



Statement of Qualifications

GeoEngineers' Capabilities

HDD and Direct Pipe Capabilities, Experience and Key Personnel

2024

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Capabilities and Experience

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Appendix A

Key Personnel Resumes

GeoEngineers specializes in crafting unique environmental, ecological and geotechnical solutions for the water and natural resource, energy, transportation, federal, and development sectors. For more information, visit GeoEngineers on the web at www.geoengineers.com.

About GeoEngineers, Inc.

OUR CAPABILITIES

GeoEngineers is a national employee-owned firm that assists pipeline owners and operators in all phases of their projects as part of an integrated suite of pipeline services

TRENCHLESS FEASIBILITY AND DESIGN



Horizontal
Directional Drilling
(HDD)

Jack and Bore

Direct Pipe

Permitting Support:
USACE, FERC, Others

GEOTECHNICAL ENGINEERING



Shallow and Deep
Foundations

Ground Improvement

Seismic Design

Earthwork
Recommendations

GEOLOGIC HAZARDS



Landslide
Identification and
Avoidance

River Erosion/
Migration

Karst

Mine Hazards

Seismic

PIPELINE ENGINEERING SUPPORT



Front End
Engineering and
Design (FEED)
Studies

Alternatives Analysis
and Routing

Construction and
Environmental
Alignment Sheets

ENVIRONMENTAL PERMITTING



Federal: FERC, NEPA,
USACE 401/404

State: NPDES,
SWPPP

Local

EXTENSIVE EXPERIENCE WITH PIPELINE OWNERS/OPERATORS

GeoEngineers works with pipeline owners/operators across North America and the world to assess, design and permit pipeline projects, helping overcome design challenges and navigate the regulatory requirements in each state. Some of our clients are listed in the table below.

OWNER	# OF PROJECTS	OWNER	# OF PROJECTS	OWNER	# OF PROJECTS
Air Liquide	20	ExxonMobil Pipeline Company	95	Phillips 66 Pipeline LLC	22
Boardwalk (Gulf South, Texas Gas)	104	Kinder Morgan	38	Plains All American Pipeline	74
Chevron Pipeline	47	NiSource	9	Tallgrass Energy, LP	1
Colonial Pipeline	14	Northwest Natural	414	Spectra Energy (Enbridge, Southeast)	27
Dominion Energy	38	Olympic Pipe Line Company	413	Tesoro Logistics Operations/ Marathon Pipe Line LLC	9
Energy Transfer (Including Florida Gas, etc.)	60	PBF Energy	6	Williams (Multiple Divisions)	251
Enterprise Products Partners	20	For a full list of our owners, please reach out to us!			

COMMITMENT TO SAFETY

GeoEngineers understands the importance of safety, on all projects that we work on. We believe safety is the responsibility of everyone. Our managers are responsible for the safety of the people who report to them. Our staff are expected to perform Task Safety Assessments prior to beginning any work activity. GeoEngineers is committed to every employee returning home each day as healthy as when they arrived on the job. We have renewed our commitment to safety in 2022 with a focus on our company-wide program, **Home Safe Every Day**, which starts with the belief that all injuries and occupational illnesses can be prevented.

Zero fatalities, zero
OSHA citations and
zero lost work day
incidents in the last
three years.

IN-HOUSE RESOURCES

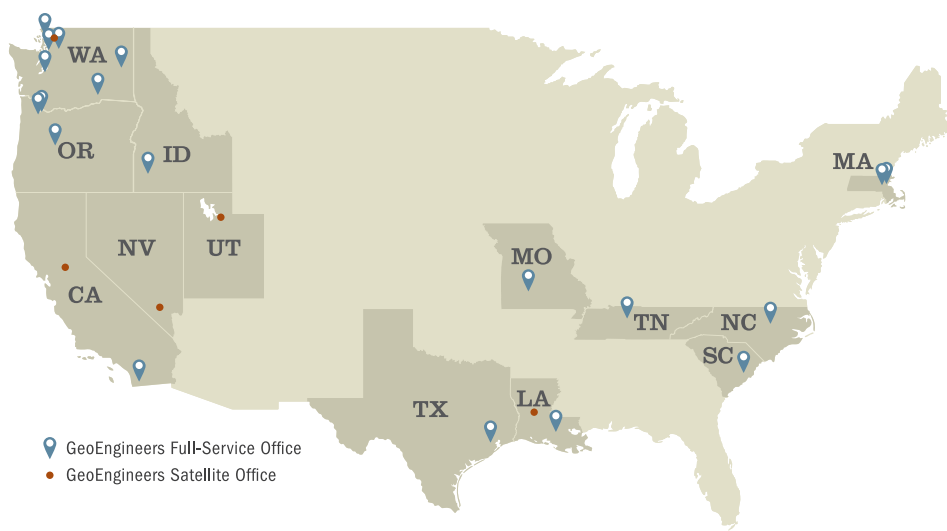
With over 40 years of engineering experience, GeoEngineers brings:

■ **400+** Personnel

■ **13** states



Specifically, GeoEngineers has a dedicated pipelines business unit with nearly 40 engineers, geologists, CAD designers and on-site construction consultants, providing coast-to-coast coverage.



REFERENCES

Our team's best measure of success

is client satisfaction. Listed below are references we have worked with that can confirm our team's ability to successfully meet our clients' needs. We encourage you to call them. We believe they will attest to the abilities and qualifications presented in this SOQ.

REFERENCE	CONTACT INFORMATION
Angela Williamson, Senior Project Manager Kinder Morgan Energy Partners	P: 713.420.2093 E: angela_williamson@kindermorgan.com
Adam Broad, Engineering Director-Interstate Pipelines Energy Transfer Partners, LP	P: 713.989.2057 E: Adam.Broad@energytransfer.com
Matthew Rudd, Construction Coordinator-Underground Dominion Energy Virginia	P: 804.305.5867 E: matthew.e.rudd@dominionenergy.com
Ron Berlin, Project Engineer Exxon Mobil Pipeline Company, LLC	P: 832.653.0734 E: ronald.a.berlin@exxonmobil.com
Brian Konrad, Senior Manager, Contract Management NW Natural	P: 502.226.4211 E: brk@nwnatural.com

A Leader in HDD Design

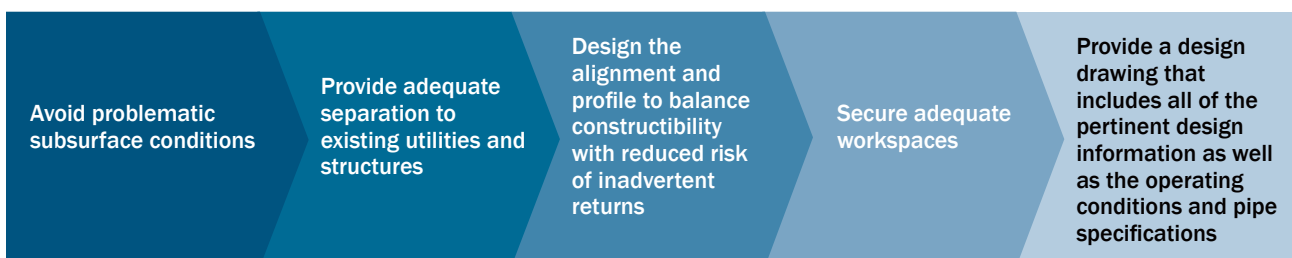
GeoEngineers' experience with design and permit requirements for HDD crossings is unmatched.

We have developed this engineering field from an original burden experienced by the HDD installation contractor, to an engineering art form that can be most beneficial to the owner, engineer, permitting agency or contractor when executed early in a project's life. Our engineers have experienced and successfully overcome many different HDD design challenges. Our work helped write the book—the American Gas Association (AGA) “Manual of Practice for Horizontal Directional Drilling”—that was first used in site characterization investigations for successful HDD installation.

Our early work on hydraulic fracture and fluid loss is reported in the US Army Corps of Engineers (USACE) CPAR-98-1 “Installation of Pipelines Beneath Levees Using Horizontal Directional Drilling.” This body of work represents our 20-plus years of experience in geotechnical and potamological characterizations (i.e. fluvial geomorphology) of almost 700 sites on waterways ranging in size from ephemeral streams to large rivers such as the Mississippi and Volga Rivers. **Such expertise—recognized worldwide—has made our firm a dominant leader in geotechnical site characterization studies and HDD design for pipeline crossings.**

OUR HDD DESIGN PROCESS

Before even beginning our design, our HDD specialists complete a site visit to observe site conditions and evaluate any constructibility issues. In each HDD design GeoEngineers creates, we consider how to:



Our HDD designs are completed in accordance with applicable pipeline design codes, including:

- Alignment and profile of the HDD,
- Minimal allowable pipeline installation radius,
- Installation stresses during HDD pullback,
- Operating stress on the product pipe,
- Hydraulic fracture and IR risk analysis, and
- HDD design drawing provided in AutoCAD or MicroStation format (24-inch x 36-inch).

Our preliminary design drawings are submitted for review and comment by the project team prior to the issuance of the final drawings. Drawings include the following for each HDD:

- Plan and profile of the HDD,
- Required temporary workspaces,
- Identification of existing utilities crossed by the HDD path,
- Construction notes,
- HDD profile geometry,
- Pilot hole tolerances, and
- Locations of the borings with respect to the HDD alignment and profile.

Knowledge

Our work literally helped write the book—the AGA “Manual of Practice for Horizontal Directional Drilling”—that is used in site characterization investigations for successful HDD installation.

SNAPSHOT OF HDD PROJECTS

The following describes some examples of our large and most complex HDD projects that GeoEngineers has successfully designed and completed. Each of the projects include diameter, material, length of drill and showcase our ability to work in varying subsurface conditions.

» **BP Trinidad and Tobago (BPTT)— New Oil Export Line (NOEL) Project**

Trinidad

In 2005, BP Trinidad & Tobago (BPTT) needed to replace a 30-year-old crude oil pipeline connecting its Galeota Point storage terminal with an offshore loading mooring off the southeast coast of Trinidad. This complex project, dubbed NOEL, called for using HDD to install the pipeline from the BPTT facility onshore to an offshore exit pit and temporary jack-up barge. BPTT turned to GeoEngineers to provide engineering design and construction consulting services for the HDD portion of the project. GeoEngineers helped BPTT successfully complete the HDD portion of NOEL by:

- Observing and providing detailed daily reporting for the first 2005 HDD construction attempt, saving BPTT \$1 million in contractor claims.
- Designing and planning the successful 2006 HDD project and helping select a qualified construction contractor.
- Collaborating with the contractor to complete the technically challenging HDD segment required to finish the pipeline.
- Overcoming complex geologic, facility, environmental, and cultural issues during the course of the project.

With GeoEngineers providing design support, coordination and planning, BPTT overcame an unsuccessful HDD construction attempt and other complexities. With the NOEL HDD completed, the Galeota Point Storage Terminal can boost oil exports and reduce the time tankers are moored, thereby increasing BPTT's profitability.

» **Boardwalk Pipeline Partners, 12-inch Mississippi River and Levee HDD Design and Construction Services, Midstream Westlake Brine Pipeline**

St. Charles and St. James Parishes, Louisiana

GeoEngineers provided geotechnical engineering and HDD design recommendations for the Mississippi River and Levee HDD project near Bayou Goula, Louisiana in Iberville Parish. The project consisted of a 12-inch-diameter steel pipeline to be installed using the HDD method of construction as part of the Westlake Brine Pipeline Project. The design horizontal length of the 12-inch-diameter HDD is 7,631 feet, crossing beneath the Mississippi River and adjacent levees.

We evaluated the existing surface and subsurface soil and groundwater conditions, to prepare an HDD design for the proposed alignment and to assist in acquiring the necessary permits from the USACE. Our HDD design services included completing a site reconnaissance, completing a subsurface soil exploration program by drilling five borings and advancing six cone penetration test (CPT) soundings near the proposed HDD alignment and preparing a detailed HDD design and hydraulic fracture and inadvertent drilling fluid returns analysis.

The Details

Diameter/Material: 30-inch-diameter pipeline
Length: 5,780 feet

World record 30-inch HDD shore approach installation of 5,780 feet with 1.85 inches of concrete coating on the pipe from within Galeota Point facility in Trinidad.

The Details

Diameter/Material: 12-inch-diameter steel pipeline
Length: 7,631 feet



Drilling operations underway in Florida for the 36-inch-diameter, 3,991-foot-long Suwannee River HDD as part of the Sabal Trail Transmission Pipeline Project. Drilling the pilot hole began December 1, 2016, and pullback was complete January 16, 2017.

» Gulf Interstate Engineering/Spectra Energy

Sabal Trail Transmission Pipeline Project, Alabama, Georgia and Florida

GeoEngineers provided geotechnical engineering, exploration and laboratory testing and HDD design services for the Sabal Trail Transmission Pipeline Project. The 465-mile pipeline begins in Tallapoosa County, Alabama, passes through southwestern Georgia and terminates in Osceola County, Florida.

GeoEngineers conducted geotechnical investigations at 18 different sites, drilling 82 borings and conducting associated laboratory testing. We also completed HDD design engineering for all 18 HDD sites—17 of these sites are along the Sabal Trail Transmission Pipeline while one is on the 24-inch-diameter Citrus County Lateral in central Florida. At least five of these HDDs were constructed in areas with karst subsurface conditions, and GeoEngineers provided recommendations to address these geologic challenges along with other HDD construction risks related to abrasive rock, difficult site topography, and other challenges. Construction on the project concluded in 2017. The 36-inch-diameter interstate natural gas pipeline is providing natural gas services for Florida Power and Light Company's power generation needs.

The Details

Diameter/Material: 36-inch-diameter steel pipeline
Length: 3,991 feet

» Phillips 66, Gray Oak Pipeline Project, Nueces Bay HDD

San Patricio County, Texas

GeoEngineers completed a geotechnical engineering evaluation and provided HDD design recommendations for a proposed new pipeline to be installed beneath Nueces Bay. The 20-inch diameter pipeline is part of the Gray Oak Pipeline Project in Nueces and San Patricio Counties, Texas. GeoEngineers evaluated the existing surface and subsurface soil conditions and prepared a 9,400-foot-long HDD design for the proposed HDD installation. We completed an analysis of the existing subsurface soil and groundwater conditions and laboratory testing to estimate the potential for hydraulic fracture and drilling fluid surface release. We also provided construction consulting and observation services.

The Details

Diameter/Material: 20-inch-diameter steel pipeline
Length: 9,400 feet

Direct Pipe®

In addition to more well-established technologies, such as HDD and microtunneling, GeoEngineers has developed design procedures to engineer Direct Pipe® (DP) crossings to API standards. We have completed several DP projects from design through construction and are currently providing consulting services on several additional projects. Additionally, one of our principals (Jon Robison, PE) chaired the ASCE Manual of Practice for DP (Direct Steerable Pipe Thrusting Manual of Practice 155, ASCE, published March 2023). A representative sampling of some of our DP experience is shown in Table A below.

TABLE A: DIRECT PIPE PROJECT EXPERIENCE SUMMARY

Project Name	Location	Owner	Length (feet)	Diameter (inches)	Services Provided
Brazos Diversion Channel Direct Pipe	TX	Exxon Mobil	1,621	36	Geotechnical Exploration, Trenchless Feasibility, Direct Pipe Engineering, Permitting Support, Construction Observation
Coastal Virginia Offshore Wind Direct Pipe Shore Approaches (9 Direct Pipes)	VA	Dominion Energy	1,820	42	Engineering and Plan Review, Contractor Selection Support, Construction Observation
I-495 Crossing	VA	Dominion Energy	3,370	42	Geotechnical Exploration, Trenchless Feasibility, Direct Pipe Engineering, Permitting Support, Construction Observation
River Niger Direct Pipe	Nigeria	Nigerian National Petroleum Corp	4,656	40.5	Geotechnical Exploration Support, Trenchless Feasibility, Direct Pipe Engineering
Saguaro Rio Grande Crossing	TX/ Mexico	Saguaro Connector Pipeline	1,648	48	Geotechnical Exploration, Trenchless Feasibility, Direct Pipe Engineering, Permitting Support
Aquashicola Creek Direct Pipe Crossing	PA	Williams Gas Pipeline	1,341	42	Geotechnical Exploration, Trenchless Feasibility, Direct Pipe Engineering, Construction Observation
I-84 Directional Microtunnel Crossing	PA	Kinder Morgan	470	42	Geotechnical Exploration, Trenchless Feasibility, Direct Pipe Engineering, Construction Observation
Rio Grande River Direct Pipe Crossing	TX/ Mexico	Net Mexico Pipeline, LP	2,347	48	Direct Pipe Engineering
Sabine-Neches Waterway and Levee Direct Pipe Crossing	TX	City of Port Arthur	3,506	48	Trenchless Feasibility, Direct Pipe Engineering, Construction Observation
TransCanada Tuxpan Direct Pipe Shore Approaches	Mexico	TransCanada	4,660, 3,280	42	Preliminary Design and Engineering for 2 Shore Approaches
Axiall I-210 Direct Pipe Crossing	LA	Axiall Corporation	855	42	Geotechnical Exploration, HDD and Direct Pipe Design, Construction Observation for Interstate Highway Crossing
Peoples Gas Calumet River Crossing	IL	Peoples Gas	1,519	36	Owner's Representative, Design Review, Construction Observation
Valley Crossings Shore Approach	TX	Enbridge	5,000	42	Geotechnical Exploration, Engineering and Contractor Design Review
I-75 Crossing	FL	Florida Gas Transmission	620	30	Geotechnical Exploration, Trenchless Feasibility, Direct Pipe Engineering
Little Kanawha Crossing	WV	TransCanada	1,251	36	Design Review and Execution Plan Development
James River DP	TX	Kinder Morgan	2,200	42	Engineering and Construction Observation

DP technology may be applicable to trenchless crossing sites where:

- Shorter and shallower design path (relative to HDD) is desirable
- A shore approach or landfall crossing is desired, DP can offer significant reduction in marine support and cost relative to HDD
- Crossing needs to be installed in geotechnical conditions not optimal for HDD
- Entry and exit pit excavations for a conventional, straight microtunnel would be overly difficult or expensive

PROJECT EXAMPLES

» Arceneaux Wilson & Cole/City of Port Arthur, Direct Pipe Crossing of Sabine Neches Waterway and Levee Port Arthur, Texas

GeoEngineers provided geotechnical exploration and trenchless engineering design along with construction monitoring services for the successful completion of the first DP crossing of a USACE regulated levee and the longest DP crossing at the time of completion (3,457 feet) in North America. The 48-inch-diameter casing—for a water line—stretches for more than a half-mile crossing under the

Sabine Neches Waterway, hurricane protection levee and rail yard in Port Arthur, Texas. The City of Port Arthur needed to deliver water to the other side of a deep shipping channel and a hurricane flood protection levee. HDD wasn't feasible because it could not meet the USACE safety standards that are designed to protect the levee and public. By



GeoEngineers provided construction monitoring as well as geotechnical and trenchless engineering design for the Sabine Neches Direct Pipe crossing in Port Arthur, Texas. Here, the product pipe is hoisted by cranes to have the specified angle when entering the Direct Pipe thruster.

thinking outside the box, and building upon its prior innovations in DP design, GeoEngineers combined different approaches to trenchless technology and design to come up with a new solution. Without these engineering innovations, the client's project would not have been successful. The City of Port Arthur would have needed to find a new pipeline route and investigate a new location for crossing the waterway and levee, which would have of increased costs and time invested significantly. Further, GeoEngineers' detailed record keeping during construction satisfied the USACE requirements to ensure that pressures and steel pipe stress thresholds during jacking were not being exceeded, giving satisfaction to the owner and agency that the pipe was installed safely. Ultimately, construction took 32 days and ended in success with no significant delays.

» Kinder Morgan, Northeast Upgrade Project Pennsylvania and New Jersey



This award-winning Tennessee Gas Pipeline Company (Tennessee Gas) project, called the Northeast Upgrade Project (NEUP), included a 30-inch-diameter steel pipeline crossing of Interstate 84 (I-84) and Highway 6 near Matamoras, Pennsylvania. GeoEngineers provided geological hazard and geotechnical investigation as well as trenchless feasibility analysis, engineering design and construction consulting for the I-84 pipeline installation, without which the NEUP project could not have been completed.



The Tunnel Boring Machine (TBM) entered the exit pit completing the I-84 DMT crossing in July 2013. GeoEngineers provided geological hazard and geotechnical investigation as well as trenchless feasibility analysis, engineering design and construction consulting on the project.

The project site was confining and had difficult geologic conditions, but Tennessee Gas needed to cross I-84 at this specific location due to environmental and regulatory requirements. After GeoEngineers' conducted a geotechnical study of the site's subsurface, several typical trenchless methods were considered to cross underneath I-84, including HDD, conventional road boring, conventional microtunneling, and the emerging trenchless technology, DP. Due to the complex project site, cost, and regulatory compliance issues, DP was the only feasible method for crossing I-84.

Thinking outside the traditional approaches, GeoEngineers combined the thrusting technology of the new DP approach with the short interlocking segments of Permalok pipe to create a steerable, Directional Microtunnel. This approach yielded a continuously cased trenchless installation with much shallower entry and exit pits than would have been required by a conventional, straight microtunnel. Using the short sections of Permalok pipe also reduced welding time and the need for an expansive pipe stringing area through nearby environmentally sensitive areas. In addition, GeoEngineers developed a new design methodology to assess the stresses and the risk of buckling in the pipe to accomplish the DMT. Construction began in June 2013 and the 470-foot I-84 DMT was completed in July 2013, allowing Tennessee Gas to continue with construction of the NEUP pipeline as planned.

GeoEngineers is very excited about this emerging technology that allows for trenchless crossings shorter and shallower than HDD and in conditions where HDD would not be feasible.

GEOENGINEERS DIRECT PIPE PRESENTATIONS

GeoEngineers has presented these new design methods at industry conferences, such as:

- Direct Pipe® in Three Case Histories- Overcoming Challenging Ground and Site Conditions, JL Robison, UA Campos, No Dig Down Under, Australia 2022
- Settlement Risk Assessment and Monitoring for Direct Pipe® Construction Beneath Critical Infrastructure, UA Campos, JL Robison, GW Castleberry, A Azimi, International Pipeline Conference 86564, V001T02A004, Calgary, AB, 2022
- "Direct Pipe Trenchless Method — Overview of Feasibility, Engineering, and Construction with Case Study Examples For Practical Application" Webinar through *Trenchless Technology* in July 2020.
- "Formational Fluid Loss and Inadvertent Returns Risk in Sedimentary Rock HDD Construction," at NASTT 2018 No-Dig Show.
- "Direct Pipe Construction – An Engineering Perspective on Quality Assurance" at ASCE 2017 Pipelines Conference.
- "Considering Buckling – Direct Pipe Engineering Design" at the NASTT 2017 No-Dig Show.
- "[Annular Fluid Pressure Analysis of the Sabine Neches Levee Direct Pipe Crossing](#)" at the ASCE 2016 Pipelines Conference.
- "Sabine Neches Levee Crossing Direct Pipe Engineering and Permitting" at the NASTT 2016 No-Dig Show.
- "Direct Pipe Levee Crossing Design - Mitigating Hydraulic Fracture Risk," NASTT 2015 No-Dig Show.
- "[Direct Pipe—Estimated and Actual Installation Load Analyses for 20 Crossings](#)" at the North American Society for Trenchless Technology's (NASTT) 2014 No-Dig Show.
- "[Innovative Directional Microtunnel Garner Success for Crucial Trenchless Crossing](#)" at the ASCE 2014 Pipelines Conference.
- "[Emerging Technologies: A Suggested Design Method for Curved, Jacked Steel Pipe](#)" at the American Society of Civil Engineers (ASCE) 2013 Pipelines Conference.

Construction Observation and Specifications

CONSTRUCTION BID SPECIFICATION PREPARATION

GeoEngineers can assist in the construction contractor bidding process to help assure details and specifications for construction are communicated during the bid process—instead of after selection of a contractor when “extras” can become costly. We provide necessary edits and modifications to existing stock specification templates to tailor them to the project, including changes driven by regulatory requirements that might impact construction methodology or sequencing.

These modifications may include requiring the contractor to acknowledge compliance with permit requirements and submit written documents to address how they will comply. The revisions to templates may also include requirements that contractors show in their construction bid documents, the costs and subcontractors.

PRECONSTRUCTION PERMIT ADHERENCE

GeoEngineers can provide preconstruction consultation services to support projects with permit-required submittals with the construction team. These services may include:

- Collecting permit-required documents from the contractor according to bid specification documents. The contractor can then provide documentation confirming its adherence to the permit.
- Assisting the contractor with writing drill plans that address the permit requirements.
- Revising hydraulic fracture analyses to account for the specific tooling the selected contractor intends to use during pilot hole operations.

Following receipt of permits for your project, if additional engineering is required to address permit stipulations, GeoEngineers can prepare required edits and modifications. We can also host a “dress rehearsal” conference call with the project team prior to meeting with permitting agencies. This allows for a more productive meeting with the agencies and ultimately more efficient permitting process.

THIRD-PARTY GEOTECHNICAL OBSERVATION AND CONSTRUCTION CONSULTING SERVICES

GeoEngineers can provide onsite consultation services during construction, including analyses of operations and detailed daily reporting in accordance with any required third-party geotechnical observation. The contractors construction schedule is evaluated daily and a comparative analysis provided. Depending on the project, daily field reports for operations may include:

- Detailed descriptions of daily activities
- Continuous reporting of downhole fluid pressures, where applicable
- Drilling fluids test reports provided by drilling fluids engineers
- Areas of concern
- Recommended actions
- Action items list

GeoEngineers can assist in the construction contractor bidding process to help assure details and specifications for construction are communicated during the bid process—instead of after selection of a contractor when “extras” can become costly.

These reports are sent to construction team members and the engineering staff upon the completion of each construction shift. GeoEngineers is generally onsite from contractor mobilization through the successful installation.

PROJECT EXAMPLES

» Texas Gas, HDD Design and Construction Consulting

Near Searcy, Arkansas

Two HDD contractors spent several months attempting to enlarge a rock hole to a diameter acceptable for installing 36-inch-diameter pipe via HDD under the Little Red River but only achieved a diameter large enough for installing 18-inch-diameter pipe. Because both initial contractors' attempts caused major delays in schedule and never succeeded with installing the 36-inch-diameter pipe, Texas Gas called in GeoEngineers to redesign the crossing, monitor the new (third) HDD contractor's

operations (including pilot hole geometry, reaming operations and pullback) and provide minute-by-minute detailed reporting on a daily basis. With GeoEngineers on site for the final HDD attempt, the 36-inch-diameter pipe with a length of 2,250 feet was successfully installed within three and a half months.



GeoEngineers observed construction of the 36-inch-diameter HDD installation beneath the Little Red River in Arkansas.

» El Paso, Line 300 Lake Conway HDD

Vernon, New Jersey

GeoEngineers worked with El Paso on several projects related to its Line 300 pipeline project in Northern Pennsylvania and New Jersey. Our services on the Lake Conway HDD began with geotechnical exploration and continued with HDD design and construction consulting services. The 30-inch-diameter Lake Conway HDD project was challenging on many levels, beginning with the long HDD design length of 5,800 feet. Initially, GeoEngineers considered two separate HDD designs (one 3,000 feet and one 2,800 feet) that met in the middle. However, because of environmental issues in the Lake Conway wetland area where the two HDDs would meet, this idea wasn't feasible.



GeoEngineers provided construction consulting services—pipe pullback pictured here—during the challenging 5,800-foot Lake Conway HDD crossing in New Jersey.

Another challenge with the Lake Conway HDD was the extremely hard and abrasive rock that the HDD profile had to traverse. The gneiss bedrock (metamorphic rock) had very high

magnetic properties, which hindered downhole surveying equipment during pilot hole operations. The team had to bring in a special gyroscopic (non-magnetic) downhole survey tool to help verify positioning of the pilot hole.

The site conditions were challenging also. Construction proceeded on a 24-hour schedule, so a tent had to be constructed and sound blankets and mufflers used to mitigate noise for nearby residential neighborhoods.

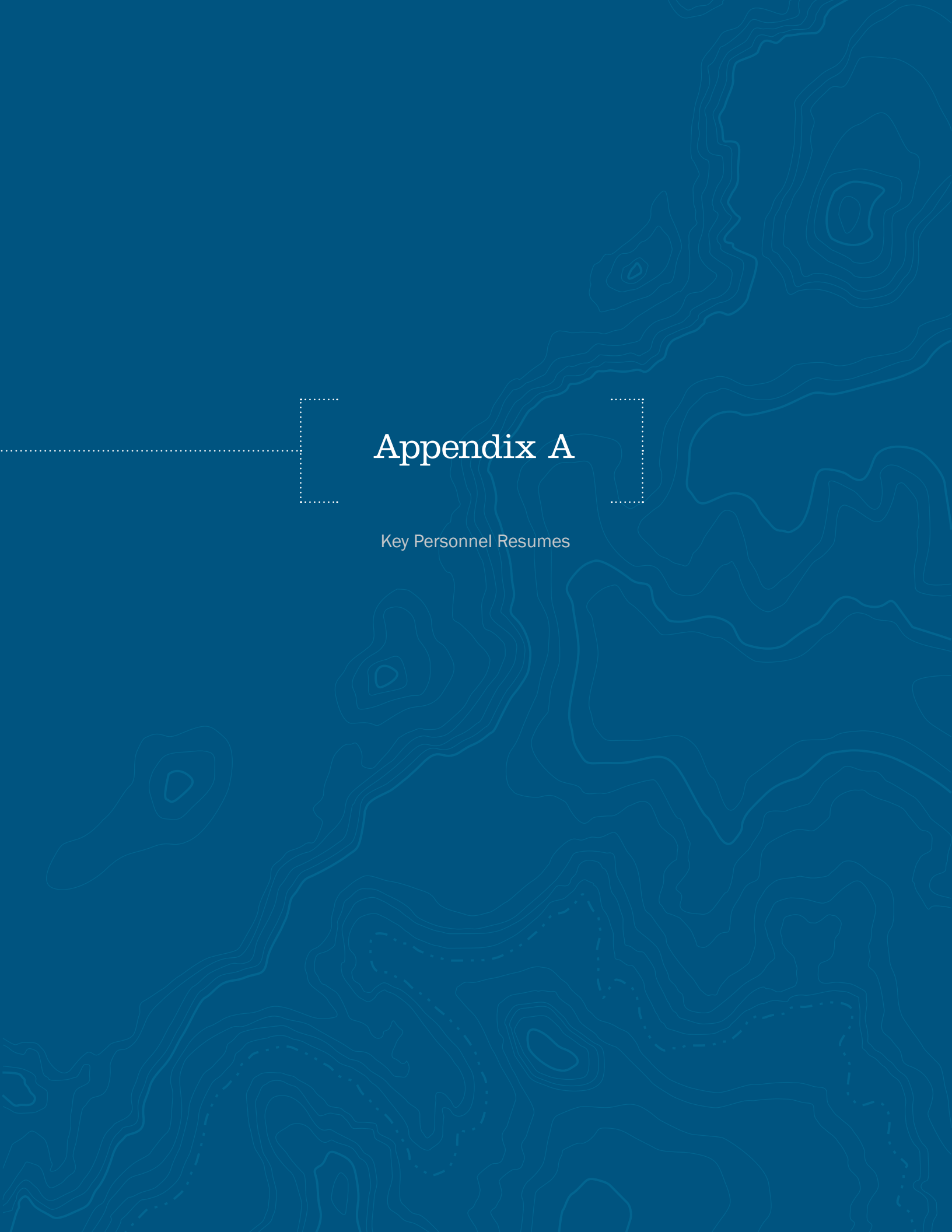
Even with all these challenges, the team managed to finish the HDD successfully and ahead of schedule. With GeoEngineers involved from the beginning, we provided reliable geotechnical analysis and offered insight based on our HDD experience of the challenges El Paso and the contractor might encounter during construction. Providing HDD construction consulting services on site for the duration of the project also helped GeoEngineers offer quick and objective responses in the owner's best interest to each new challenge that occurred.

Pipeline Experience Summary

A representative list of pipeline projects is shown in Table B on the following page.

TABLE B: PIPELINE EXPERIENCE SUMMARY (PARTIAL LIST)

COMPANY	PIPELINE NAME/ROUTE	LENGTH	DIAMETER	SERVICES PROVIDED
Energy Transfer	Dakota Access Pipeline/ North Dakota, South Dakota, Iowa, Illinois	1,150 MI	12.75-inch 20-inch 24-inch 30-inch	Geotechnical investigation, HDD design, large-diameter tank foundation design, soil chemistry testing, Missouri River scour study.
Enterprise Products Partners	Acadian Haynesville Extension Pipeline/ Western Louisiana	250 MI	24-inch 36-inch 42-inch	Geotechnical investigations, meter stations, trenchless feasibility studies, HDD engineering design for 35 crossings (including three USACE levees requiring permitting), and construction consulting services for three pipeline segments. Drilled 124 geotechnical borings for HDD crossings.
Spectra Energy	Sabal Trail Pipeline/ Alabama, Georgia, Florida	280 MI	24-inch 36-inch	Geotechnical investigation and laboratory testing, HDD design and reporting, and permit support for one 24-inch and 17 36-inch HDD crossings.
Gulf South	East Texas-Mississippi/ Texas, Louisiana, Mississippi	242 MI	42-inch	Geotechnical investigation, foundation design and engineering for compressor and meter stations and 18 HDD crossings.
ExxonMobil	Golden Pass/Texas, Louisiana	75 MI	42-inch	Geotechnical investigation, foundation design and engineering for meter stations, and HDD design for 21 crossings.
Tennessee Gas	Line 300/Pennsylvania, New Jersey	128 MI	30-inch	Geotechnical investigations, rock excavation studies, meter stations, trenchless feasibility studies, HDD engineering design
MarkWest Energy Partners	Arkoma Connector/ Oklahoma	50 MI	24-inch	Geotechnical engineering and HDD recommendations for 10 proposed HDD crossings, two compressor stations and a meter station.
Spectra Energy/ Enbridge	Valley Crossings Project, Texas	150 MI	42-inch 48-inch	Geotechnical engineering, HDD, auger bore, Direct Pipe design and consulting, 9 HDDs.
Gulf South	Southeast Expansion/ Mississippi, Alabama	111 MI	42-inch	Geotechnical investigation, foundation design and engineering for compressor and meter stations and 15 HDD crossings.
Kinder Morgan	Louisiana Pipeline	140 MI	42-inch	Geotechnical investigation, foundation design and engineering for pump and meter stations, HDD design of 24 42-inch-diameter crossings and one 24-inch.
Spectra Energy	Southeast Supply Header/Louisiana, Mississippi, Alabama	274 MI	36-inch 42-inch	Geotechnical investigation, foundation design and engineering for compressor and meter stations, 25 HDD crossings, USACE levee crossings and FERC Loess soil management practices.
Fayetteville Express Pipeline LLC (FEP)	Fayetteville Express/ Arkansas	185 MI	42-inch	Geotechnical investigation, foundation design and engineering for compressor and meter stations and 16 HDD crossings, construction engineering support for weathered rock excavation for road bores.
Texas Gas	Fayetteville-Greenville/ Arkansas, Mississippi	165 MI	36-inch	Geotechnical investigation, foundation design and engineering for compressor meter stations, interconnects, USACE levee crossings and water body crossing buoyancy, HDD design and construction consulting for 23 HDD crossings.
BP	Baku, Tbilisi, Ceyhan Pipeline/Kura River, Republic of Georgia	1,100 MI	46-inch	Expert geologic and HDD advice and design input. Initially, participated in PEER review process. Then, re-designed HDD and provided 24/7 construction consulting services to successful completion of HDD.
Chevron Pipe Line Company	Ethylene Feedstock Pipeline, Near Houston, Texas	20 MI	Bundles varied, mostly 10.75-inch and 12.75-inch	HDD design review and re-design per existing alignments and workspace parameters for 25 HDD crossings. Provided geotechnical investigation specifications for additional geotechnical required for re-design. Provided construction observation and detailed consulting on 27 HDD crossings.
BPTT	New Oil Export Line (NOEL)/Trinidad & Tobago		30-inch, 1.85 inches of concrete coating	HDD engineering design and construction consulting services, including assistance in choosing a qualified construction contractor, for shore approach at Galeota Point facility.
Tennessee Gas	Northeast Upgrade Project/Pennsylvania, New Jersey	40.4 MI	30-inch	HDD feasibility, Direct Pipe feasibility and design, desktop geology, and geotechnical engineering for compressor and meter stations.
Williams NWP	Lockwood Marina and Crossway Creek HDD/ New Jersey	0.3 MI	26-inch 42-inch	Geotechnical investigation and HDD design for new 26-inch pipeline in proximity to existing 42-inch pipeline.
Northwest Natural	North Mist Project/ Oregon	12 MI	24-inch	Engineering geology, geotechnical investigation and HDD services for 8 installations crossing Highway 30, a railroad, local roadways, Clatskanie River, Beaver Slough, Larson Slough and several drainage ditches.
Olympic Pipe Line Company	SR167 Completion/ Pipeline Relocation, Washington	0.6 MI	14-inch	Geotechnical recommendations, HDD engineering design and construction consulting, federal, state and local permits for new pipeline segment installed by HDD and in direct-bury trenches.



Appendix A

Key Personnel Resumes



Jonathan L. Robison, PE, Principal

QUALIFICATIONS

Jon has been providing trenchless and geotechnical project management and engineering services on pipeline and other projects across the United States since 1997. The projects he works on range in size from single trenchless crossings of a few hundred feet to long, multi-state greenfield alignments with numerous trenchless crossings. His pipeline experience has primarily focused on steel pipes up to 60 inches in diameter. Jon brings specialized experience as a trenchless subject matter expert, including HDD, Direct Pipe® (DP), and microtunneling.

In addition to his work on traditional geotechnical and trenchless engineering projects, Jon has led the development of GeoEngineers' DP design process. He currently chairs the ASCE Manual of Practice Development Committee for DP and serves as the Chair of the Trenchless Installation Practices Committee. Jon has presented several technical, peer-reviewed papers at industry conferences (representative examples). Jon also represents GeoEngineers on the Industrial Advisory Board for the Trenchless Technology Center at Louisiana Tech University.

Jon has led engineering and construction consulting services teams on many geotechnical and trenchless engineering projects, some of which are listed below.

Education

M.S., Civil Engineering
(Geotechnical), University of
Missouri-Rolla

B.S., Civil Engineering,
University of Missouri-Rolla

Registrations

Professional Engineer: AR, CO,
IL, IA, KS, ND, SD, MD, MN,
MO, NJ, OK, PA, VA, WY

Publications/Presentations

"Formational Fluid Loss and
Inadvertent Returns Risk
in Sedimentary Rock HDD
Construction," NASTT 2018
No-Dig Show, Palm Springs,
California.

"Direct Pipe® Construction –
An Engineering Perspective
on Quality Assurance," ASCE
2017 Pipelines Conference,
Phoenix, Arizona.

"Considering Buckling –
Direct Pipe® Engineering
Design," NASTT 2017 No-Dig
Show, Washington, District of
Columbia.

"Sabine Neches Levee
Crossing Direct Pipe®
Engineering and Permitting,"
NASTT 2016 No-Dig Show,
Dallas, Texas.

"Direct Pipe® Levee Crossing
Design- Mitigating Hydraulic
Fracture Risk," NASTT
2015 No-Dig Show, Denver,
Colorado.

EXPERIENCE

- Kinder Morgan, Northeast Upgrade Project, Multiple HDDs and I-84 Directional Microtunnel, PA and NJ
- Nigerian National Petroleum Corporation, Direct Pipe Engineering and Design, River Niger, Nigeria
- Kinder Morgan, HDD Construction Support, Kinder Morgan Susquehanna West Wetlands HDD, Tioga County, PA
- Kinder Morgan, Illinois and Iowa Civil Base TEE Replacement Project, Rock Island County, IL and Muscatine County, IA
- Kinder Morgan, Direct Pipe, Permian Highway Pipeline Project, Spread 23, West TX
- Kinder Morgan, Geotechnical Exploration and HDD Design Services, Kinder Morgan Line 261B Upgrade, Hampden County, MA
- Energy Transfer, Preliminary Route and Trenchless Construction Risk Assessment, Panama Pipeline West Bank Route, Panama Canal, Panama
- Cheniere Energy, Inc., DP® Crossing of Sabine Neches Waterway and Levee, City of Port Arthur, TX
- Enbridge, Valley Crossings Project, TX
- Peoples Gas, Calumet River Direct Pipe® Crossing, Chicago, IL
- Net Mexico, Rio Grande River Crossing, Texas to Mexico
- Williams Gas Pipeline, Bogueloosa Creek Direct Pipe® Crossing, AL
- Trinity River Gas, Pipeline Expansion, 13 HDDs, Fort Worth, TX
- Williams Gas Pipeline, Aquashicola Creek Direct Pipe®, PA
- Energy Transfer, Dakota Access Pipeline Project, ND to IL
- Williams Gas Pipeline, Constitution Pipeline Project, PA and NJ
- Tallgrass Energy, HDD Feasibility and Design Services, Cheyenne Connector Pipeline Project, 17 36-inch-diameter HDDs, Weld County, CO
- ExxonMobil Pipeline Company, TX-112 and 113 Hearne to Hillsboro Line Replacements, Two 8.625-inch-diameter HDDs, TX
- ExxonMobil Pipeline Company, Beaumont 2 and 3 and BCPL Projects, Multiple HDDs Ranging from 8- to 36-inch pipe diameters, TX
- ExxonMobil Pipeline Companies' Water Crossing Mitigation and High Consequence Area Project Teams, Geotechnical Exploration and HDD Feasibility and Design Services, Multiple HDD Projects, Various Locations, MT and TX
- Florida Gas Transmission Company, Geotechnical Exploration, HDD Feasibility and Design and Permitting Support Services, Putnam Expansion, Two 30-inch-diameter HDDs and One 30-inch-diameter DP, Columbia, Union and Putnam Counties, FL
- Florida Gas Transmission Company, Geotechnical Exploration, HDD Feasibility and Design and Permitting Support Services, Turnpike-Palmetto Road Relocation, 23 24-inch-diameter HDDs, Miami-Dade and Broward Counties, FL
- Williams Northwest Pipeline, Geologic Hazards Assessment, Geotechnical and HDD Services, Bluestem Pipeline Project, 27 HDD Crossings, 16-inch-diameter, 188-mile-long pipeline, KS and OK



Mark Miller, PE, Principal Engineer

QUALIFICATIONS

Mark has over 20 years of experience in geotechnical engineering, focusing on engineering design, construction observation, and subsurface investigations. Since 2005, Mark has dedicated his career to Horizontal Directional Drill (HDD) design and construction observation projects with pipeline diameters up to 48 inches and lengths up to 12,800 feet.

Mark has significant experience with HDD levee and water body crossings, including shore approach and water-to-water installations, providing HDD design and permitting support, construction services, bid evaluation and drilling plans. Mark also developed GeoEngineers' proprietary HDD design and hydraulic fracture analysis software packages, which are more versatile than commercially available software packages and integrate well with GeoEngineers' CAD systems.

Education

M.S., Geotechnical Engineering, University of Washington
B.S., Geology, University of Washington

Registrations

Professional Engineer: NY, WA, LA, MI, FL, MA

Publications/Presentations

"Soil Mechanics and Calculating Hydraulic Fracture Risk," North American Society for Trenchless Technology 2019 No-Dig Show, Chicago, Illinois.

"HDD Construction Observation and Documentation: Risk Management and the Role of the Engineer," American Society of Civil Engineers (ASCE) 2016 Pipelines Conference, Kansas City, Missouri.

"Formational Fluid Loss and Inadvertent Returns in Sedimentary Rock HDD Construction," NASTT 2018 No-Dig Show, Palm Springs, California.

"Design and Permitting of Trenchless Crossings in USACE Flood Control Projects," Underground Construction Technology (UCT) 2018 International Conference & Exhibition, New Orleans, Louisiana.

EXPERIENCE

- Enterprise Products Partners, Aegis Pipeline Project HDD Installations, New 20-inch-diameter Steel Pipeline, St. Martin, Iberville and St. Charles Parish, LA
- Enterprise Products Partners, Atchafalaya River HDD, Geotechnical and HDD Design Engineering and Construction Consulting, Melville, LA
- Colonial Pipeline, Houston Ship Channel HDD Design, Houston, TX
- Enbridge, St. Clair River HDD Geotechnical Engineering, HDD Design and Construction Consulting, Port Huron, MI, USA to Sarnia, Ontario, Canada
- Energy Transfer, Dakota Access Pipeline, 30-Inch-Diameter Pipeline Over 1,100 Miles, ND and IL
- Navigator Co2 Ventures LLC, Preliminary HDD Feasibility Studies, Heartland Greenway Pipeline Project, SD, NE, IA, MN, IL
- Flowtex, HDD Installation Stress Evaluation, 30-inch diameter Arroyo Parejas HDD, Puerto Rosales, Buenos Aires
- Spectra Energy, Sabal Trail Transmission Project, 19 HDD Crossings, 480 Miles of 36-inch-diameter Steel Pipeline, Multiple Locations, AL, GA, FL
- Confidential Client, LNG Transmission Line Hydraulic Fracture Analyses, Cameron, LA
- Florida Gas Transmission Company, HDD Construction Consulting Services, 24-inch Pipeline Replacement, Sulphur, LA
- Florida Gas Transmission, Feasibility Study for One 24-inch Shore Approach and Nine 24-inch Water to Water HDDs (Marine Installations), FL
- Kinder Morgan, Geotechnical Exploration and HDD Design Services, Kinder Morgan Line 261B Upgrade, Hampden County, MA
- Kinder Morgan, Comite River HDD 12-inch MDA Pipeline Relocation Project, HDD Construction Observation, East Baton Rouge Parish, LA
- Trunkline Gas Company LLC, Geotechnical Exploration and HDD Design Services, Spring Creek HDD, Spring, TX
- Phillips 66, HDD Services, Gray Oak Project, Nueces Bay HDD, San Patricio County, TX
- Boardwalk Pipeline Partners, 12-inch Mississippi River and Levee HDD Design and Construction Services, Iberville Parish, LA
- Kinder Morgan, Kinder Morgan Louisiana Pipeline, Geotechnical Engineering and HDD Design for 24 HDD Installations, Multiple Locations, TX and LA
- Energy Transfer, Bayou Bridge Pipeline Project, 161 Miles of 24-Inch-Diameter Pipeline, Various Locations, LA
- Chevron, HDD Design and Construction Consulting, Empire, LA
- BP, New Oil Export Line (NOEL) HDD Design and Construction Consulting, Trinidad & Tobago
- Bluewater Gas Storage (Bluewater), St. Clair River HDD Geotechnical Engineering, HDD Design and Construction Consulting, Port Huron, MI to Sarnia, Ontario, Canada
- Eversource Energy, Woburn to Everett 115kV Underground Transmission Line Support of Excavation, Charlestown, MA
- Dominion Energy Transmission, HDD and Direct Pipe® Consulting Services, Tysons to Idylwood 230 kV Project, Fairfax County, VA



Gary Castleberry, Senior Trenchless Consultant

QUALIFICATIONS

Gary is a Senior Consultant with more than 20 years of experience in the pipeline industry. He started his career as a drilling fluid technician, monitoring drilling fluid volume and properties on trenchless construction sites, and worked his way into management and engineering positions supporting large pipeline projects.

He has significant expertise in the entire life cycle of pipeline construction, including horizontal directional drill (HDD) feasibility, design analyses and route selection; permitting support, geotechnical and geophysical investigation and analysis; contractor HDD drill plan review; pilot hole as-built curvature analysis, pipeline construction management and inspection; bid, cost and schedule analysis; invoice review and evaluation; and claims reviews.

Prior to joining GeoEngineers, Castleberry was a field engineer for the Atlantic Coast Pipeline, which includes 600 miles of natural gas pipeline extending from West Virginia to North Carolina.

Education

M.E. Geological Engineering
- Geotechnics, Missouri
University of Science and
Technology, Rolla, Missouri

B.S., Civil Engineering
Technology (minor in
Engineering Management), Old
Dominion University, Norfolk,
Virginia

A.S., Engineering Technology,
Trine University

Professional Affiliations

American Society of Civil
Engineers, Member

Publications and Presentations

"A Methodical Approach for
HDD Lift Plan Development"
presented at NASTT 2021 No-
Dig Show, Orlando, Florida.

"Evaluation of HDD Induced
Hydraulic Fracture in
Sedimentary Rock Formations"
presented at NASTT 2021 No-
Dig Show, Orlando, Florida.

"Mitigating Geologic Risk:
Four Large Diameter HDDs
Successfully Completed in
Karst Terrain," presented at
NASTT 2019 No-Dig Show,
Chicago, Illinois.

Campos, Urso A., et al.
"Trenchless Technologies
in Railroad Utility Crossing:
Considerations, Allowed
Construction Methods, and
Economic Implications."
Practice Periodical on
Structural Design and
Construction, vol. 25, no.
3, 2020, p. 06020006.,
doi:10.1061/(asce)sc.1943-
5576.0000488.

EXPERIENCE

- Dominion Energy Transmission, HDD and Direct Pipe® Consulting Services, Tysons to Idylwood 230 kV Project, Fairfax County, VA
- Dominion Energy, Glebe Microtunnel Project, Alexandria, VA
- Spectra Energy, New Jersey-New York Expansion Project, (42 and 30-inch HDDs and marine tie-ins), NJ and NY
- Dominion Energy Transmission, Haymarket 230 kV Transmission Line Project, Prince William County, VA
- Dominion Resources, Atlantic Coast Pipeline Project, Multiple Locations, 42-inch (HDD and Direct Pipe®), 36 and 20-inch HDDs, WV, VA, NC
- Confidential Client: FEED Study for trenchless installations associated with two pipeline routes in Staten Island NY, Newark and Bayonne NJ
- Williams Companies, Madison Loop Pipeline Project, One 26-inch HDD and 42-inch Pipeline, NJ
- Enbridge, Inc., Line 5 Straits of Mackinac Replacement Options, MI
- Spectra Energy, Sabal Trail Transmission, Multiple Locations, (36-inch and 20-inch HDDs), AL, GA, FL
- Florida Gas Transmission, Feasibility Study for One 24-inch Shore Approach and Nine 24-inch Water to Water HDDs (Marine Installations), TX
- National Gas Company of Trinidad and Tobago's, North Eastern Offshore and Tobago Pipeline Projects, Multiple Locations throughout Trinidad and Tobago West Indies and Offshore Waters adjacent to Trinidad and Tobago
- Williams Companies, Bridgeline Pipeline Project, One 24-inch Conventional Auger Bore, PA
- Williams Companies, Harrison Hub Pipeline, Two 12-inch HDDs and one 12-inch Railroad Bore, WV and OH
- Town of Friday Harbor, One 18-inch Shore Approach Sewer Outfall, WA
- Dominion Energy, Direct Pipe Crossing of Interstates 66 and 495, Tysons Corner, VA



Urso Campos, PhD, PE, Pipelines Engineer

QUALIFICATIONS

Urso Campos has extensive education in engineering materials and infrastructure systems and construction engineering management—in fact, he has authored several technical papers in his career that have been cited. Urso earned his doctorate degree from Louisiana Tech University which is renowned for its Trenchless Technology Center (TTC) program that promotes the research, development and technology transfer in the trenchless industry. During his time at the TTC, Urso was and remains heavily involved with multiple interdisciplinary research projects in the field of Trenchless Technology.

Urso's expertise includes pipeline trenchless crossing design by HDD, auger boring, and Direct Pipe® methods of construction. In addition to his design work, Urso has been actively involved in construction observation, documenting construction activities on HDD projects, communicating areas of concern during construction with the client, and providing detailed daily reports in the field on trenchless projects. He also has evaluated site survey data, performed subsurface soil and groundwater exploration, laboratory testing programs, and reviewed contractor provided design and pilot hole as drilled data for trenchless installations. Urso is active in publishing papers at industry conferences and journals. Urso currently serves as reviewer for the International Journal of Construction Management, ASCE–Pipelines 2020 Conference, and several engineering conferences in China.

Education

Ph.D. Engineering –
Mechanics, Louisiana Tech
University

M.S., Construction Engineering
Management, Purdue School
of Engineering – IUPUI

B.S., Civil Engineering,
Clemson University

Registrations and Certifications

Professional Civil Engineer: SC

TTC Auger Boring School: 5-day
Engineering Track

ASCE-UESI Utility Investigations
School (UIS) Geophysical
Investigations Course 401

Associate Water Asset
Manager. BAM-I

Recent Publications/ Presentations

Campos, Urso; Hall, David;
Robison, Jonathan; and
Castleberry, Gary. "An Overview
of Cyclic Loading and Fatigue
on Steel and PE Pipe During
HDD Installations." ASCE
Pipelines Conference. Calgary,
Alberta, Canada. August 2021.

Campos, Urso; Robison,
Jonathan; Marti, Tom;
Halderman, Ron; and Sharma,
Jwala. "Installation Force and
Stress Considerations on HDD
Design of Bundled Pipelines."
North American Society for
Trenchless Technology No-Dig
Show. Orlando, FL. March
2021.

EXPERIENCE

- NextEra Energy, HDD Design Services, NextEra Lowman Pipeline Project, Williams County, AL
- Dominion Energy, HDD Feasibility and Design Services, 12-Inch Steel T-33 HDD, Buncombe County, NC
- Dominion Energy, HDD Feasibility and Design Services, 12-Inch Steel M-201 HDD, Rutherford County, NC
- Dominion Energy, HDD Design Review Services, M-64 and NC-751 Projects, Beaver Creek HDD, Wake and McDowell Counties, NC
- Dominion Energy, HDD Feasibility and Design, E-1577 East First Street Kannapolis HDD, Kannapolis, NC
- ExxonMobil Pipeline Co., Installation Calculations for Numerous Proposed Single and Bundled HDD Crossings, Several Pipelines in Various Locations, TX
- PBF, Collins Pipeline, West Pearl River HDD, 637-foot 16-inch-diameter HDD Crossing, St. Tammany Parish, LA
- Williams Natural Gas Pipeline, Bluestem Pipeline Project, 188 miles of 16-inch-diameter Pipeline, OK and KS
- Facebook Ferret Project: Urso is currently and actively involved in the proof-of-concept program lead by Louisiana Tech University to develop Trenchless Technology for Facebook Engineering Program.
- Louisiana Tech University, Instructor and Research/Laboratory Assistant, Ruston, LA
- Grambling State University, Geotechnical Engineering Adjunct Faculty, Grambling, LA
- People's Gas, Trenchless Feasibility and HDD Design Services, Allegheny River HDD, Armstrong County, PA
- Cheniere Energy, E 1550 Road and Stream HDD, Grady County, OK
- NuStar Energy LP, Diversion Channel HDD, Cass County, ND



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