - Hugh Voehl – Engineering Manager
- Black & Veatch – Owner's Engineer
 - Donald Eddy – Project Manager
 - Ted Aggeler – Construction Manager
- Mears – HDD Contractor
 - Ron Halderman – Project Director
 - Shai Joshi – Project Manager
 - Bert Chapman – Site Superintendant
- LS Cable – Duct Bank and Cable
 - Kevin Kim – Site Superintendant



Summary for Success

- ✓ Exciting and Challenging Project – Must Be Successful
- ✓ Extensive Public Relations Campaign
- ✓ Engineering Excellence and Outstanding Project Planning
- ✓ Best of Class Contractors and Very Experienced Project Team
- ✓ Solid Execution Plan and Schedule
- ✓ Environmental Best Management Practices Used
- ✓ Hydraulic Fracturing Analysis - Successful HDD
- ✓ Defined Drilling Fluid Monitoring and Operations Plan
- ✓ Established Pipe Assembly and Handling Plan
- ✓ Implement a Noise Reduction Plan

Get the Right People and Develop a Solid Work Plan