November 8, 2022

Mr. Paul Lake
Illinois Environmental Protection Agency
Bureau of Land - Remedial Project Management Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Re: Remedial Delineation Field Sampling Plan & Response to Comments
917 South Webster Street
Taylorville Former Manufactured Gas Plant
LPC #170000173096 – Christian County

Dear Mr. Lake:

On behalf of Ameren, Environmental Resources Management (ERM) has prepared a *Remedial Delineation Field Sampling Plan* (FSP), dated November 8, 2022, and *Response to IEPA Review of Remedial Delineation Field Sampling Plan* (Response to Comments) for the former manufactured gas plant (FMGP) site at 917 South Webster Street in Taylorville, Illinois.

Ameren appreciates your assistance and cooperation as we proceed with this project. If you have any questions regarding the responses provided, or need additional information, please feel free to contact me.

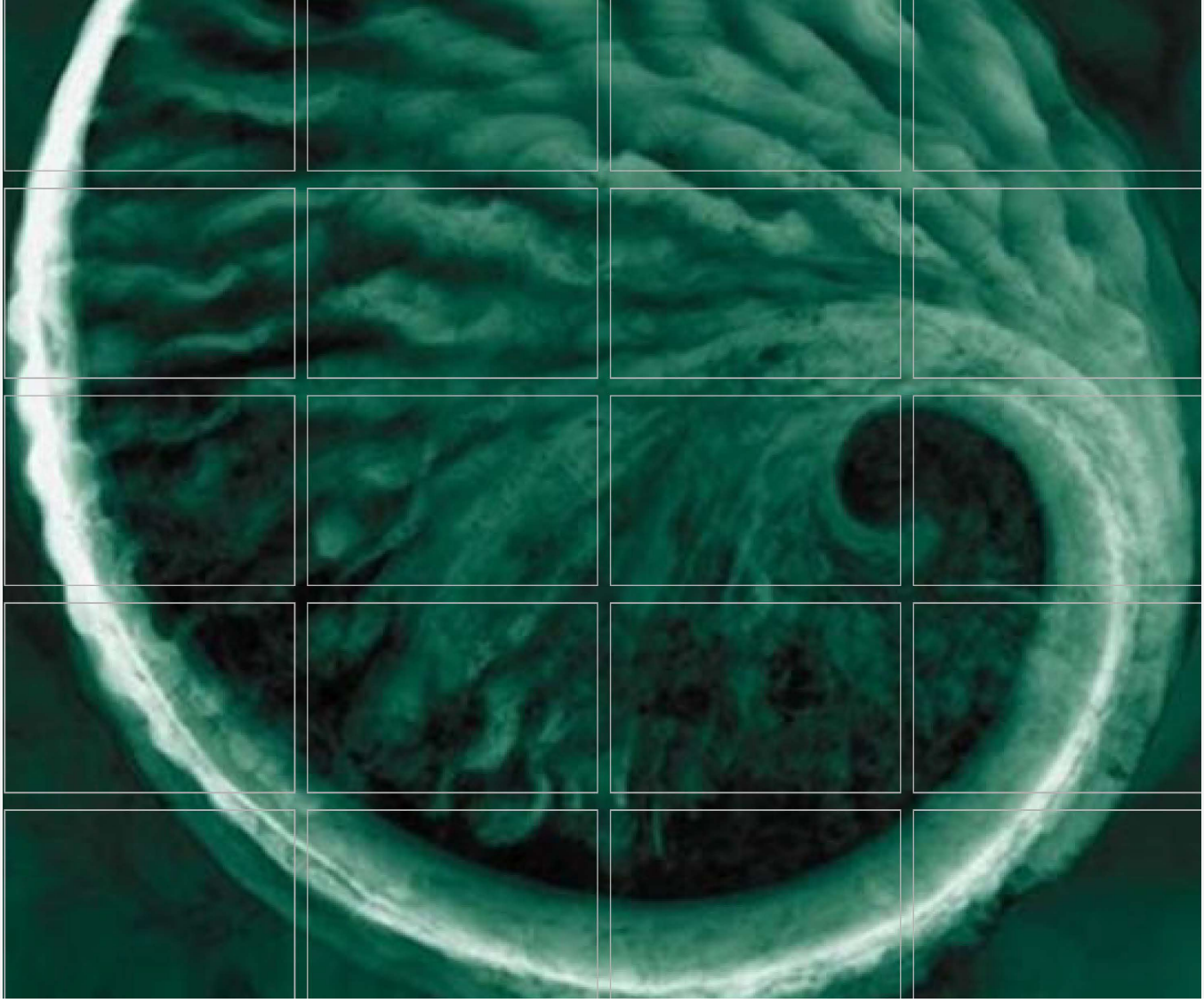
Respectfully,

Dave Palmer, PG, PMP, EVMP
Manager, Remediation Projects
Ameren Services

Attachments

Attachments

Remedial Delineation Field Sampling Plan,
dated November 8, 2022
and
Response to IEPA Review of Remedial Delineation Field Sampling Plan
dated November 8, 2022



Remedial Delineation Field Sampling Plan

Ameren CIPS Site
Taylorville, Illinois

November 2022

Project No.: 0638675

Revision 1

The business of sustainability

ERM

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1. INTRODUCTION

Ameren Services (Ameren) has contracted Environmental Resources Management, Inc. (ERM) to conduct an investigation and sampling program at the former Central Illinois Public Service (CIPS) Site, now referred to at the Ameren CIPS Site ("Site"), located at 917 South Webster Street in Taylorville, Illinois. The Site location is shown in Figure 1. ERM has prepared this Remedial Delineation Field Sampling Plan (the "FSP") to describe the proposed investigation and sampling activities at the Site that are needed to evaluate the potential for the use of in-situ solidification (ISS) for site closure. These activities are being conducted to evaluate the potential to accelerate closure of the Site using additional remediation and demonstration of lack of risk to human and environmental resources.

Ameren has been operating a groundwater recovery and treatment system since 1995 to contain and treat MGP-impacted groundwater on the Site. While hydraulic containment is still effective, the recovery of constituents in the groundwater has decreased substantially, which delays site closure. This evaluation is being conducted to determine whether remediation using ISS, followed by a limited period of groundwater quality monitoring, will sufficiently address the MGP-related impacts that remain on the Site and eliminate the need for further long-term groundwater recovery and treatment. Prior to implementation of this FSP, Ameren is seeking IEPA concurrence on the investigation scope of work provided herein and the concept of ISS (if shown to be feasible) followed by a finite period of monitoring (up to two years depending on the success of the ISS as the presumed remedy) to secure closure and a No Further Action determination for the Site.

The goals of the proposed activities are to identify the presence, concentration, and distribution of impacts remaining in soil on-site and/or near the Site that may be related to past MGP activities. Such residual impacts are suspected to be contributing to the ongoing groundwater impacts observed at the Site through groundwater monitoring. These goals will be attained via implementation of a High-Resolution Site Characterization (HRSC) program performed in two phases: a Waterloo Advanced Profiling System (Waterloo^{APS}) program and conventional soil boring/sampling efforts.

These investigation activities will also include the collection of soil to perform bench-scale treatability studies in support of remedial design, which is currently anticipated to be ISS. The results of the HRSC, along with the ISS bench-scale study results and evaluation, will be used to determine the feasibility of ISS in effectively targeting and solidifying in-situ residual impacts, which would therefore result in a reduction of future groundwater monitoring. These data will also be used to develop a conceptual site model (CSM) that will be incorporated into a Focused Remedial Treatability Study for submittal to the Illinois Environmental Protection Agency (IEPA).

Soil and groundwater samples collected during this work will be analyzed for the constituents of concern (COCs) listed in the September 1992 Superfund Record of Decision (ROD). Table 1 lists the ROD COCs and Cleanup Objectives (COs), including IEPA-approved revisions since the ROD was issued, that groundwater sampling results will be compared to. The ROD did not provide COs for soil; thus, soil sampling results will be compared to the Illinois TACO Soil Component to Groundwater Remedial Objectives (Class I).

A Quality Assurance Project Plan (QAPP), which will detail the Data Quality Objectives (DQOs) for the project, and a Site-specific Health and Safety Plan (HASP) are being developed to establish controls for the remedial evaluation activities and ISS treatability studies described herein and will be provided to the IEPA under separate cover.

2. BACKGROUND

2.1 Site Description

The former Ameren/Taylorville Manufactured Gas Plant (MGP) is located at 917 South Webster Street in Taylorville, Christian County, Illinois. The footprint of the former MGP is approximately one acre in size. The Site is located on a 2.56-acre parent parcel (PIN# 17-13-27-331-005-00), that is owned by Ameren. Adjacent to the parent parcel's southern border there is a 15.56-acre combined parcel (PIN# 17-13-27-300-001-00) and immediately south of it is a 2.74-acre parcel (PIN# 17-13-34-100-010-00). These two southern adjacent parcels are owned by Ameren and, along with the parent parcel, make up an approximate area of 20.8 acres that are under an Environmental Covenant (EC) with the IEPA, restricting disturbance of soil and use of groundwater for potable purposes from the EC Area. In addition, Ameren owns a 20.29-acre parcel (PIN# 17-13-34-200-003-01), further to the southeast, across South Webster Street.

The Site lies in a residential area adjacent to Manners Park, which is a popular community park in Taylorville. Ameren owns the property south of the Site, which totals about 39 acres. Manners Park is located east of the Site, and residences are located to the north. Railroad tracks border the northwest side of the property. The Site currently houses a large groundwater treatment facility, several groundwater monitoring wells, and two deep wells used for recovery and containment of impacted groundwater. The Site is currently used for general Ameren equipment laydown and is generally unoccupied with exception to the daily inspections conducted for treatment plant monitoring.

The Site is covered primarily by gravel, with a large grassy area along the side of the Site facing Webster Street. Surface water from the Site drains toward the south and Seamen Estates Pond. This surface water body receives most of the drainage from the Site. Sampling over the previous 20 years have not identified impacts to fish, sediment, and water in the pond. The pond drains on its south side to the South Fork of the Sangamon River.

2.2 Site MGP History

The former MGP was constructed in 1892 and was operated by the Taylorville Gas and Electric Company until it was purchased in 1912 by Central Illinois Public Service Company (CIPS). CIPS was subsequently merged into Ameren, who currently owns the facility. Ameren predecessor companies operated the MGP from 1912 until 1932. The plant produced a gas from coal, which was used for lighting and heating of the Taylorville community. The coal gasification process that was used at the plant produced a byproduct known as coal tar. Coal tar is a mixture of volatile compounds such as benzene and toluene, heavier compounds such as naphthalene and a class of compounds known as polynuclear aromatic hydrocarbon (PAHs). Some of the compounds in coal tar have been shown or are suspected to cause cancer in humans.

The plant was closed in 1932 when higher quality natural gas became available in the area. When the plant was closed, most of the above ground structures were torn down, and below ground tanks were apparently filled with soil and miscellaneous materials and left in place.

Environmental impacts were discovered in October 1985 when a plumbing contractor, making repairs to a septic tank on the property, dug a trench and found coal tar in the subsurface soils. When the coal tar was discovered, work on the septic tank was halted and Ameren was notified. Recognizing its legal liabilities for the Site, and in-order-to protect public health and the environment, Ameren notified the IEPA and immediately began an onsite investigation to determine the nature and extent of coal tar contamination.

PREVIOUS INVESTIGATIONS

Site investigations were initiated in 1986 by Hanson Engineers Incorporated (Hanson). Hanson conducted a Phase 1 Site Assessment in 1986 to evaluate current Site conditions and to score the Site in accordance with the United States Air Force Hazard Assessment Rating Methodology (HARM) model. Based on the Site assessment, Hanson recommended additional Site investigation be conducted at the Site. This investigation was initiated in 1986 with a site investigation and was followed by a number of smaller investigations to address questions arising from the primary investigation.

Hanson conducted an Immediate Removal Action (IRA) to locate and remove all buried tanks and pits at the Site which contained coal tar or other wastes. The IRA was initiated in January 1987 and completed in March 1987. Source materials were encountered during the IRA. An immediate removal action taken by Ameren in 1987 resulted in the demolition and removal of all former gas plant structures above and below ground, excavation and offsite disposal of heavily-impacted source materials, and backfilling of affected areas with clean soils. Structures that were removed during the IRA include a 40-foot diameter, partially buried gas holder, a smaller tar well, along with the former brick MGP building, retaining walls, a septic tank, and two tar separators. Approximately 9,000 yd^3 of soil to a depth of 10 feet bgs on the Site and 3,000 yd^3 to a depth of 3 feet bgs offsite, adjacent to the south of the Site.

A number of additional investigations were conducted subsequent to the 1987 IRA and excavation to further investigate the extent of impacts. These investigations provided additional information for remedial design, which resulted in groundwater extraction, containment, treatment, and discharge of the treated water locally. These studies resulted in the definition of remaining residual impacts below the water table that could, at that time, only be remediated using hydraulic containment and recovery. The primary area of impacts was identified to be in an area roughly 100 feet by 100 feet in size, on the eastern portion of the former MGP operational location.

The groundwater Pump and Treat (P&T) system operation began in 1995. Groundwater recovery, treatment, and sampling related to the remedial action has been conducted essentially continuous since 1995, except for periods during additional on-site remedial actions conducted in 2006 and again between 2010 and 2012. During these periods, in-situ chemical oxidation (ISCO) was conducted and the P&T system was shut down to facilitate the ISCO works. Due to staffing shortages, the City of Taylorville was not able to continue operation of the P&T system Monitoring of groundwater quality downgradient of the Site during these periods of non-operation did not identify impacts exceeding the COs at the downgradient limits of the Site during these periods of P&T well pumping shutdown.

Residual impacts of VOCs and semi-volatile organic compounds (SVOCs), including PAHs, are suspected to remain below the limits of the 1987 excavation and water table. The level of impact in soil that currently exists will be determined through implementation of this FSP. The VOC, benzene, and the SVOC, naphthalene, have been the primary COCs to exceed objectives in groundwater. Currently, the highest levels of impact in groundwater, which has been monitored since 1995, is noted at GW-4R (see Figure 3). Benzene concentrations in groundwater samples from well MW-4R have dropped from almost 1,800 ug/L in 2015 to about 1,000 ug/L in 2022, while naphthalene in groundwater samples from this well had a maximum concentration of 5,500 ug/L but is currently approximately 3,300 ug/L.

2.3 Site Hydrogeology

The Site geology was obtained from information prepared previously by Hanson. The Site is located in the Till Plains Section of Illinois. Drainage systems are well developed but are not deeply incised, and morainal features are less evident due to the age of the glacial till materials. The topography is relatively level to gently undulating, except where dissection has occurred along major river valleys.

The uppermost soils at the Site consist of loess overlying glacial till. The thickness of these materials in the Taylorville area is estimated to be about 100 feet thick. The upper 7 to 15 feet of these materials consist of loess, which is composed of clayey silt. At most locations throughout this region, glacial till, consists of a poorly-sorted mixture of clay, silt and sand with lesser quantities of gravel, underlies the loess to bedrock. At the Taylorville Site, sand and gravel underlies a thin seam of glacial till from about 13 feet below grade to bedrock, which is at a depth of about 90 feet. This sand and gravel are the result of an esker deposit, and provides a number of communities northeast and southwest of Taylorville with potable water.

Groundwater is unconfined beneath the Site and has been encountered from 12 to 20 feet bgs. Monitoring wells that were installed on the Site were completed within the upper and lower bounds of this unconfined aquifer. Depths to water in these monitoring wells indicate that groundwater is flowing toward the south and southwest. The aquifer is considered a prolific source of groundwater for many communities, excluding Taylorville, and is considered to be a Class 1 system. It should be noted that there are no groundwater users near the Site, as Ameren has provided municipal water service to all the former groundwater users south and southwest of the Site.

3. PROJECT OVERVIEW

3.1 Purpose

The purpose of this FSP is to meet one of two components required for a Sampling and Analysis Plan (SAP) for investigation activities in the Superfund process. A Quality Assurance Project Plan (QAPP) is the second component of the SAP and has been completed for the remedial delineation investigation. The *Quality Assurance Project Plan, CIPS Taylorville Site – Remedial Delineation* report was submitted to IEPA on 14 September 2022. This FSP will describe the field and analytical procedures to be conducted at the Site, in conjunction with the QAPP, in order to gather sufficient and usable data to evaluate the feasibility and possible implementation factors for ISS remediation at the Site.

3.2 Regulatory Approach

Following discovery of the MGP-related impacts at the Site in 1985 and the IRA and excavation in 1987, the Site was listed on the National Priorities List (NPL) in 1989. This categorized the Site as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) project. The IEPA assumed regulatory leadership of the Site from the United States Environmental Protection Agency (USEPA). The IEPA conducted a Remedial Investigation and Feasibility Study in 1991. In September 1992, IEPA issued a ROD for the Site and a Consent Decree was executed. The ROD required that a groundwater P&T system be constructed and monitored and also expanded the ground water monitoring program that had been initiated in 1987.

The groundwater P&T system began operation in 1995 and has operated continuously, with the exception of time periods in 2006-2007 and 2010-2012 for the implementation of ISCO and subsequent monitoring activities. The P&T system was also shut down for a period in 2017 as there were staffing and contractual issues with the City of Taylorville's operator. Groundwater continued to be monitored during this period of time and significant decreases were seen in onsite wells as expected with the P&T system shut down. An increase in benzene and naphthalene was noted in two central wells onsite in 2019 and the P&T system was put back into operation.

IEPA issued an Explanation of Significant Differences (ESD) in 2005, which USEPA concurred with, that allowed Ameren to conduct a pilot for alternative treatment methods and reduced the clean-up objective for benzo(a)pyrene in groundwater from 0.00023 mg/L to 0.0002 mg/L based on a new Maximum Contaminant Level (MCL)s for the COC.

Ameren recorded an Environmental Covenant on August 30, 2012, which granted IEPA and USEPA access to the C.I.P.S. Site and restricted the installation of wells, use and handling of groundwater, and handling of soils on the Site, the Site's parent parcel and two adjacent, downgradient properties, currently owned by Ameren.

In 2014 and 2015, Ameren approached the IEPA, after a number of investigations and modeling simulations, to discuss idling the system. As part of this effort, Ameren prepared an Explanation of Significant Differences (ESD). This ESD recognized the following elements of the new Alternative 6 to the ROD:

- Long-term groundwater monitoring along the pathway of risk
- Reduce groundwater sampling to address only the pathway of risk
- Closure of groundwater monitoring wells in accordance with IEPA requirements that are not needed to monitor the current extent and/or potential migration of impacted groundwater
- Establishment of GW-17 as the point of compliance

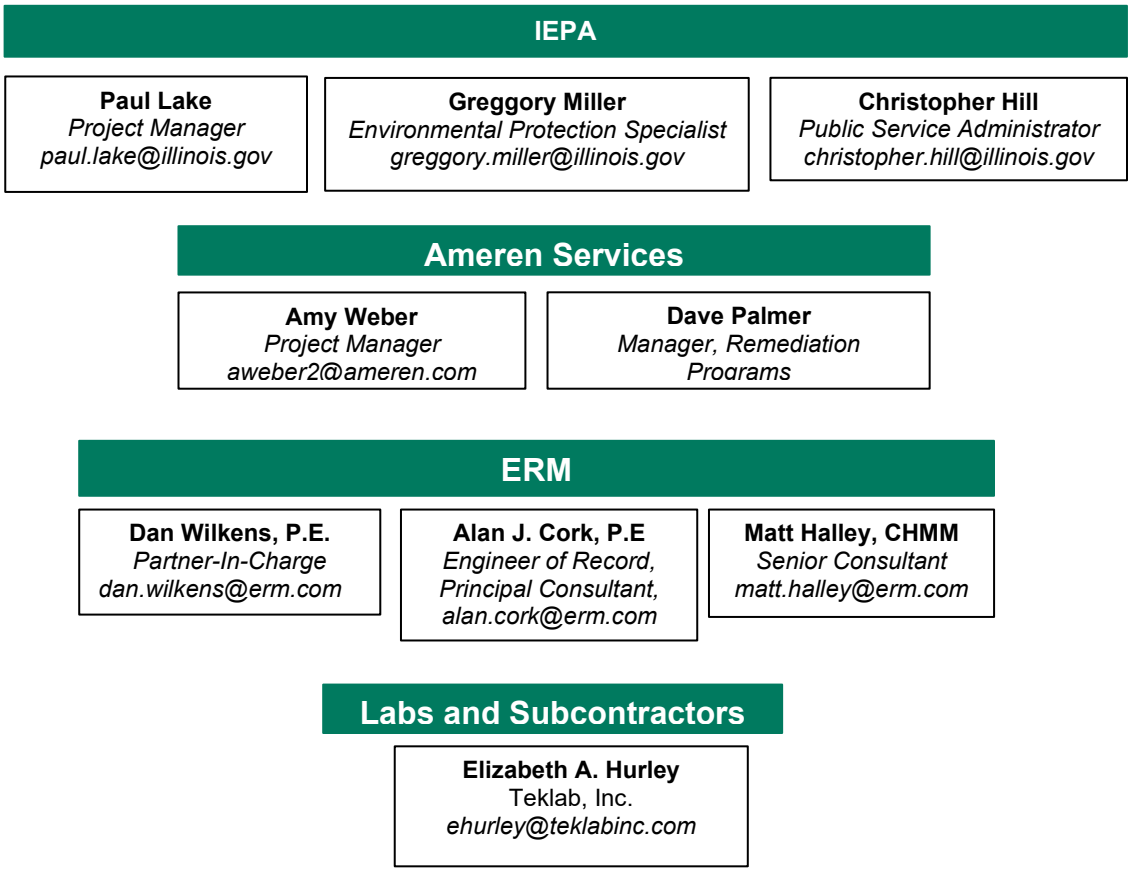
- Placement of P&T system on standby
- Implement contingency plans to resume operation of the P&T system if groundwater standards exceedances occur at well GW-25
- Maintain soil/gravel cover on the Site
- Revise the Environmental Covenant (EC) to address the indoor inhalation pathway
- Eliminate surface water sampling, sediment sampling and fish tissue sampling since lack of impact has been demonstrated for these media and potential receptors

Ameren and ERM met with the IEPA in January 2015 to discuss this issue, at which time Ameren was authorized to proceed. The ESD was submitted as a draft to the IEPA, who responded in 2022 with requirements for the entire Site to meet the COs for closure versus just the proposed point of compliance well GW-17. The 2015 ESD has been withdrawn from IEPA and Ameren is now pursuing this potential change of remedy through an eventual ROD amendment.

Soil and groundwater data obtained during the FSP will be compared relative to other results from the Site per media. Groundwater results will also be compared to the groundwater COs as established in the ROD. Table 1 lists the ROD CoCs and COs, including revisions since the ROD was issued. Since the ROD offers no soil COs, soil results will also be compared to the Illinois TACO Soil Component to Groundwater Remedial Objectives (ROs). ERM will work closely with IEPA regulatory personnel so that remedial delineation activities described herein will adhere to the ROD and Consent Decree, and forthcoming QAPP and HASP.

3.3 Project Organization

The management of this project and primary stakeholders are presented in the organization chart below.



The project contacts and roles for the collection, analyses, and reporting of groundwater monitoring samples are presented in the table below:

Ameren CIPS Site – Roles and Responsibilities

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Regulatory agency interface	ERM	Dan Wilkens, Partner-in-Charge	314 733 4491	Contact IEPA only after contacting Ameren Services. Documentation required.
Field Activities and Subcontractors	ERM	Dwayne Keagy, Project Manager; Field Lead; Field Staff	Dwayne Keagy 317 706 2005	Oversight and logistics for field activities and subcontractors to visit the Site. Any significant deviance from planned activities should be reported immediately to the ERM project manager and to Ameren Services
Field progress reports	ERM	Dwayne Keagy, Project Manager; Field Lead; Field Staff	Dwayne Keagy 317 706 2005	Contact ERM project manager, project geologist, engineer, or designated project staff by phone at end of each day and as needed to summarize work completed and notify that all tasks were completed safely. Any significant deviance from planned activities should be reported immediately to the ERM project manager and to Ameren Services.
Stop work due to safety issues	ERM	Any team member	Dwayne Keagy 317 706 2005	Notify ERM project manager, project geologist, engineer, or designated project staff immediately to assess, direct and make changes, and notify others. Notify Ameren Services after contacting ERM project manager.
Sample receipt and laboratory QC variances	ERM	Dwayne Keagy, Project Manager	317 706 2005	If the issue could possibly result in the rejection of data, contact the task manager and field manager. Otherwise, note the issues in the laboratory case narrative of the sample delivery group (SDG).
Analytical and Date Review corrective actions	ERM	Dwayne Keagy, Project Manager	317 706 2005	If the issue could possibly result in the rejection of data, contact the ERM project manager, project geologist, engineer, or designated project staff immediately. Additionally, note the issues in the case narrative if the report is required to be revised, or the data validation report.
Legal Contact for the Facility	Ameren	Susan B. Knowles, Dir & Asst General Counsel	314 554 3183	Attorney for Ameren; representative for Owner of Site

4. SCOPE OF SERVICES

ERM is proposing the following Tasks to be completed during the remedial evaluation investigation.

1. Data Management Preparation
2. Develop QAPP and HASP
3. Surveying, Subsurface Clearance, and Air Monitoring
4. Waterloo^{APS} Program
5. Soil Borings/Sampling
6. ISS Bench-Scale Treatability Study and ISS Feasibility Evaluation
7. Data Reduction/Evaluation and Update CSM
8. RETS Preparation and Submittal
9. Abandonment of monitoring wells that will not be utilized for short-term monitoring after completion of the proposed ISS activities

The above activities are described in more detail below.

4.1 Task 1 – Data Management Preparation

In preparation for, and ease of, reduction and evaluation of the significant data set that will be generated by the focused remedial evaluation activities described below, ERM will prepare its EQuIS database to accept the forthcoming data. Teklab, Inc. in Collinsville, IL (Teklab) will also upload available historic groundwater monitoring data to the EQuIS database as electronic data deliverables (EDDs) and Level 2 Adobe Acrobat electronic file (PDF) reports. ERM's EQuIS data manager will perform a quality control / quality assurance (QA/QC) check of the data in the EDDs against the Level 2 PDFs and generate tables of analytical results as may be needed. Available soil boring logs and well construction diagrams will also be entered into the EQuIS database. This EQuIS database will be specific to Site data only, and accessible only by ERM's assigned EQuIS data manager, the ERM project manager for the Site, and those approved for access by the ERM project manager, including Ameren and/or IEPA personnel if requested.

4.2 Task 2 – Develop QAPP and HASP

ERM will develop a QAPP and a HASP prior to performing any field activities.

The QAPP will include sampling requirements and DQOs, and quality assurance measures to document the specific procedures to be followed during the completion of the project tasks associated with the investigation. The QAPP will also include information on training, personnel, equipment, sampling procedures, analytical requirements, record keeping, photographic logs, etc. The Unified Federal Program (UFP) format will be utilized for the QAPP.

The HASP will be prepared to document the procedures to be followed to ensure the safety of the site workers and surrounding community during the completion of field activities, and to also address the actions to be taken in the event of an emergency situation. The HASP will include information on personnel training, personnel protective equipment, anticipated CoCs, potential health risks, emergency contact numbers, hospital routes, action levels, and other health and safety related concerns.

4.3 Task 3 – Surveying, Subsurface Clearance, and Air Monitoring

An Illinois licensed surveyor will be subcontracted to conduct a professional survey of the Site, the nearby surrounding area, and all additional adjacent Ameren property. The survey will be referenced to a state plane coordinate system and to an established National Vertical Geodetic Datum (NVGD) elevation benchmark. The survey will include the following:

- Legal description for the Site and adjacent Ameren properties;
- A boundary survey of the Site and adjacent properties/parcels owned by Ameren, including any easements (utilities and/or other), and adjacent public rights-of-way (Webster Street). This may include a local record deed search to determine parcel boundaries as needed, and to acquire the valuation map for the adjoining Norfolk-Western Railroad right-of-way;
- On-property and nearby off-property structures, such as buildings, manholes/grates, fireplugs, power and light poles and above-ground lines, fences, sidewalks, manholes and drain inlets, and any underground utilities as may be marked by public and private utility location services;
- The location (within 0.25-foot accuracy) and ground surface and top-of-casing elevations (within 0.01 feet on well pipe risers and 0.1 feet on ground surface) of approximately 30 monitoring wells associated with the Site and
- A computer-aided design (CAD) file, to serve as a base map for the project moving forward, will be generated and include all the locations of the items surveyed. Monitoring wells will surveyed into the site coordinate system and included on the CAD base map so that groundwater flow can be confirmed.

Prior to any subsurface investigative activities, ERM will implement subsurface clearance (SSC) procedures. A public utility mark-out will first be performed to identify subsurface utilities, and a private utility locating firm will be subcontracted to clear areas where subsurface work will be performed. As an additional SSC safety measure, boring locations will be cleared per ERM and Ameren specifications before powered drilling equipment can be used, where applicable. Soil removed by hand auger from the upper five to eight feet of any Waterloo^{APS} boring will be returned to the boring to support later advancement of the Waterloo^{APS} tooling. Overhead electrical lines are also located near some of the proposed boring locations. These lines will be shielded by Ameren to permit safe drilling conditions. More detailed utility clearance procedures will be included in ERM's Subsurface Clearance (SSC) Plan to be included in the HASP.

As a further safety measure, air monitoring will be conducted during the intrusive activities to monitor for the presence of volatile organic compounds (VOCs) in areas where human exposure may occur, to establish controlled work zones, and to document worker exposure. Air monitoring will be conducted based on guidance to be included in the HASP. Air monitoring will be performed using a photoionization detector (PID). The monitoring procedure generally includes:

- Instrument calibration;
- Baseline survey of VOC concentrations prior to soil disturbances;
- Setting alarm level;
- Establishment and monitoring of work zones;
- Monitoring work zones during soil disturbing activities; and
- Recordkeeping.

The Waterloo^{APS} transects/borings (Task 4, below) will be spaced and staked roughly equidistant from each other by ERM staff. Between the field activities for Tasks 4 and 5, below, the surveyor will survey the location and ground surface elevation for all completed Waterloo^{APS} borings and will also layout and stake the planned sonic soil boring grid shown in Figure 2. Once Task 5, below, is completed, the surveyor will remobilize to survey all the completed sonic soil boring locations and ground surface elevations. Any pre-staked borings that fell within the Critical Zone (10 feet per ERM policy) of a marked utility will be adjusted to outside the Critical Zone or an SSC waiver through ERM's internal permit process will be pursued. Any borings that must be repositioned off the staked transect and grid, such as due to overhead clearance and/or SSC concerns, will be resurveyed after completion of the boring/sampling activities. Ultimately the location (within 0.25-foot accuracy) and ground surface elevation (within 0.1 feet on ground surface) of all completed Waterloo^{APS} and soil borings will be determined and incorporated into the CAD Site base map.

4.4 Task 4 – Waterloo^{APS} Program

The Waterloo^{APS} will be used to advance two east-west boring transects at the Site. The Waterloo^{APS} is a direct-push, real time measurement tool that utilizes continuous measurements of the flow rate and pressure of the water pumped out of the sampler as it is advanced through the aquifer. This generates a plot of the so-called "index of hydraulic conductivity" ("I_K") for the entire borehole. This allows for real-time determination of transitions between high and low hydraulic conductivity (K) soil zones. (Note, the I_K scan for the upper 8 feet of any boring that must be hand-clear will not be useable due to soil disturbance from SSC activities, noted above.) The tool is also equipped to collect discrete groundwater elevation measurements and water samples from saturated geologic units exhibiting K values of approximately 1 x 10^{-4} centimeters per second (cm/sec) or greater (i.e., fine sand or coarser).

Cascade Drilling/Technical Services (Cascade) will be contracted to perform Waterloo^{APS} advancement and groundwater sample recovery services. Two Waterloo^{APS} transects are proposed as shown in Figure 2; one east-west along the north border of the Site consisting of five borings, and one east-west along the south border of the Site consisting of eight borings. The purpose of the north transect is to assess for impacts that may be entering the Site from upgradient locations and at what depths, while the south transect is to assess for impacts on the downgradient side of the Site that could migrate off the Site and at what depths. The Waterloo^{APS} borings at the end of each transect will be completed first and those groundwater samples collected will be analyzed on a fast turn-around-time (TAT) at the laboratory. This will allow for a determination if additional east or west Waterloo^{APS} step-out borings are necessary to contain the edges of the groundwater impacts plume before the Waterloo^{APS} equipment is demobilized from the Site.

Trees and other vegetation currently overhang the south and north borders of the Site. This vegetation will be trimmed back to accommodate the boring locations proposed and allow the Waterloo^{APS} rig to be positioned as close to the Site's north and south borders as possible.

Each Waterloo^{APS} boring is planned to be advanced to bedrock, which is expected at about 90 ft-bgs. Cascade will generate real-time continuous I_K scans from each Waterloo^{APS} boring. The Waterloo^{APS} tool will be used to collect a discrete groundwater sample every five feet vertically from the groundwater surface ranging 12 to 20 ft-bgs to approximately 50 ft-bgs from each boring. Below approximately 50 ft-bgs to bedrock, groundwater sampling will be at an interval of 10 feet vertically. Real-time review of I_K scans during the field activities will also allow for additional, discrete, groundwater samples to be collected from the top of relatively less conductive zones as may be identified in I_K scans. Samples will be collected in accordance with the procedures described in the QAPP. Water quality measurements, including pH, specific conductivity, dissolved oxygen (DO) and oxidation-reduction potential (ORP), will be recorded for each sample. Turbidity measurements will also be recorded separately by ERM for each

sample using a calibrated turbidity meter. The groundwater samples will be managed for analysis as described in the QAPP and Section 5.0, below.

Each Waterloo^{APS} boring will be abandoned immediately upon completion and collection of groundwater samples using bentonite grout applied with a tremmie pipe. All downhole equipment will be decontaminated on a temporary decontamination pad prior to and after each boring, whereas sampling equipment will be hand washed during sampling activities. Decontamination water will be contained and treated using the on-site treatment plant.

Upon completion of the project, Cascade will provide ERM with a final report of all the I_K scans, groundwater sampling intervals, and water quality measurements for each Waterloo^{APS} boring advanced for the project.

4.5 Task 5 – Soil Borings/Sampling

Following completion of Task 4, above, ERM proposes to advance up to 80 soil borings by sonic drilling techniques in a grid pattern as illustrated in Figure 2. Cascade will be contracted to perform the drilling and soil sample recovery services. Sonic drilling techniques will be used to advance each boring to promote better recovery and for better control of expected heaving sands. The borings around the perimeter of the grid will be completed first and those soil samples collected will be analyzed on a fast TAT at the laboratory. This will allow for a determination if an expansion of the grid is necessary to delineate soil impacts before the sonic rig is demobilized from the Site. Of the 80 soil boring locations currently planned, up to 40 will be advanced to the bedrock surface (approximately 90 ft-bgs) and up to 40 will be advanced to 50 ft-bgs. This depth variation will be generally spread evenly throughout the grid.

Trees and other vegetation overhang the south and north borders of the Site. This vegetation will be trimmed back to accommodate the boring locations and allow the sonic rigs to be positioned as close to the Site's north and south borders as possible.

Continuous soil sampling will be performed for every boring, and the soil will be logged and photo-documented by a qualified ERM staff geologist and reviewed by an Illinois-licensed professional geologist. Logging descriptions will consist of recovery length, color, density, grain size, sorting, composition, structure, and moisture content of the soil sample from visual observation. A Munsell® color chart will be used to accurately identify the color of the soil. All soil logging will be performed using the Uniform Soil Classification System (USCS). Screening for evidence of volatiles will also be conducted using a photoionization detector / flame ionization detector (PID/FID).

Soil samples for laboratory analysis will be collected every two vertical feet to 50 ft-bgs, and every 5 vertical feet below 50 ft-bgs to bedrock. Soil samples may be added or subtracted based on visual and olfactory observations and on PID/FID readings. The goal is to delineate the vertical and horizontal extent of COCs in soil. Samples will be collected in accordance with the procedures described in the QAPP and managed for analysis as described in the QAPP and Section 5.0, below.

Soil cuttings and other solids derived from the soil borings will be placed in a lined and covered roll-off box or 55-gallon steel drums for later disposition. Each boring will be abandoned immediately upon completion using bentonite grout applied with a tremmie pipe. All downhole equipment will be decontaminated on a temporary decontamination pad prior to and after each boring, whereas sampling equipment will be hand washed during sampling activities. Decontamination water will be contained and treated using the on-site treatment system.

Geologic logging and screening information, along with the analytical results, will be used to generate a CSM, and to identify residual impacts for targeted remediation. These logs will be included into the EQuIS database that will be established under Task 1, above.

4.6 Task 6 - ISS Bench-Scale Treatability Study

ERM will use the sonic rig to collect soil from the worst-case impacted soil boring and intervals (target zones), based on previous data collection efforts. Soil recovered from the boring will be used to perform an ISS bench-scale treatability study (TS). The TS will evaluate the effectiveness of ISS to address COCs in soil and groundwater at the Site. The primary goal of the TS is to maximize leachability reduction at the Site.

ERM is performing the TS to define (Phase 1 portion of study) and then refine (Phase 2 portion of study) the reagent types and mixing ratios for the use of ISS at the Site, including the potential inclusion of sorptive or oxidative agents. The bench-scale testing will evaluate the treatment effectiveness of ISS using various combinations and dosages of cement, bentonite, carbon, and/or sodium persulfate on soil from the expected most impacted portion of the Site.

The goals of the testing are as follows:

- Determine / maximize the reduction in leachability of the COCs from the treated soils for the conditions tested, ideally to below the Site ROs.
- Determine the effects of treatment on soil strength and permeability, with the goal of achieving a permeability of 1 x 10-6 centimeters/second (cm/sec) or lower, and a minimum soil compressive strength of 50 pounds per square inch (psi).
- Determine the degree of swell (i.e., expansion in soil volume) due to the addition of ISS amendments based on bulk density measurements of soil pre- and post-treatment and for cost considerations.

These remedial goals are general field requirements for ISS and are consistent with the July 2011 Interstate Technology and Research Council (ITRC) guidance document "*Development of Performance Specifications for Solidification/Stabilization*".

4.6.1 ISS Reagents

The ISS test conditions that will be conducted and associated analyses are summarized below and are shown on Table 1. Loureiro Engineering Associates, Inc. (Loureiro), formerly XDD, will coordinate and perform the bench study, but will subcontract Pace Analytical Services (Pace) in Indianapolis, Indiana and Sheridan, Wyoming to perform analytical and leach testing and JLT Laboratories, Inc. (JLT) in Canonsburg, Pennsylvania to perform geotechnical testing. Depending on the test condition, the following will be tested on Site soils:

- ISS Amendments
  - Cement – Portland Cement Type I/II
  - Bentonite
  - Carbon – Rempak, a powdered activated carbon (PAC) provided by Calgon Carbon
  - Sodium persulfate
- Water – site groundwater will be added at a dose sufficient for cement curing. Note that the groundwater for testing will be collected from a Site monitoring well that is not impacted by the COCs.

The dosages specified for all amendments, including water, will be added to soil on dry weight basis. The two Phases (described below) include an initial screening phase (Phase 1) and a refinement phase (Phase 2). Phase 1 will evaluate three dosages of cement (5%, 7%, and 9% by weight of dry soil) with and without low and high dosages of bentonite, carbon, and sodium persulfate. Based on the Phase 1 results, three test conditions will be refined for the Phase 2 testing. The Phase 1 bentonite and carbon dosages will be tested at 1% and 2% by weight of dry soil. The persulfate dosages will be selected based

on total oxidant demand (TOD) test results and according to recommendations by the sodium persulfate vendor.

4.6.2 Phase 1 Testing

Soil Homogenization and Baseline Analyses

Upon receipt at Loureiro's laboratory, soil samples from the Site will be composited and homogenized as efficiently as possible to minimize volatilization of contaminants. During the homogenization, large rocks and fragments will be removed. A sample of the soil will be submitted to Pace for baseline analysis of volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method 8260, semi-volatile organic compounds (SVOCs) using USEPA Method 8270, and pH. Leachate concentrations of VOCs, SVOCs, and pH will also be determined on baseline soil using USEPA Synthetic Precipitation Leaching Procedure (SPLP) 1312. Baseline soil, as bulk and Shelby Tubes, will also be submitted to JLT to determine select soil index properties following the referenced methods in Table 1. Standard turn-around-times will be requested unless otherwise specified.

If the results of the baseline analyses indicate that the soil COC concentrations are not representative of historical results and are too low to obtain meaningful results from the analytical testing, (i.e., COCs concentrations close to laboratory detection limits would make it difficult to ascertain the level of treatment effectiveness and/or differentiate the treatment effectiveness between treatment conditions). Collecting additional soil samples for use in the treatability may be warranted. The laboratory will discuss the baseline results with ERM prior to setting up the ISS test conditions.

Persulfate Dosage Determination

The stability/TOD test evaluates the total amount of sodium persulfate required to overcome non-target sources such as reduced minerals, naturally occurring organic compounds, the oxidant demand of the activator (e.g., sodium hydroxide, cement), and the COCs in the soils.

Two oxidant concentrations will be tested for (cement activated persulfate (CAP) in the TOD test. Evonik (formerly Peroxychem), a supplier of sodium persulfate, recommends using a ratio of 1.5 to 2 parts cement to 1 part persulfate. It is proposed to evaluate a low test condition at 5% cement with 2.5% persulfate and a high test condition at 9% cement with 6% persulfate to cover the range in potential TODs. Based on the TOD results, the Phase 1 test conditions for CAP will be refined.

The decomposition of persulfate in all test conditions will be evaluated at two timepoints throughout a two-week test period. pH will also be monitored to evaluate if alkaline conditions are maintained, as the target pH required for alkaline activation is 10.5 or greater. Two pore volumes of persulfate will be added to 30 grams (g) of soil in order to provide enough aqueous volume for pH and persulfate measurements. Controls will consist of sodium persulfate only (no activator or soil), dissolved in distilled water. The estimated TOD values will be reported as the mass of oxidant (g) consumed per mass of soil (kg). The testing will be conducted while baseline analyses are being conducted to condense the overall project schedule.

Contaminant Leachability and Geotechnical Testing

For each test condition, the soil will be mixed with the amendments at the weight percentages specified in Table 1. The dosages for sodium persulfate will be determined following an evaluation of the TOD test results. After the amendments, water, and soil are thoroughly combined, the mixtures for each test condition will be transferred to several replicate molds in order to supply the laboratories with enough sacrificial samples per analysis per time point. The molds will consist of high-density polyethylene (HDPE), 2 x 4-inch cylinders, and will be allowed to cure at room temperature until sacrificed for analysis.

Eleven molds in total will be created for each test condition, with two molds dedicated for the SPLP analyses at the analytical laboratory and the other nine for the geotechnical analyses at JLT at the time points specified on Table 1. Some of the analyses at the latter time points may not be conducted depending on interim results.

The SPLP method requires monolithic samples to be broken into pieces of 3/8 inches or less in diameter prior to conducting the leaching procedure. This could be considered to be a worst-case scenario (i.e., increased surface area of the sample would likely result in a higher mass of COCs leached into the aqueous phase). In situ, it is anticipated that the amended soils will maintain their solidification properties. Therefore, for a side-by-side comparison, the laboratory will conduct the traditional SPLP (breaking up the monolith) and the SPLP keeping the monolith as whole as possible for select test conditions, as shown on Table 1. This data will be useful in defining the basis for the Phase 2 LEAF testing.

4.6.3 Phase 2 Testing

Based on the Phase 1 results, the amendments and dosages used in the Phase 2 testing will be refined. Three test conditions are proposed for Phase 2 and the analyses and time points are shown on Table 1. The same Phase 1 procedures for creating the monoliths will be followed during the setup of the Phase 2 mixtures. As with the Phase 1 setup, several replicate molds will be created for each test condition to be sacrificed for each analysis and each time point.

A similar analysis protocol is proposed for Phase 2 but the contaminant leachability will be assessed using SPLP 1312 as well as a more comprehensive leaching method that is specific to monolithic samples. USEPA Leaching Environmental Assessment Framework (LEAF) Method 1315 will be used to determine mass-transfer based release rate information over a series of nine time points for each test condition. At each of the nine time points, VOCs, SVOCs, and pH will be measured for each test condition. Pace will conduct the SPLP and LEAF analyses. Loureiro will request that the results for each time point be reported when available prior to the end of the test.

4.6.4 Schedule

The estimated schedule is presented below. This schedule assumes that the full duration of each testing cycle is necessary to ascertain the data for a final mix design. However, data from real-time testing may be used to shorten the schedule, based on the defined treatability study.

SCHEDULE	Duration (calendar weeks) (Following Receipt of Soils) Weeks	Subtotal
PHASE 1		
Homogenize soils, submit baseline samples.5	0.5	
Conduct TOD testing, Receive baseline results	2.0	
Discuss baseline and TOD test results with project team, determine dosing, calculations for mixes, prepare molds	1.5	
Submit Day 3 penetrometer samples [1]	0.5	
Submit Day 7 penetrometer, UCS, and permeability samples [1]	0.5	
Submit Day 14 penetrometer, UCS, and permeability samples [1]	1.0	
Submit Day 28 SPLP, penetrometer, UCS, and permeability samples [1]	2.0	
Receive SPLP results	3.0	
Discuss SPLP, penetrometer, UCS, and permeability test results with project team; Determine test conditions / dosing for Phase 2	1.0	
	Phase 1 Total	**12 Weeks**

SCHEDULE	Duration (calendar weeks) (Following Receipt of Soils) Weeks	Subtotal
PHASE 2		
Calculations for mixes, prepare molds	1.5	
Submit Day 3 penetrometer samples [1]	1.0	
Submit LEAF Samples (assume 7 days of cure time) / Submit Day 7 penetrometer, UCS, and permeability samples [1]	1.0	
Submit Day 14 penetrometer, UCS, and permeability samples [1]	1.0	
Submit Day 28 SPLP, penetrometer, UCS, and permeability samples [1]	2.0	
Receive SPLP results	2.0	
Receive final set of LEAF results [2]	7.0	
Draft report	2.0	
	Phase 2 Total	**17.5 Weeks**
	Total Phase 1 and 2	**29.5 Weeks**

Notes:

[1] UCS test results typically received within 1 to 2 days of conducting the test. Permeability tests can take up to 1 week or longer depending on testing progress.

[2] The laboratory can provide results from interim time points. Standard turn-around-times for data reporting is 10 days. SPLP requires an extra 2 to 3 days for sample size reduction (i.e., crushing) of the monolith.

4.7 Task 7 – Data Reduction/Evaluation and CSM

As groundwater and soil sampling results are uploaded as EDDs and Level 2 PDF reports by Teklab to ERM's EQuIS database, ERM's EQuIS data manager will perform a QA/QC check of the data in the EDDs against the Level 2 PDFs and generate tables of analytical results for real-time evaluation by the ERM project team. The laboratory will also provide Level 4 PDF reports a short time later. ERM will use the Level 4 reports to perform a USEPA Stage 2B data validation of the soil and groundwater results.

ERM's Geographic Information System (GIS) and Environmental Visualization System (EVS) modeling team will create a CSM as new data is obtained. The CSM will be presented as geologic cross sections and/or fence diagrams and 3D plume models identifying zones of impact, and including sedimentology, sample locations, aerials, and site features. The CSM will be updated as new data arrives in EQuIS and will be used in presentations to and discussions with Ameren and IEPA.

ERM anticipates that the ISS Bench Scale Treatability Study Report will be available from the laboratory within 29.5 weeks of receipt of soil by the laboratory. ERM's ISS subject matter experts (SMEs) will evaluate the laboratory's ISS Treatability Study Report and prepare a Focused Remedial Treatability Study.

4.8 Task 8 – Focused Remedial Treatability Study Preparation and Submittal

At the completion of all field activities and data evaluations noted above, ERM will prepare a Focused Remedial Treatability Study for review by Ameren and eventual submittal to IEPA. The Focused Remedial Treatability Study will discuss the progression of, and methods used, for the field activities, present the results of the investigation, and provide an evaluation of the data with the focus being to identify target zones of residual contamination. The Focused Remedial Treatability Study will contain tabulated sampling results (groundwater and soil), CSM visuals, boring logs, Waterloo^{APS} I_K scans, and validated Level 4 laboratory analytical reports, and provide the recommended design parameters for ISS (if viable) implementation.

4.9 Task 9 – Monitoring Well Abandonment & Post Remediation Sampling Program

Groundwater monitoring has occurred on and around the Site since the late 1980's. Some of the wells have not been sampled for many years, while others have shown no indications of impact since installation. As part of the investigation and potential remedial efforts, a majority of the offsite monitoring wells will be abandoned. The wells that will be retained for continued monitoring include the downgradient monitoring wells GW-16S, GW-16D, GW-17, GW-25 and GW-26. All other monitoring wells, including those installed by the IEPA, will be properly abandoned. A Monitoring Well Locations & Proposed Abandonment figure is included as Figure 3.

Monitoring wells will be abandoned in accordance with the Illinois Department of Public Health requirements 77 Illinois Administrative Code 920.120. Ameren will notify the local county health department for documentation of abandonment activities.

Note that the two on-Site extraction wells and all the on-Site monitoring wells, will require abandonment prior to the start of ISS activities. ERM will confirm this request with the IEPA after a decision on ISS feasibility is determined by Ameren. If remediation is performed via ISS, ERM proposes to collect groundwater samples from monitoring wells GW-16S, GW-16D, GW-17, GW-25, and GW-26 for a maximum eight consecutive quarters following ISS implementation in an effort to demonstrate that downgradient groundwater concentrations are stable. Post-remediation groundwater samples will be analyzed for the ROD list of parameters.

Finally, ERM requests to discontinue collection of samples associated with the Seaman Estates Pond. Ameren has been conducting fish, sediment, and water sampling in the Seaman Estates Pond since the 1980's on a five-year basis, and results have been submitted to the IEPA with the five-year reviews. For approximately the last 20 years, impacts have not been observed at concentrations above applicable risk threshold values. Based on the lack of impact in these media associated with the Seaman Estates Pond, Ameren is requesting that these sampling and reporting activities be terminated.

5. ANALYTICAL APPROACH

All soil and groundwater samples will be collected in laboratory-provided sample bottles and delivered on ice and under proper chain-of-custody via courier to Teklab Collinsville, IL for analysis of the ROD-specific VOCs and PAHs / semi-VOCs (SVOCs) listed in Table 1. Analytical methods that will be used are also indicated in Table 1. Teklab will direct-upload the analytical results, as EDDs and Level 2 PDF reports, to ERM's EQuIS database on a standard five to seven business-day TAT. Select samples may be analyzed on quicker TATs, as may be necessary to complete the delineation of soil and/or groundwater impacts. The laboratory will also provide Level 4 PDF reports a short time later.

Applicable QA/QC samples in the form of field duplicates (DUP), matrix spike / matrix spike duplicates (MS/MSD), equipment rinsate blanks (EB), and trip blanks (TB) will also be collected and submitted to the laboratory for analysis. This will apply to both groundwater and soil sampling. The collection rate of QA/QC samples will be as follows.

- DUP = 1/10/media
- MS/MSD = 1/20/media
- EB = 1/day/media
- TB = 1/shipment (cooler) of samples for VOC's analysis

Sampling, analyses, and relevant QA/QC samples will be described in further detail in the project QAPP.

6. PROJECT SCHEDULE

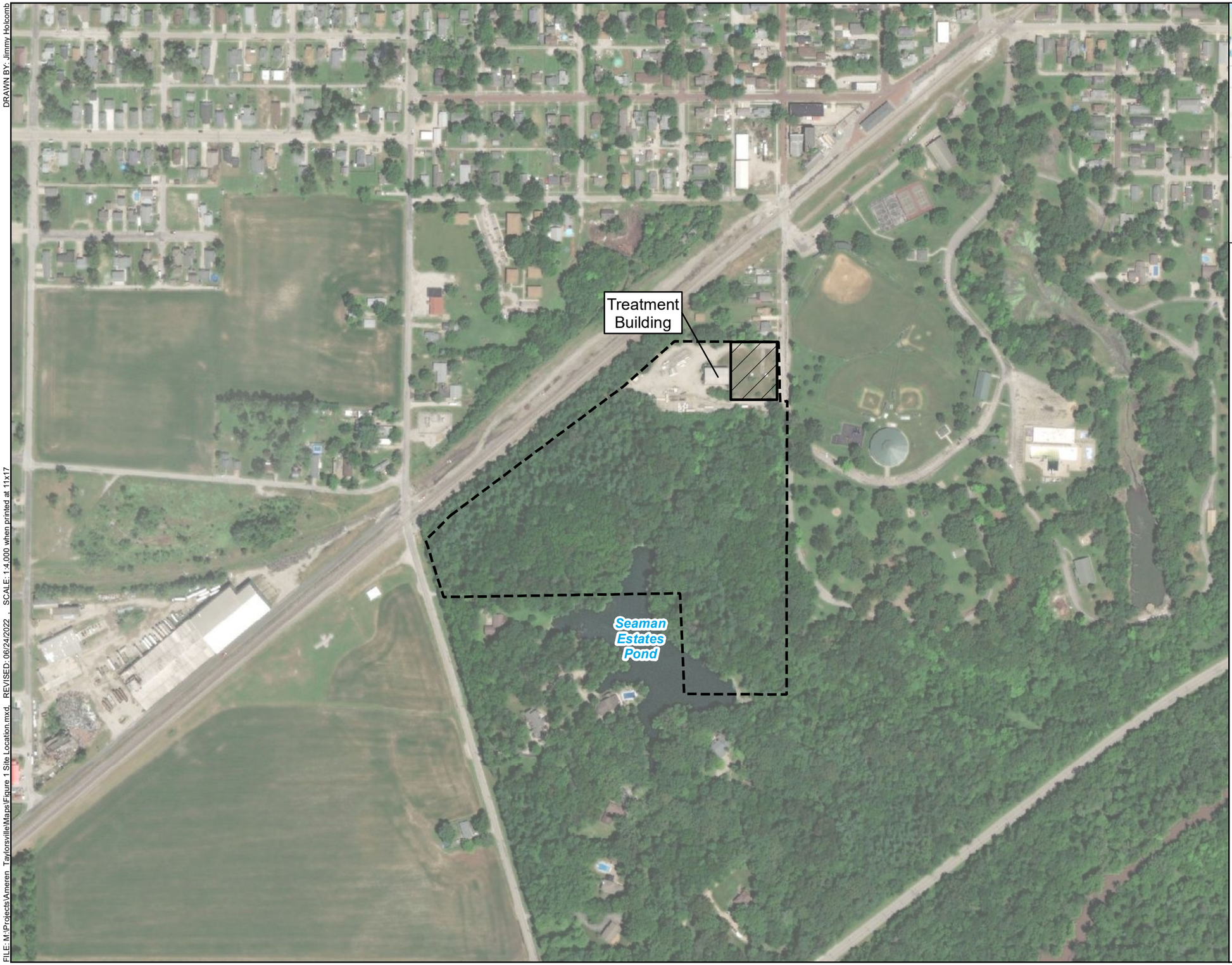
The duration of the scope of services proposed, above, is expected to be completed by approximately year-end 2023, with mobilization for field work starting in August 2022, assuming a timely review/approval of this FSP and the forthcoming QAPP and HASP by IEPA. The schedule for specific tasks within the planned scope of services is anticipated as follows:

- A draft of the QAPP and HASP is expected be submitted to IEPA for review within eight weeks of IEPA approval of this FSP.
- The non-concurrent sampling activities described in Tasks 4 and 5 of Section 4, above, are anticipated to be completed in 28 on-site working days for the Waterloo^{APS} program activities and 55 on-site working days for the sonic soil borings/sampling activities. These two field programs are anticipated to be performed on a 10-day on / 5-day off field work schedule. The Waterloo^{APS} program will be overseen by one ERM field technician, while the sonic soil borings/sampling work will be overseen by two ERM field technicians/geologists.
- Validation of twenty percent of groundwater and soil results is anticipated to be completed within one month of receipt of all Level 4 reports from the laboratory.
- It is anticipated that an updated CSM presentation will be available for Ameren and IEPA consideration within two months following receipt of all groundwater and soil sample results from the lab.
- Following receipt of the necessary containers of soil and water at the ISS bench study laboratory, and to allow for proper curing of the various soil/reagent blends, the ISS bench-scale tests using SPLP and LEAF may take approximately 29.5 weeks to complete before the report of ISS bench-scale studies is received.
- A draft RETS is expected to be submitted to Ameren for review within two months following receipt of all results from the labs, with finalization and submittal of the RETS to IEPA soon after.

The proposed project schedule may be affected by outside conditions including, but not limited to:

- Weather;
- Surface and subsurface Site conditions;
- Contractor availability;
- Regulatory approvals;
- Access agreements; and
- Utility clearance and location.

FIGURES



Legend

- Former MGP Boundary and Soil Restrictions (Christian Co. Parcel ID No. 17-13-27-331-005-00)
- Groundwater Restrictions Boundary

N

0 340 680
Feet

Figure 1
Site Location
Former CIPS MGP Site
Ameren Services
Taylorville, Illinois

Environmental Resources Management
www.erm.com

DRAWN BY: Jimmy Holcomb

FILE: M:\Projects\Ameren_Taylorsville\Maps\Figure 1 Site Location.mxd REVISED: 06/24/2022 SCALE: 1:4,000 when printed at 11x17

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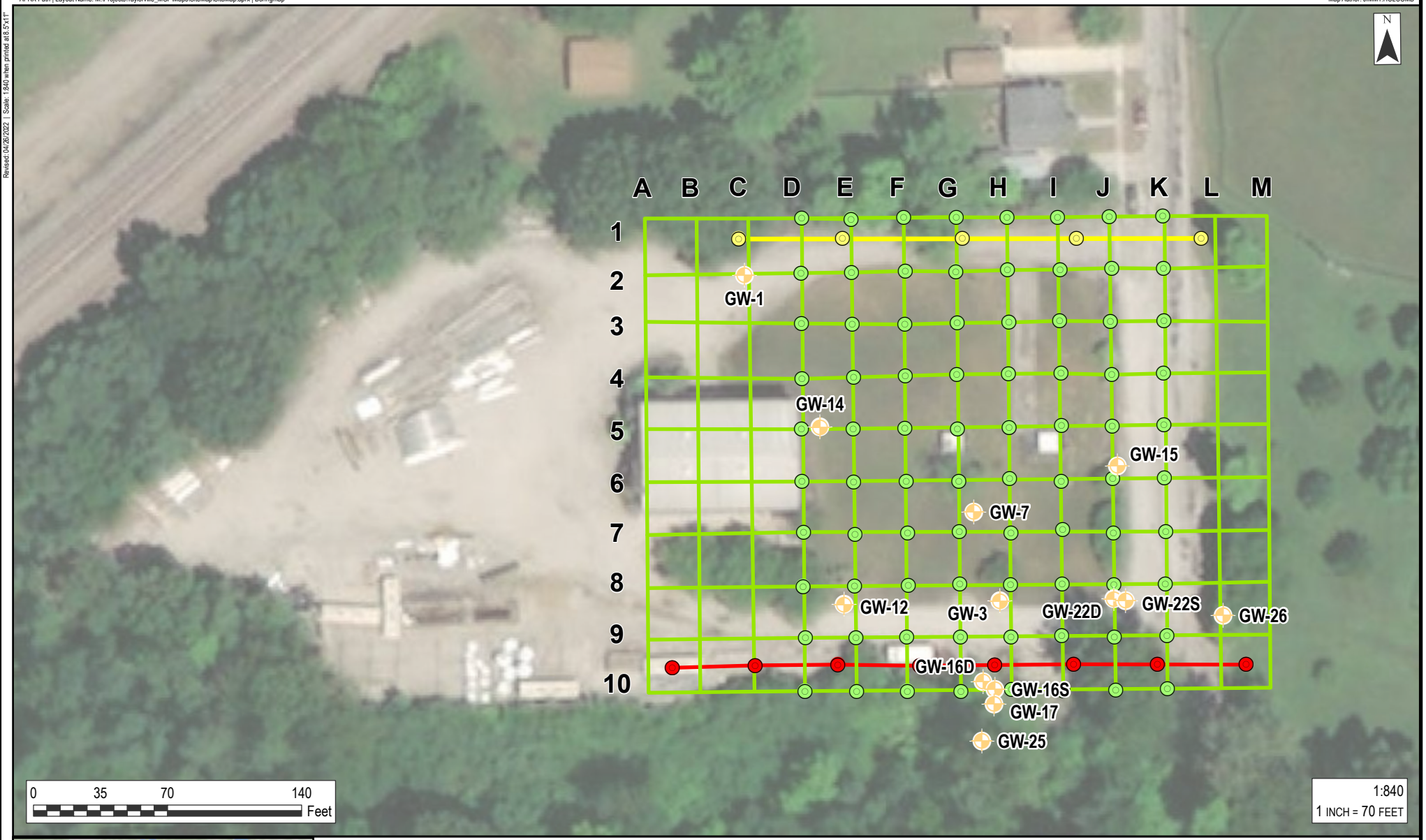
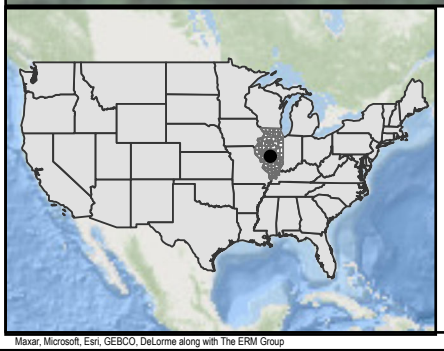
Map Author: JIMMY.HOLCOMB
Revised: 04/26/2022 | Scale: 1:840 when printed at 8.5"x11"





Legend

Proposed Locations

- Upgradient WaterlooAPS Location
- Downgradient WaterlooAPS Location
- Soil Boring Location
- North Transect
- South Transect
- Boring Grid

Existing Locations

- Existing Groundwater Monitoring Well

NOTES

1. Analyze upgradient and downgradient groundwater samples for ROD list of analytes
2. APS: Aquifer Profiling System

Figure 2

Proposed Site Delineation Sampling Locations
Former Taylorville MGP Site
917 South Webster Street
Taylorville, IL 62568

Environmental Resources Management, Inc.
www.erm.com
The business of sustainability
ERM

COORDINATE SYSTEM: NAD 1983 StatePlane Illinois West FIPS 1202 Feet

Overview Map
Unlabeled Wells are shown on map inset

GW-5
GW-8D
GW-6D
GW-8S
GW-6S
GW-11
GW-12
GW-21
GW-9D
GW-9S
GW-24
GW-23
GW-13D
GW-10
GW-13S

GW-1
Treatment Building
GW-14
GW-15
GW-7
GW-4R
GW-2
GW-3
GW-22S
GW-16S
GW-22D
GW-16D
GW-26
GW-17
GW-25

GW-18S
GW-18D
GW-102D
GW-102S

GW-19D
GW-19S

GW-101S

GW-103S
GW-103D

Seaman Estates Pond

GW-20

Legend

- Extraction Well
- Monitoring Wells to Keep
- IEPA Monitoring Wells to be Abandoned
- Monitoring Wells for Abandonment
- Former MGP Boundary and Soil Restrictions (Christian Co. Parcel ID No. 17-13-27-331-005-00)
- Groundwater Restrictions Boundary

N

0 130 260
Feet

Figure 3
Monitoring Well Locations & Draft Proposed Abandonment Plan
Former CIPS MGP Site
Ameren Services
Taylorville, Illinois

Environmental Resources Management
www.erm.com
ERM

TABLES

Table 1
ROD Analytes List, Remediation Objectives, and TekLab RLs/MDLs
Ameren Taylorville, IL MGP

	Groundwater					Soil					
Analyte	ROD Table 12 - Cleanup Objective (mg/L)	IL TACO Residential Remediation Objective (Class I) (mg/L)	EPA Tapwater RSL (THQ = 0.1) (mg/L)	Teklab RLs	Teklab MDLs	ROD Cleanup Objective (mg/Kg)	IL TACO Residential Remediation Objective (Class I) (mg/Kg)	EPA Residential Direct Contact RSL (THQ = 0.1) (mg/Kg)	EPA Region 5 PGW Risk-Based RSL (THQ = 0.1) (mg/Kg)	Teklab RLs	Teklab MDLs
PAHs/SVOCs (EPA Methods 8270SIM/8270C)											
Acenaphthene	0.42 [7]	0.42	0.053	0.0001	0.00007	-	570	360	0.55	0.0034	0.0010
Acenaphthylene	0.21	-	-	0.0001	0.00005	-	-	-	-	0.0034	0.0012
Anthracene	2.1	2.1	0.18	0.0003	0.0002	-	12000	1800	5.8	0.0034	0.0011
Benzo(a)anthracene	0.00013	0.00013	0.00003	0.0001	0.00007	-	2	1.1	0.011	0.01	0.0023
Benzo(a)pyrene	0.0002 [1]	0.0002	0.000025	0.0002	0.00011	-	8	0.11	0.029	0.0034	0.0014
Benzo(b)fluoranthene	0.00018	0.00018	0.00025	0.0001	0.00007	-	5	1.1	0.3	0.0034	0.0017
Benzo(g,h,i)perylene	0.21	-	-	0.0002	0.00012	-	-	-	-	0.0034	0.0013
Benzo(k)fluoranthene	0.00017	0.00017	0.0025	0.0001	0.00005	-	49	11	2.9	0.0034	0.001
Chrysene	0.0015	0.0015	0.025	0.0001	0.00005	-	160	110	9	0.0034	0.0013
Dibenzo(a,h)anthracene	0.0003	0.0003	0.000025	0.0002	0.00012	-	2	0.11	0.096	0.0034	0.0017
Fluoranthene	0.28 [7]	0.28	0.08	0.0003	0.00027	-	4300	240	8.9	0.0034	0.0019
Fluorene	0.28 [7]	0.28	0.029	0.0002	0.00017	-	560	240	0.54	0.0034	0.0012
Indeno(1,2,3-cd)pyrene	0.00043	0.00043	0.00025	0.0002	0.00016	-	14	1.1	0.98	0.0034	0.001
Phenanthrene	0.21	-	-	0.0006	0.00053	-	-	-	-	0.006	0.0043
Pyrene	0.21 [7]	0.21	0.012	0.0002	0.00018	-	4200	180	1.3	0.0034	0.0018
Bis(2-ethylhexyl)phthalate	0.006 [2, 8]	0.006	0.0056	0.006	0.00143	-	3600	39	1.3	0.067	0.0142
m,p-Cresol (3-,4-methylphenol)	0.35 [6]	-	0.14	0.01	0.00059	-	-	630	0.17	0.01	0.0033
o-Cresol (2-methlyphenol)	0.35 [6]	0.35	0.093	0.01	0.00054	-	15	320	0.075	0.0034	0.0018
Di-n-butyl phthalate	0.7	0.7	0.09	0.01	0.00083		2300	630	0.23	0.034	0.0067
VOCs (EPA Method 8260B)											
Benzene	0.005	0.005	0.00046	0.0005	0.00005	-	0.03	1.2	0.00023	0.001	0.00027
Toluene	1	1	0.11	0.002	0.0001	-	12	490	0.076	0.002	0.00035
Ethylbenzene	0.7	0.7	0.0015	0.002	0.0001	-	13	5.8	0.0017	0.002	0.00034
Xylenes, Total	10	10	0.019	0.004	0.00028	-	150	58	0.019	0.008	0.00138
Naphthalene	0.14 [3]	0.14	0.00012	0.005	0.00032	-	12	2	0.00038	0.005	0.00064
Bromoform	0.001 [4]	0.001	0.0033	0.002	0.00009	-	0.8	19	0.00087	0.005	0.00037
Methylene chloride	0.005 [5, 8]	0.005	0.011	0.002	0.00087	-	0.02	35	0.0027	0.010	0.00754
trans-1,2-DCE	0.1	0.1	0.0068	0.002	0.0001	-	0.7	7	0.0021	0.002	0.00018

Notes:
1 = ROD Cleanup Objective changed from 0.00023 mg/L to 0.0002 mg/L
2 = ROD Cleanup Objectve changed from 0.0027 mg/L to 0.006 mg/L
3 = ROD Cleanup Objectve changed from 0.025 mg/L to 0.14 mg/L
4 = ROD Cleanup Objectve changed from 0.0002 mg/L to 0.001 mg/L
5 = ROD Cleanup Objective changed from 0.0002 mg/L to 0.005 mg/L
6 = Per ROD, sum not to exceed 0.35 mg/L
7 = Per ROD, sum not to exceed 1.0 mg/L
8 = Per ROD, sum not to exceed 1.0 mg/L
TekLab RL exceeds ROD Objective
MGP = Manufactured Gas Plant
ROD - Record of Decision
IL TACO = Illinois EPA Tiered Approach to Corrective Action Objectives
PGW = Protection of Ground Water
RSL = Regional Screening Level
THQ = Target Hazard Quotient
PAH = Polyaromatic hydrocarbon
VOC = Volatile Organic Compound
SVOC - Semi-VOC
Mg/L = milligrams per liter
Mg/Kg = milligarms per kilogram
RL = Reporting Limit
MDL = Method Detection Limit

APPENDIX A STANDARD OPERATION PROCEDURE FOR THE WATERLOO^{APS} PROGRAM

STANDARD OPERATING PROCEDURE

CTS-6.43.8

Operation of the Waterloo Advanced Profiling System

SOP Number: CTS-6.43.8 Date Issued: 4/19/18
Revision Number: 8 Date of Revision: 1/13/20

1.0 OBJECTIVE

Groundwater profiling is conducted to assess the distribution of contaminants and hydrogeologic conditions of a given aquifer at a scale much smaller (several centimeters) than the conventional monitoring well system. This method uses the Waterloo Advanced Profiling System (Waterloo^{APS,} or APS) to collect groundwater samples at multiple discrete depths as the profiler is advanced vertically through unconsolidated, saturated porous media at a given location. The Waterloo^{APS} is a direct push tool used to collect samples and other data at multiple depths within a single hole without withdrawing and decontaminating the tool between samples. The profiling system can generate the following data in addition to the collection of groundwater samples for analysis:

1) Index of Hydraulic Conductivity (I_k)
2) Depth to potentiometric surface (water table)
3) Specific conductance
4) pH
5) Dissolved oxygen
6) Oxidation/reduction potential
7) Temperature

The Index of Hydraulic Conductivity (I_k) provides a real-time indication of the relative changes in hydraulic conductivity which allows for assessment of the hydro-stratigraphy across the site and depths to collect groundwater samples.

There are two types of profiler configurations: 1) a peristaltic pump configuration with a single downhole stainless steel tube and 2) a gas drive pump configuration with three downhole stainless steel tubes.

The peristaltic pump can be used when the depth to water is less than the suction limit (typically around 25 feet below ground surface). The gas drive pump system must be used when the depth to water is greater than 25 feet below ground surface (ft bgs)..

1.1 POLICIES

- An experienced, qualified Cascade Technical Services (CTS) staff member will train all CTS staff using this SOP.
- CTS staff will read the most current version of this SOP and other appropriate SOPs prior to starting fieldwork.

2.0 TABLE OF CONTENTS

3.0 DEFINITIONS

KPRO – Hydraulic Conductivity Profiling

APS – Waterloo^{APS}

I_k – Index of Hydraulic Conductivity

4.0 SAFETY CONSIDERATIONS

The corporate Health and Safety Plan and the Site Health and Safety Plan specify the procedures to be followed and equipment to be used during site activities. The following is a brief and general overview of safety issues.

- Potential Safety Issues include:
    - Noise Levels
    - Heavy equipment (drill rigs or direct push rigs) hazards
    - Overhead utility hazards
    - Underground utility hazards
    - Traffic/ motor vehicle hazards
    - Hazards associated with exposure to various chemicals
    - Slip, trip and fall hazards
    - Pinch point hazards
    - Compressed gas hazards
    - Fire hazards from hot work (e.g., grinding) or open flames (torpedo heaters, brush burners, propane torch)
    - Gasoline and diesel hazards (filling trucks and generator)
- CTS staff and others under contract with CTS that may be present on-site will wear a hardhat whenever overhead hazards are present or when working near the drill rig.
- Appropriate eye protection should be worn
- Hearing protection shall be worn whenever the drill rig is actively advancing profiling equipment.
- Steel toed boots will be worn.
- Nitrile gloves shall be worn when handling contaminated water or soil.
- CTS staff will read the site specific health and safety plan (HASP) prior to beginning a project.

- Additional personal protective equipment shall be worn in accordance to the site specific health and safety plan.

5.0 PROCEDURE

5.1 Equipment

The Waterloo^{APS} Equipment Checklist is included as Attachment 1. This list includes the equipment used for the peristaltic pump configuration and the gas drive pump configuration.

5.1.1 Drive Platform and Related Equipment

A Geoprobe is the preferred method for advancing the APS tooling, although any device that vibrates, hammers, or pushes drill tools can be used to advance the APS tooling. The type of drive platform selected is a function of the type of material to be sampled and the depth to which the APS tooling needs to be advanced. Typical drive platforms include a Geoprobe 66 or 78 series probe rigs or similar. A Geoprobe 80 or 32 series (non-sonic) or equivalent is recommended to drive the 2.25” tip and rods. Field staff must ensure that the proper adaptors and subassemblies are provided for the particular drive platform to be used prior to taking to the field.

5.1.2 APS Sampling Tip

This system is comprised of a 1.75 or 2.25-inch diameter tip that is attached to 5’ long 1.75 or 2.25-inch Geoprobe or quick thread style drill rod. The 1.75-inch rod is the standard rod size that CTS uses for the APS.

1.75”, 2.25" APS Profiling Tips and 1.75”, 2.25” APS/EC Tips

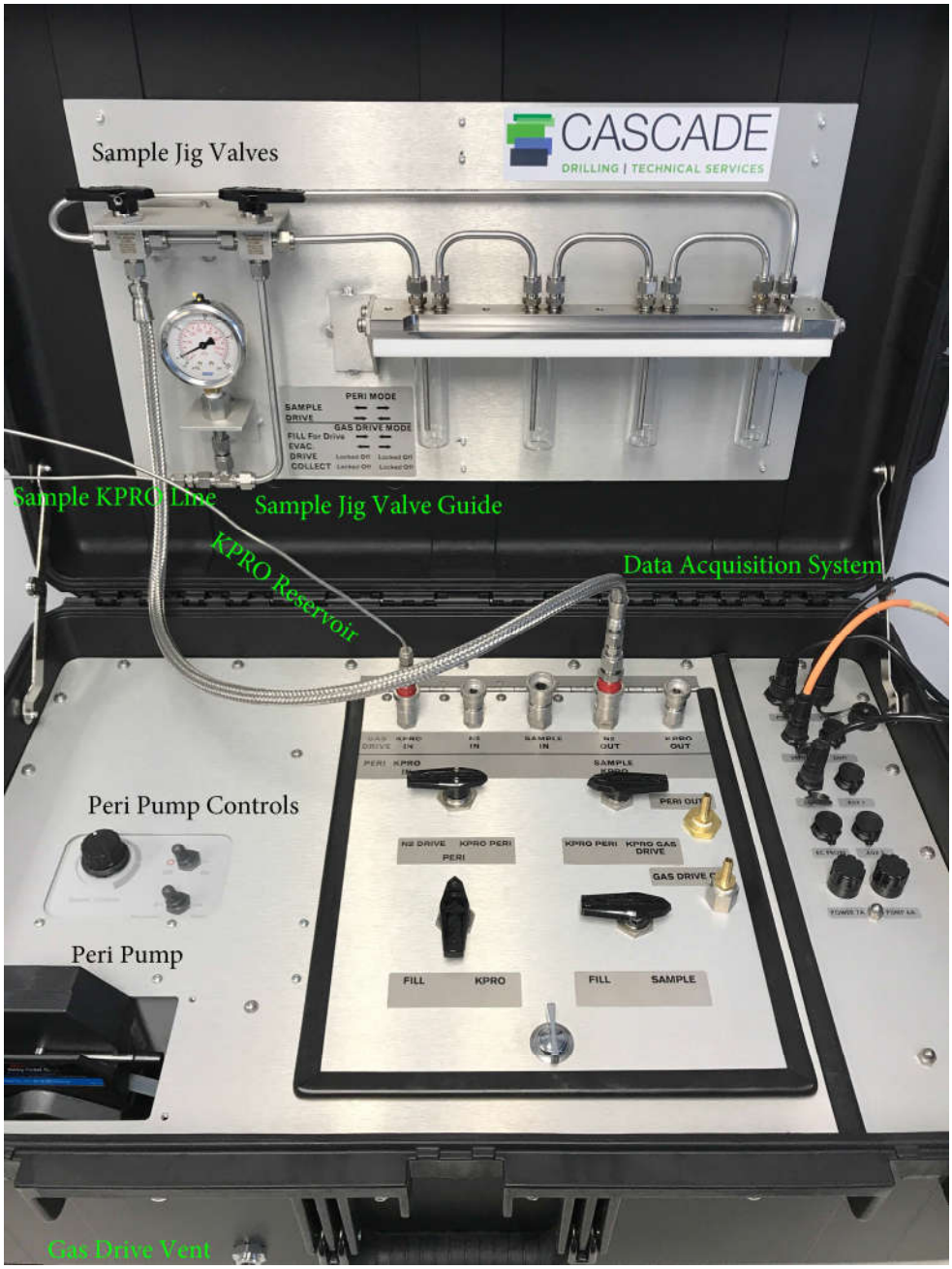
The 1.75-inch sampling tips contains 4 removable plates that allow groundwater to pass into the tip and for water to flow out the tip during tooling advancement and I_k collection. The 2.25-inch tip contains 6 plates. The 1.75" EC tip contains 2 plates and the 2.25" EC tip contains 5 plates. Groundwater samples are collected using either a peristaltic pump or a gas-drive system (see below for a schematic of these two configurations).

5.1.3 Volatile Organic Analysis (VOA) Vial Filling System

The Vial Filling System (or sample jig) contains four vials connected in-series using stainless steel tubing and specially designed vial holders. The system is designed to mitigate loss of volatile organic compounds (VOCs) by ensuring that no exposure to the atmosphere occurs while the sample is collected. The vial filling system has been incorporated into the APS box. Although the APS box utilizes a peristaltic pump, the sample vials are located on the *down hole side of the pump* so that groundwater is pumped through the vials before going through the head of the pump.

5.1.4 Waterloo^{APS} Data Acquisition System

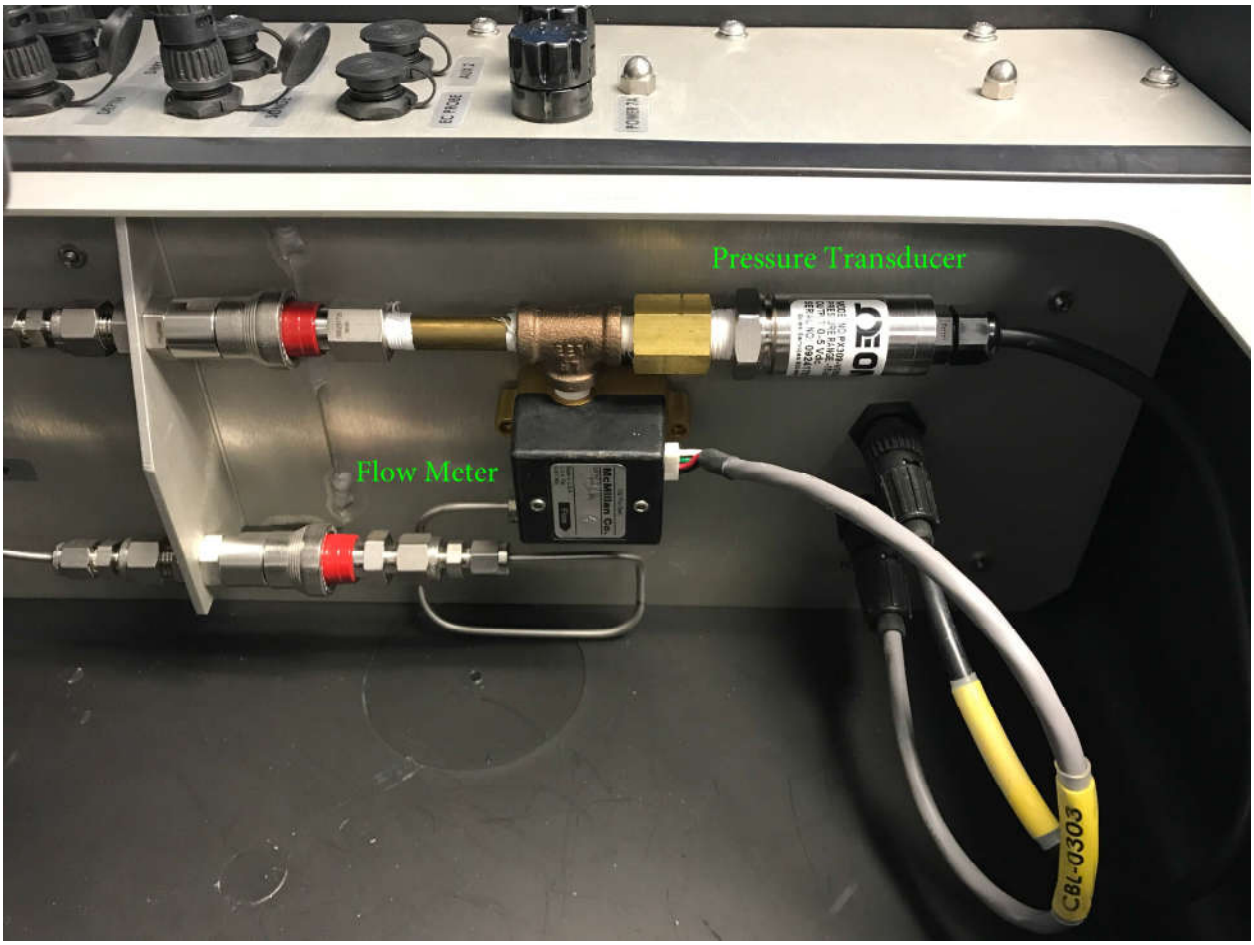
The APS box consists of several valves, an electronic data acquisition system, flow meter, pressure transducer, peristaltic pump and vial filling system (referred to as the sample jig). The valves can be oriented in a variety of ways in order to send water down and out of the APS tip or to collect a groundwater sample in both peristaltic and gas drive modes. The data acquisition system has 6 inputs for the string pot, down hole pressure transducer (DHPT), water quality sonde and three auxiliary inputs (for Ion Selective Electrode or Electrical Conductivity probe). The following photo illustrates the box setup in peristaltic mode:



APS Box in Peristaltic Mode

The APS Data Acquisition System consists of the following components:

- Cable ports for Power, USB, String pot, and Sonde
- Cables for USB/data, string pot, DHPT and power supply
- Hydrolab Quanta Water Quality Sonde with 4 sensors (Dissolved Oxygen, Specific Conductance, pH and ORP).
- McMillan Model 102-4 (20-200mL/min) Flow Sensor
- Omega Model PX309-V050G5V (0-50 psi) Pressure Transducer
- Unimeasure Model HXE-PA-100-S10-N1S-1BC String Potentiometer
- GeoTech Model Geopump Peristaltic Pump
- Labview APS Software Program
- Data acquisition computer (Panasonic Toughbook or other)
- USB mass storage unit for data backup (thumb drive)
- Use, Maintenance and Calibration Log



Flow Meter and Pressure Transducer

The following photo illustrates how the entire system looks when it is set up in the truck:

5.1.5 Sonde Water Quality Monitoring Systems

The APS system has been designed to exclusively use the Hydrolab Quanta multiparameter sonde. Specific instruction regarding the use, calibration and maintenance of Hydrolab Quanta can be found in CTS SOP 5.32.0. When coupled with the APS, calibrations and verifications are performed weekly rather than daily. If required a verification check may be performed at the start and / or finish of a field day or as needed, however, since these systems are in situ and used to verify three readings prior to sampling, full calibrations are not performed on a daily basis. All maintenance and calibrations are recorded in the dedicated Use, Maintenance and Calibration Log for each sonde.

Calibration solutions are assigned a lot number by the manufacturer and Certificates of Analyses are provided for each lot number. The lot number must be recorded in the Use, Maintenance, and Calibration log for each sonde for each calibration. The procedure for archiving the Certificates of Analysis are included in Section 6.

The Hydrolab Quanta Water Quality Monitoring System consists of the following components:

- Use, Maintenance and Calibration Log
- pH/ORP and Standard Reference Probe
- Specific Conductance Probe
- Temperature Probe
- Dissolved Oxygen Probe
- Circulator
- Depth Probe
- Custom Made Flow-Through Cell.

5.1.6 Record Keeping Materials

- Use, Maintenance and Calibration Log (dedicated to APS box).
- Groundwater Profiling Log (paper field log).
- Pens
- USB mass storage unit

5.2 General Procedure

The procedure for operating the APS in both peristaltic pump mode and the gas drive mode consists of 6 main steps:

1. Set up of the APS box and associated equipment
2. Tip / Pump assembly
3. Adding rod and tubing
4. Advancing the tool and acquiring I_k data
5. Purging water from the system and obtaining physico-chemical data from the sonde.
6. Collecting samples and recording data.

5.3 APS Box Set Up

5.3.1 Set up common to both Peristaltic and Gas Drive Modes

1. Open the APS box and plug in the power cable.
2. Plug the USB cable into the APS box and the computer.

3. Plug one end of the string potentiometer (string pot) cable into the “Depth” receptor on the APS box and attach the other end to the string pot.
4. Unpack the water quality sonde from its case. Detach the calibration cup and attach the flow through cell. Plug the communication cable and into the “Sonde” receptor on the APS box. Connect a length of poly tubing to the APS box effluent (either Peri Out or Gas Drive Out) and the other to the bottom connection on the flow through cell. Connect a second length of tubing to the upper fitting on the flow cell. The other end of this tubing will go into a graduated cylinder.
5. Connect a male swage quick connect to a five foot length of stainless steel tubing and plug it into the female quick connect labeled “KPRO IN” on the APS box. Connect the other end to the “out” port on the stainless steel reservoir using a quick connect fitting (black band).
6. Fill the stainless steel reservoir with analyte free water (distilled or spring water). Seal the top and close the pressure release valve.
7. All analyte free water used to fill the reservoir and for equipment blanks needs to be assigned a lot number. Each time a supply of water is purchased a new lot number is to be assigned to all containers purchased at that time. The lot number, date of purchase, manufacturer and place of purchase need to be recorded on the field form, and the lot number is to be written on all containers from that lot. When filling the reservoir the date and lot number of the water should be recorded on the field form.

5.3.2 Set up specific to Peristaltic Mode

1. Attach a low-pressure regulator (0-60 psi) to the nitrogen cylinder.
2. Attach a five-foot length of tubing to the “In” (white) port on the stainless steel reservoir using a quick connect fitting. Attach the other end to the outlet port on the nitrogen tank regulator. Open the valve on the nitrogen cylinder and set the regulator to 30 psi.
3. Attach a 20-foot length of stainless steel tubing to the inlet side of the SwageLok® fitting at the bottom of the pressure/vacuum gauge on the top panel. Tighten firmly. This line is the KPRO / sample line and is referred to as the harness.
4. On the APS box plug the male quick connect that is attached to the sample jig to the “KPRO Out” female quick connect on the APS box (Second from the right).

5.3.3 Set up specific to Gas Drive Mode

1. The gas drive system utilizes two regulators attached to the cylinder by a “T” adaptor. One of the regulators is low pressure (0-60 psi) and the other is high pressure (0-200 psi).
2. Attach a five-foot length of tubing to the “In” (white) port on the stainless steel reservoir using a quick connect fitting. Attach the other end to the outlet port on the low-pressure nitrogen tank regulator. Open the valve on the nitrogen cylinder and set the regulator to 30 psi.
3. Connect a five-foot length of tubing to the high pressure regulator. Attach a male swage quick connect to the other end and insert into the “N2 In” female quick connect on the APS box. Set the regulator to 60 psi.
4. On the APS box, plug the male quick connect that is attached to the sample jig to the “Sample In” female quick connect on the APS box (middle connection).
5. The harness for gas drive mode consists of three stainless steel tubes which are labeled with colored zip ties. Plug the KPRO line male quick connect (blue) into the “KPRO Out” quick connect on the APS box and plug the Nitrogen line (red) quick connect into the “N2 Out” quick connect. The Sample line (yellow) does not have a quick connect. This line connects to the 1/8” Swage fitting on the pressure gauge of the sample jig.
6. Attach a one end of a length of poly tubing (FEP or other) to the “Peri Out” port located at the bottom right of the APS box and put the other end into a plastic 1L graduated cylinder. Attach a similar length of tubing to the “Gas Drive Out” port and connect this to the bottom port on the flow cell of the water quality sonde.
7. Inside each APS box is a vent tube, which is a length of poly tubing attached to a quick connect that is used to vent excess nitrogen during the sampling process. Connect this tube to the port located on the outside front of the APS box.

5.4 Tip and Pump Assembly for Peristaltic and Gas Drive Modes

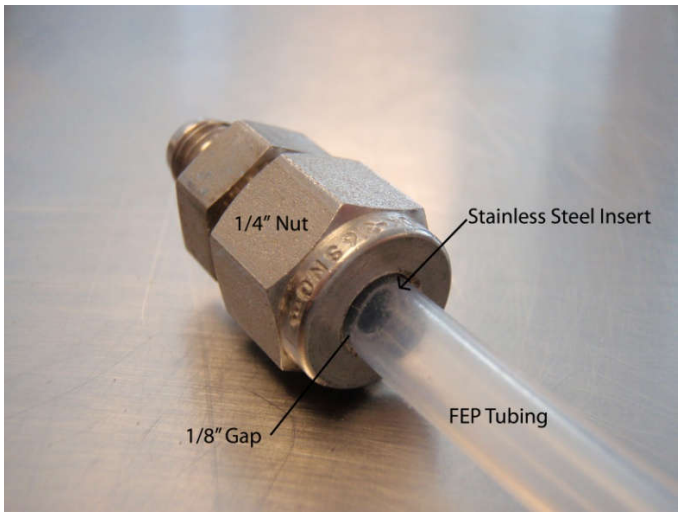
The 1.75-inch APS tip has 4 plates and the 2.25-inch tip has 6. Behind the plate is a removable mesh screen. The size of the inner screen can be changed to prevent fine-grained sediment from entering the tip or to maximize flow. Screen mesh sizes range from 40 (coarse) to 120 (fine). 80 size screens are usually the default screen size and can be changed depending on site geology.

5.4.1 Peristaltic Mode

A ¼-inch outside diameter fluorinated ethylene propylene, or FEP, tube is fitted into the threaded hole in the center of the profiler tip by means of a ¼- inch NPT

thread to ¼- inch SwageLok® fitting. The following procedure will outline the procedure for assembling the tip and adding rod and drive hardware.

1. Wrap the NPT threads of the ¼- inch NPT to ¼- inch SwageLok® fitting with Teflon tape and thread into the tip. With the tip locked into a vise, tighten the fitting as tight as you can with a 9/16" wrench by hand. Most APS tips already have this fitting installed and if so, there is no need to remove it unless the outer threads are damaged.
2. Each tip has plates that are attached to the tip via T-25 torx plus screws. Under each plate is a mesh screen (40-120 slot). The smaller the slot size the larger the opening is in the screen. The most common screen size used is 80 slot. First place the mesh screen into the space for the plate making sure to line up the screw holes. Put on the plate and tighten the screws as tight as possible using only a T handle screwdriver or similar tool. Do not use an impact driver as it will over tighten the screws. If you are using a tip that already has the plates installed, double check that the screws are tight.
3. Cut a 6-8" length of FEP tubing and insert a steel barb into each end.
4. For this step it is best to lock the tip into a vise. On the end of the FEP that will attach to the tip, slide a ¼- inch SwageLok® nut onto the FEP and then slide on a ¼" nylon ferrule. Insert the end of the FEP tubing into the ¼" fitting on the tip making sure that it is inserted as far as it can go. Using a $^{9}/_{16}$" wrench, tighten the ¼" nut until there is approximately $^{1}/_{8}$" vertical gap between the top of the steel insert and the nut as shown in the following photo:



5. For the other end of the FEP, slide on another ¼" SwageLok® nut and ¼" nylon ferrule. Insert the end of the FEP into a ¼ "to $^{1}/_{8}$" SwageLok®

reducer. Using a ½" and $^{9}/_{16}$" wrench, tighten the nut as before. Be careful to keep the FEP seated tightly into the fitting while tightening. A completed tip can be seen in the following photo:

6. Gently pull on the reducer after the fittings have been attached to make sure that it is attached properly. If the fittings are over tight then the FEP can snap; if they are too loose than the FEP can pull out of the fitting.
7. A five-foot length of 1.75-inch diameter rod is slipped over the stainless steel tubing with the pin end up and is threaded into the APS tip. If the thread style on the tip (Geoprobe) is the same as that on the rods the tip can be directly screwed into the rod. There may be times when quick thread rod (ECT style) rods are used. In this case an adaptor needs to be used. This union should also be "stepped on" using pipe wrenches to ensure that it does not vibrate loose.
8. The slotted drive cap is then placed over the threads and fitted into the bottom of the hammer on the drive platform. There are two types of slotted caps, one for ECT style rods and one for Geoprobe style rods.

5.4.2 Gas Drive Mode

1. Wrap the NPT threads of the ¼- inch NPT thread to ¼- inch SwageLok® fitting with Teflon tape and thread into the tip. With the tip locked into a vise, tighten the fitting as tight as you can with a $^{9}/_{16}$" wrench by hand. Most APS tips already have this fitting installed and if so, there is no need to remove it.
2. Each tip has plates that are attached to the tip via T-25 torx plus screws. Under each plate is a mesh screen (40-120 slot). The smaller the slot size the larger the opening is in the screen. The most common screen size used is 80 slot. First place the mesh screen into the space for the plate making sure to line up the screw holes. Put on the plate and tighten the screws as tight as possible using only a T-handle screwdriver or similar tool. Do not use an impact driver as it will over tighten the screws.

If you are using a tip that already has the plates installed, double check that the screws are tight.

3. Instead of FEP tubing, the gas drive system utilizes a ¼" stainless steel tube ("piston"). This piston needs to be 5.5"-6" in length. To attach the piston, slip a ¼" swage nut and ¼" steel ferrule onto one end of the piston. Insert this end into the ¼" fitting on the tip. It is best to have the tip locked in a vise for this step. Use a $^{9}/_{16}$" wrench and tighten the nut as tight as you can.
4. The gas drive pump body has three parts, the bottom (which has the KPRO line), the middle and top (which has the sample and nitrogen lines). Look into the narrow part of the pump bottom from the bottom. The piston on the tip will eventually be inserted into this end of the pump. There should be two very small rubber o-rings (size 010) seated into two slots. If they are present, it is a good idea to replace them. If the o-rings get worn or dry out you will not get a proper seal between the piston and pump.
5. Remove the O-rings with an angled pick and discard. Rinse out the slots with water. Replace the O-rings using the same pick.
6. Place an O-ring (size 115) at the base of the threads of the top and bottom pump pieces and wrap the threads with Teflon® tape. One or two wraps is sufficient.
7. Trim a reed valve and place it onto the stub on the top of the pump bottom. In order for the reed valve to fit inside the middle pump piece, the flange of the valve must be trimmed.
8. Thread the middle pump body onto the top and bottom pump pieces. Lock the middle of the pump into a vise and tighten the top and bottom pump pieces with a $^{9}/_{16}$" open ended wrench until tight. The O-rings should squeeze out of the joint slightly.
9. Slide the plastic bushing and spring over the three stainless steel tubes so it rests snug on the top of the pump. Make sure that the KPRO line is located into the slot on the bushing.
10. The pump housing is comprised of three pieces: the middle 2.4-foot section of rod (with female ECT style threads on both ends), the bottom sub which has female Geoprobe threads to connect to the tip and male ECT style threads to go into the housing, and the top sub which has male ECT style threads to go into the housing and either male ECT or Geoprobe threads to connect to the rod. Insert the bottom spring into one end of the middle pump housing. Apply Teflon tape to the male

threads on all of the pump housing pieces as well as the APS tip and first drill rod. This will prevent silt from migrating into the pump housing. Screw in the bottom housing piece so that the extended end is inside the pump. Make sure that the spring is at this end of the pump. Insert the pump into the housing. Screw on the top housing piece.

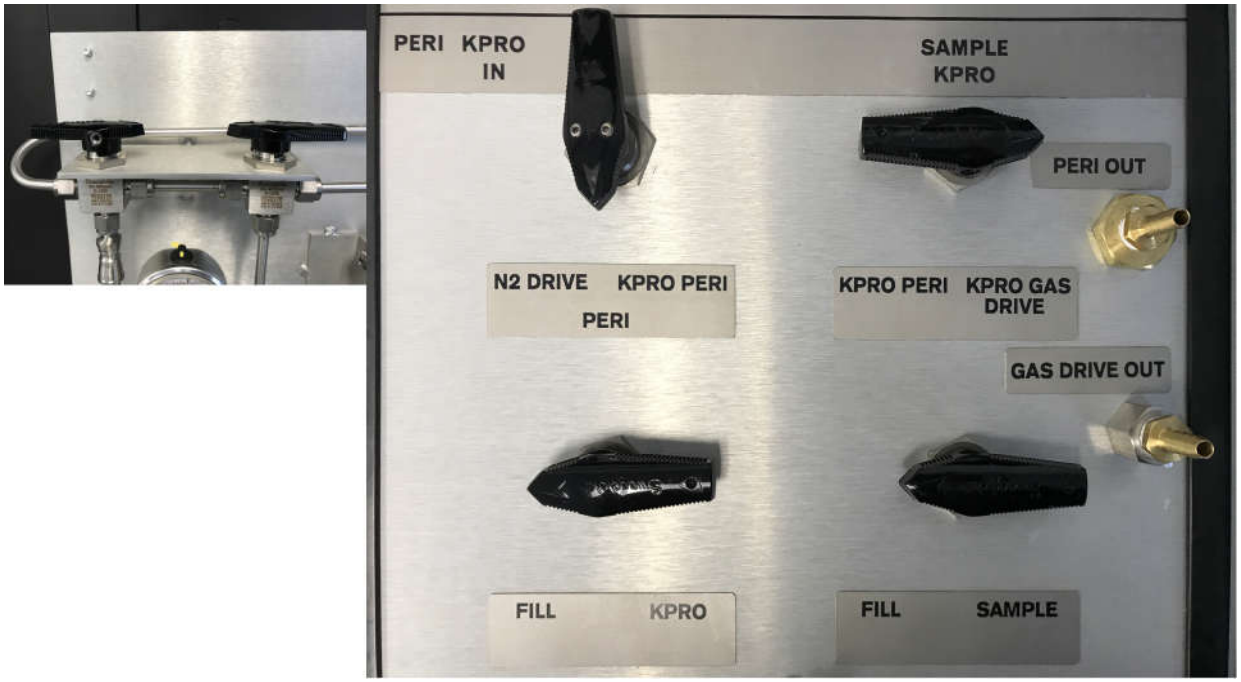
11. Take the APS tip and slide the ¼-inch stainless steel tube up into the receptacle in the pump bottom. Screw the tip onto the pump housing.

12. With the pump in a vertical position and the tip on the ground, grasp the three stainless steel lines and push them down. You should feel the springs move up and down smoothly. If they don't, the pump must be taken out of the housing and checked. It is very important that the springs are free to move. If they cannot, the vibration of the hammer will damage the pump.

13. **Pressure testing the Gas Drive Pump:** The pump must be pressure tested before it is used to make sure that the O-rings and the reed valve have been installed properly. It is usually a good idea to pressure test the pump after collecting the equipment blank or decontaminating the APS box since the pump is attached and full of water. The following steps will lead you through this:

    a. Connect the pump to the tubing harness (all three tubes). You will notice that the three lines coming out of the pump are at three different lengths. The difference in length is the only way to be able to differentiate between them. The KPRO line is the longest, the nitrogen line is the shortest and the sample line is in the middle.

    b. Arrange the valves according to the following photo and turn on the peristaltic pump to start filling the pump:



c. When a steady stream of water is flowing out of the Peri Out tubing on the APS box then the pump is full. Turn the two valves on the sample jig so that they are closed (facing the back of the box). Turn the bottom left valve 90 degrees to shut off the flow. Turn the top left valve to N2 Drive. Turn off the peristaltic pump. The pressure on the gauge will rise to where it is set on the regulator. Make sure the pressure is set to around 60-100 psi or the expected working pressure.

d. Disconnect the N2 Out quick connect on the APS box and watch the pressure gauge. If the needle on the gauge is steady, then the pump is holding pressure. **Note**: The pressure may drop slightly initially, but if it holds afterwards, it is working properly. If the pressure continues to drop then there is a leak. Check that all the fittings on the harness/pump are tight and refill and pressurize the pump. If that does not work, there is a leak in the pump itself (either an O-ring or reed valve) or possibly there is a leaky valve in the APS box.

e. **Testing the Bottom O-rings.** If there is not a tight seal between the small O-rings at the bottom of the pump and the piston, KPRO water will not be able to flow into the tip, which will result in

inaccurate I_K data, sampling of the water inside of the drilling rods and a clogged tip.

To determine if there is a leak: check for air bubbles flowing through the vials while collecting the equipment blank. Double check that all of the fittings on the harness, APS box and pump are tight. Double check that the VOA vials are tight in the sample jig. If there are still bubbles then the small O-rings in the bottom of the pump need to be checked. Refer to section 4.9.3 on equipment blank procedures.

14. Add a 20-foot length of stainless steel tubing to each tube fitting leading from the pump.
15. Slide a 5' drill rod over the stainless steel tubing and screw it into the pump.
16. Tighten all joints by firmly by standing on the pipe wrench. To do this put one pipe wrench so that it is resting on the ground. Place the middle of the pump into the wrench. Put the other wrench on the tip and stand on it, making sure that the other end of the rod is weighted down (have a helper stand on it). This will tighten the tip and the bottom pump housing piece. Repeat for the top of the pump and rod.
17. The slotted drive cap is then placed over the threads with the three pieces of stainless steel tubing protruding through the center of the drive cap and fitted into the bottom of the hammer on the drive platform. There are two types of slotted caps, one for ECT style rods and one for Geoprobe style rods.

5.5 APS Software Calibration and Startup

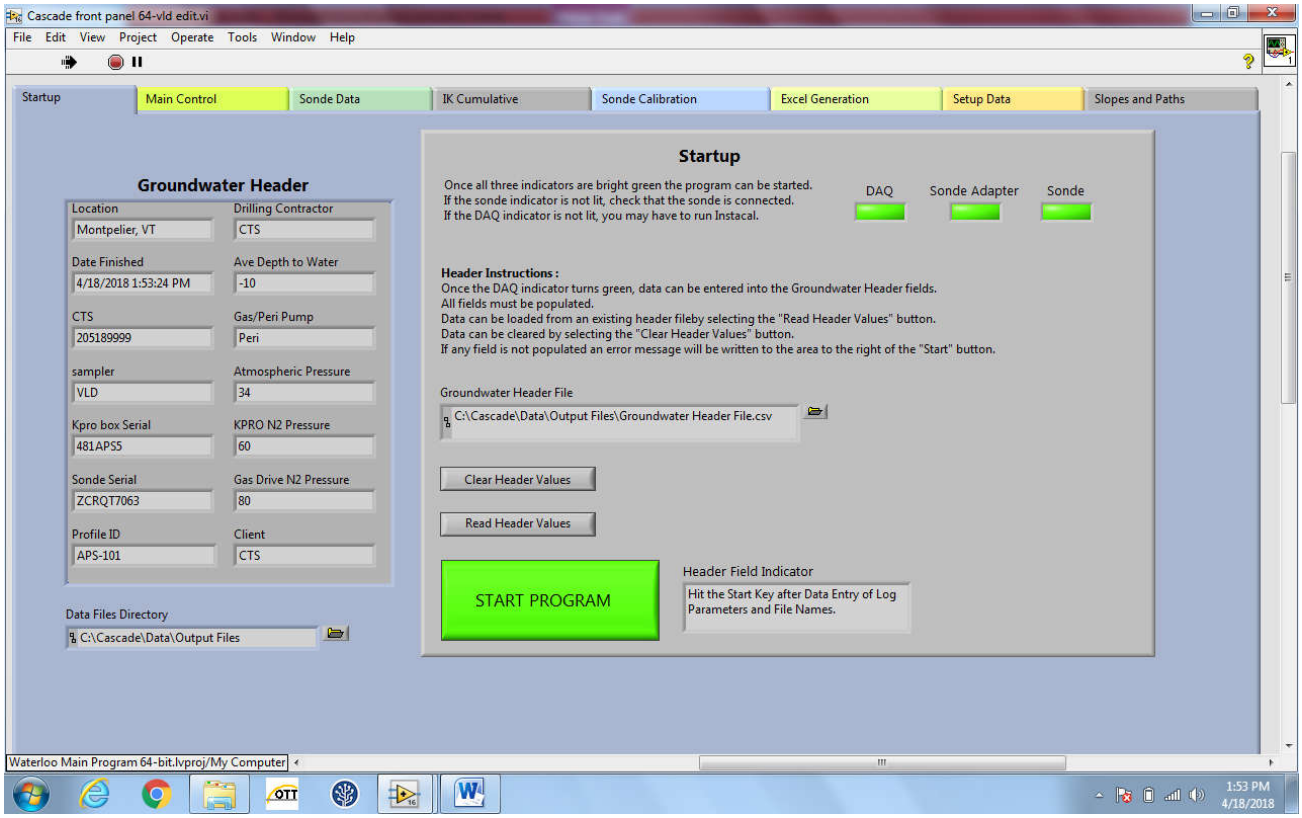
5.5.1 Calibration

The APS box should be calibrated at the beginning of a new project and once weekly (or every 5 days if there is a longer shift). If an individual sensor or entire APS box is replaced, then there should be a recalibration. The calibration is saved on the field computer, so if the APS box was calibrated with a different computer then it needs to be recalibrated.

1. At this point the computer should be plugged in and booted up. If not, do so now.
2. Locate and start the Instacal program. After the program starts, select "OK" twice. Instacal will discover the data acquisition hardware in the APS box.

Instacal must be run when an APS box and computer have not been used with each together.

3. Find the APS program executable shortcut located on the desktop. If there is no shortcut, the executable can be found in the C:\Program Files\Waterloo folder. A screenshot of the startup screen of the software is included below:



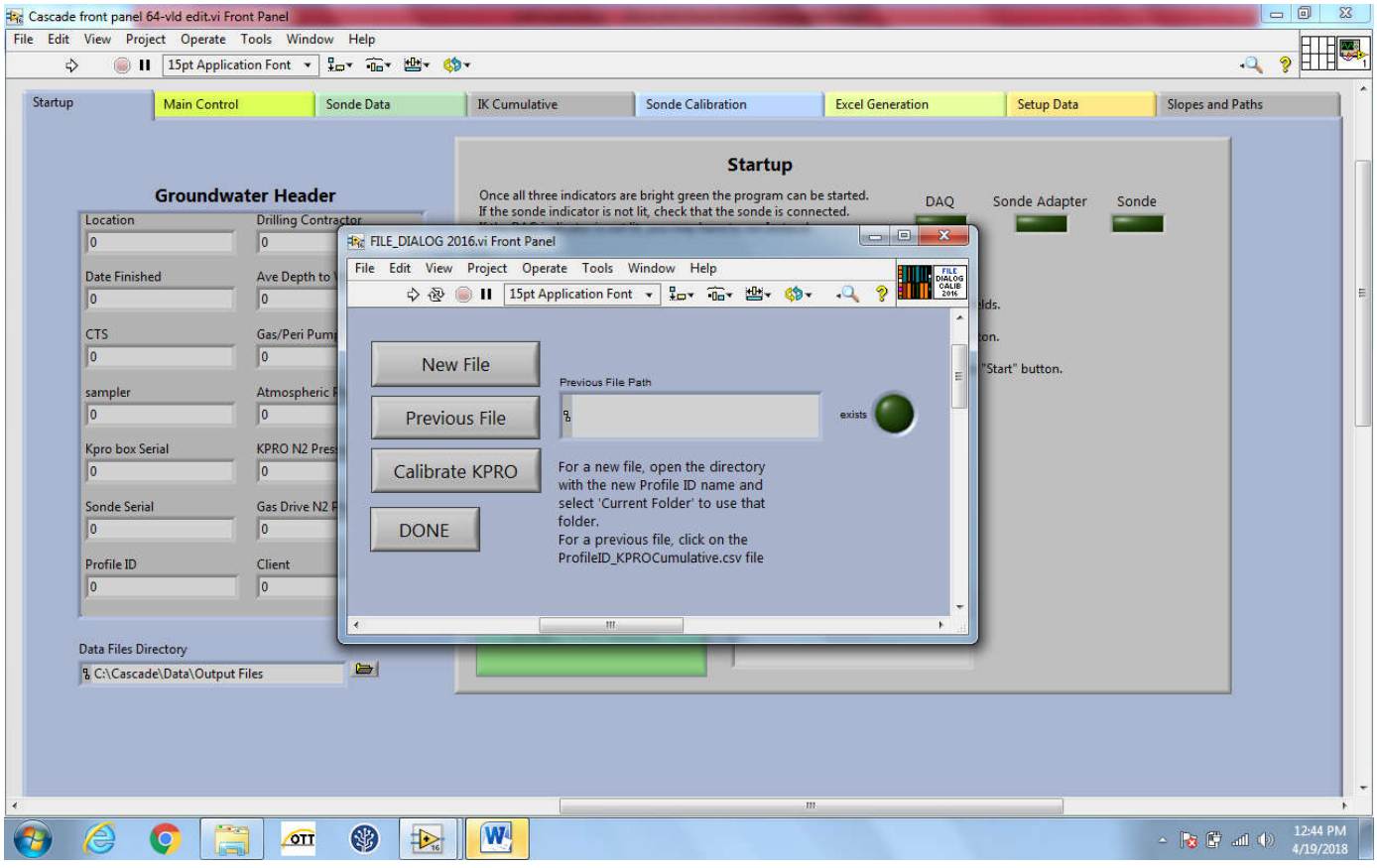
APS Software

4. As soon as the executable opens, the software will connect to the APS box and sonde automatically. Wait for the 3 indicators in top right-hand corner to change from gray to green (it can take 30 seconds). If any of the three indicators do not change to green, then there is a problem – most likely the APS box is not powered up, the sonde is not connected to the APS box or the data cable is not plugged in to the computer. It is possible to run the software without the sonde but it will not work if it is not connected to the APS box.

5. The Labview software is organized into a series of tabs. When the software is opened, the “Startup” tab is enabled. Populate every box in the Groundwater Header section. The program will not start otherwise. You can

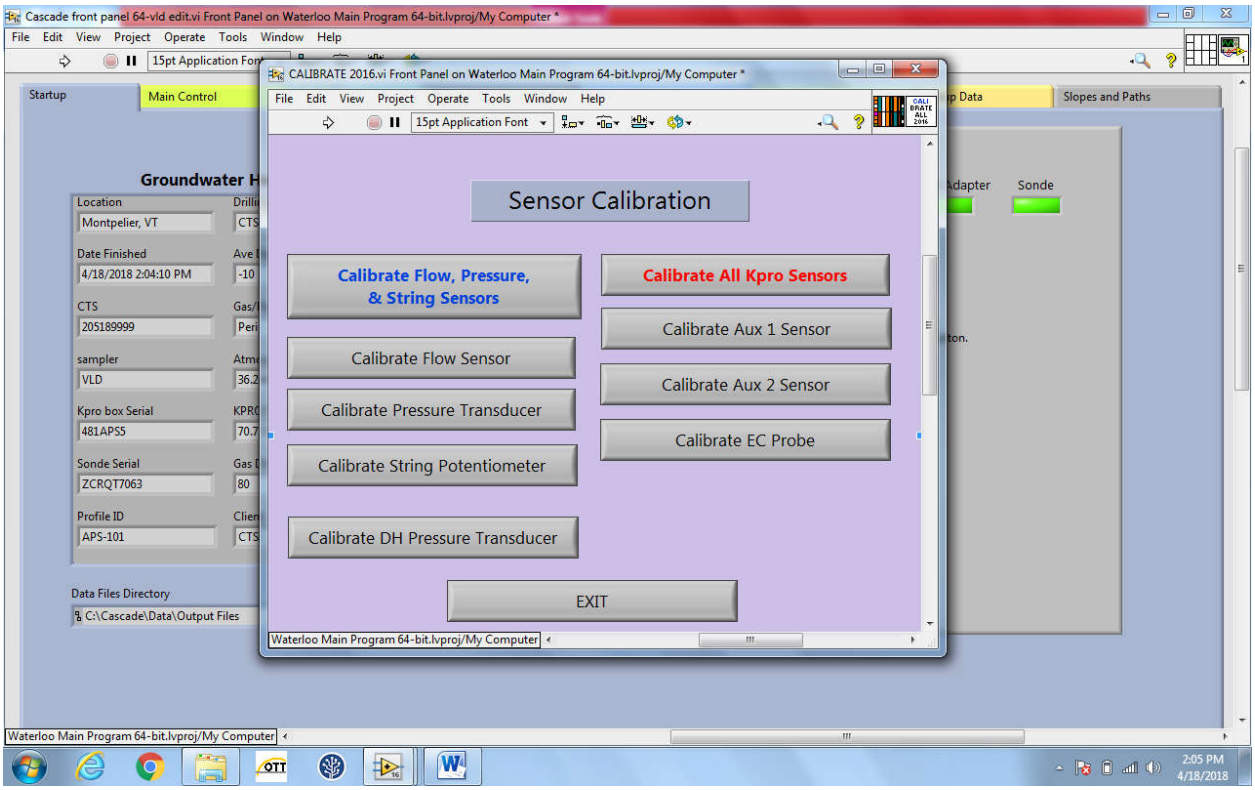
also select the “Read Groundwater Header File” button to populate the section with previously used data.

6. The APS software now needs to be initialized by clicking on the “Start Program” button. Even though the executable is running, the software will not begin the process of initialization and data collection until it is started. If any of the fields in the Groundwater Header are not complete, an error message will be displayed to the right of the “Start Program” button.
7. A window opens and prompts you to enter the Profile ID. The text box will contain the value that was entered in the Groundwater Header. Enter a new Profile ID or leave the value unchanged.
8. The next screen is prompts you to select New file, Previous File or Calibrate KPRO.



9. Select Calibrate KPRO. Make sure that there is a 20’ foot length of stainless steel tubing attached to the APS box when calibrating. This will ensure accurate calibration of the flow and pressure. Using a shorter or longer piece of tubing can adversely affect the validity of the calibration.

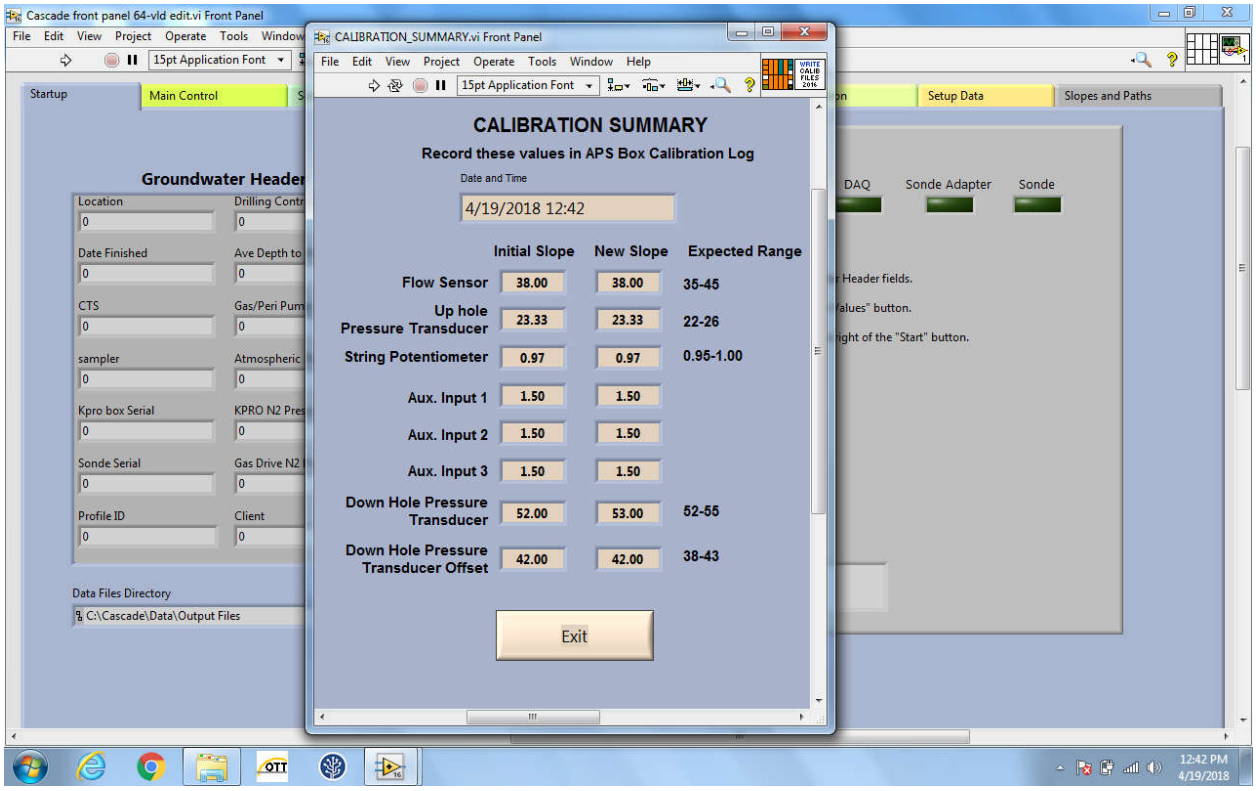
10. The next screen allows you to calibrate all the sensors or each individual sensor (string pot, flow, pressure, DHPT).



Calibration

11. Select the “Calibrate Flow, Pressure, & String Sensors” or the button corresponding to each individual sensor (if you do not need to calibrate all the sensors). The program will then lead you through the calibration. Follow the directions on the screen to calibrate the flow, pressure and string pot. After calibration is complete, if you feel that one or more of the sensors was not calibrated correctly, you can repeat the entire calibration or just repeat the calibration for an individual sensor. If you decide to recalibrate one or all the sensors, be aware that the program will use the original slopes and not the newly calibrated slopes for the recalibration.

12. After calibration, a summary screen will open.



Calibration Summary

13. Record the initial and new slopes in the Use, Maintenance and Calibration Log for the APS box you are using. Slope values should be within the following ranger: string pot – 0.97, flow 35-42, and up hole pressure 22-28. If the slopes deviate from these values, the sensors should be recalibrated. If that does not work, you may need to change out the pressure transducer, flow meter or string pot. Select the OK button to exit this screen.

14. The APS software records the slope values in a file located in the C:\Cascade\Data\Output_Files folder. The file is named “slopes.csv” and is used by the APS software to import the slopes the next time it is started and after calibration. Do not delete the files or any of the data in them or move them to a different folder. **Note**: If the calibration slopes are off due to a calibration error, simply go through the calibration process again. If you are having problems calibrating, see the APS Problem Solving Guide for more information. It may be necessary to delete bad slope values from the slopes.csv file in order to calibrate the APS box. The software uses the previous slope to calculate the new slope, so if the slope that the software is using is way off, it may not be possible to get a good new slope using this

value. If this seems to be the case, open the slopes.csv file and delete the entire line of bad data. Save and close the file. The slopes file can be found in C:\Cascade\Data\Output Files\slopes.csv.

5.5.2 Startup

1. **New File:** After calibration or after clicking on the start button, the startup screen will load (Figure 4.5-2). If you are starting a new location, select New File/Folder. The software will create a folder with the name of the Profile ID you just entered in the C:\Cascade\Data\Output Files folder. Open the folder and select Current Folder (not the Save Button). The software will create 6 files in the new folder –
    a. ProfileID_IK failure.csv – this file stores the I_k behavior data.
    b. ProfileID_KPROcumulative.csv – this is the main data file and stores all data related to depth, pressure, flow, I_k, etc.
    c. ProfileID_KPROsession.csv – temporarily stores data that is eventually written to the cumulative file.
    d. ProfileID_Sample failure.csv – stores data related to failed sample attempts.
    e. ProfileID_SondeData.csv – stores the sonde data sample parameters.
    f. ProfileID_Static Ik.csv – currently not used.
2. **Previous File:** If you are continuing a file select Previous File and select the folder with the name of the location you want to continue. Select the ProfileID_KPROcumulative.csv file and select Save.
3. The first window that appears is for setting the atmospheric pressure. Follow the instructions on screen to set the pressure. The atmospheric pressure reading should be between 33-35 feet of water. If the reading is higher or lower, the pressure transducer needs to be calibrated. This value can also change depending on elevation and weather conditions.
4. The next window is for setting the water vessel pressure. Follow the instructions on screen to set the pressure. If the pressure is too high, turn the handle on the regulator counter-clockwise and release some pressure from the vessel by using the valve on the top of the vessel. If the pressure is too low, turn the handle on the regulator clockwise and allow pressure to

stabilize. After adjusting the pressure make sure that the pressure has stabilized and is not falling or climbing before clicking the OK button.

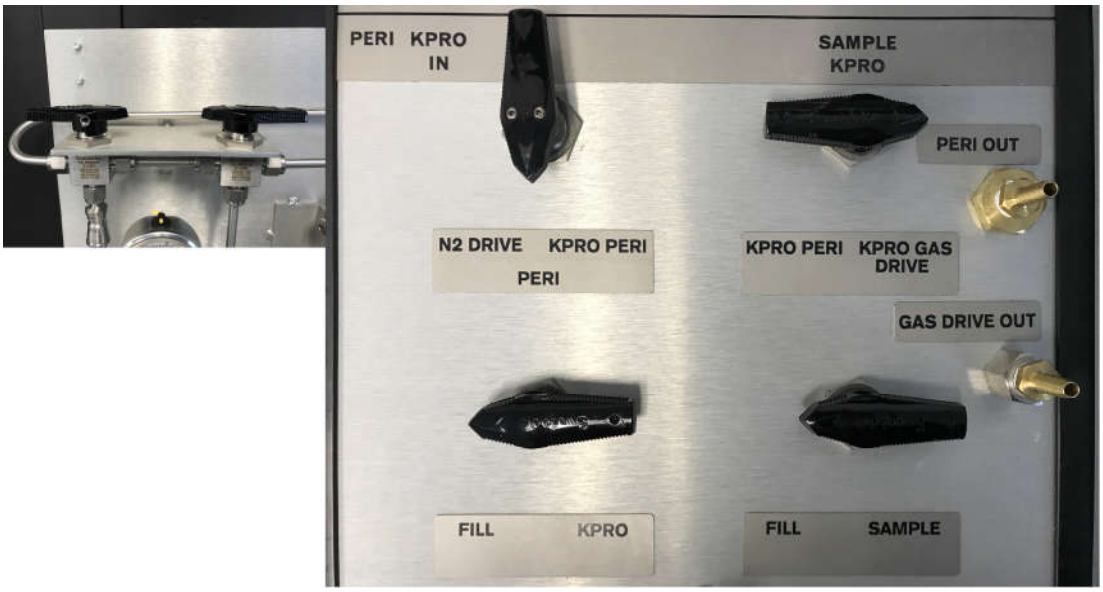
5. The next window will prompt you to enter the start depth. If you are continuing a profile, the last recorded depth will be provided. You can use this depth or enter a different depth. When entering a depth you can enter a positive or negative value; the program will change it to negative regardless of the sign that was entered.
6. The next window will prompt you to enter the height of the sample box above the APS location. Measure the height from the ground to the pressure transducer and enter it. On level ground and working out of a box truck the height is 7 feet. When working out of a van, the height is 5.5 feet. The height will be different if you are profiling out of a different vehicle or other situation (cart, wagon, etc). If the ground between the truck and location has a significant slope, this also must be accounted for.
7. The next window will prompt you to enter the depth to water. If you are continuing a profile, the last recorded depth to water will be provided. You can use this depth or enter a different depth. If you do not know the depth to water, you must make an educated guess or ask the client. You can enter a more accurate depth later. When entering a depth you can enter a positive or negative number. Make sure you enter the depth to water from ground surface, not from the height of the APS box.
8. The last window will prompt you to zero the pressure to the ground at the APS location. Make sure that the graduated cylinder is placed on the ground as close to the same elevation of the location as possible. Follow the instructions on the screen and select OK. The setup is now complete and tooling advancement can begin.

5.6 Advancing the APS to Acquire I_k data for both Peristaltic and Gas Drive Modes

1. Attach the harness to the stainless steel tube or tubes sticking up out of the top of the profiler rod at the drive platform. Place the string pot on the ground next to the drill rig and weigh it down with a pipe wrench or the rod puller. Pull out the string and attach it to head of the drill dig.
2. **Peristaltic Mode**: turn on the flow by arranging the valves as shown below:

Peri Mode - Drive

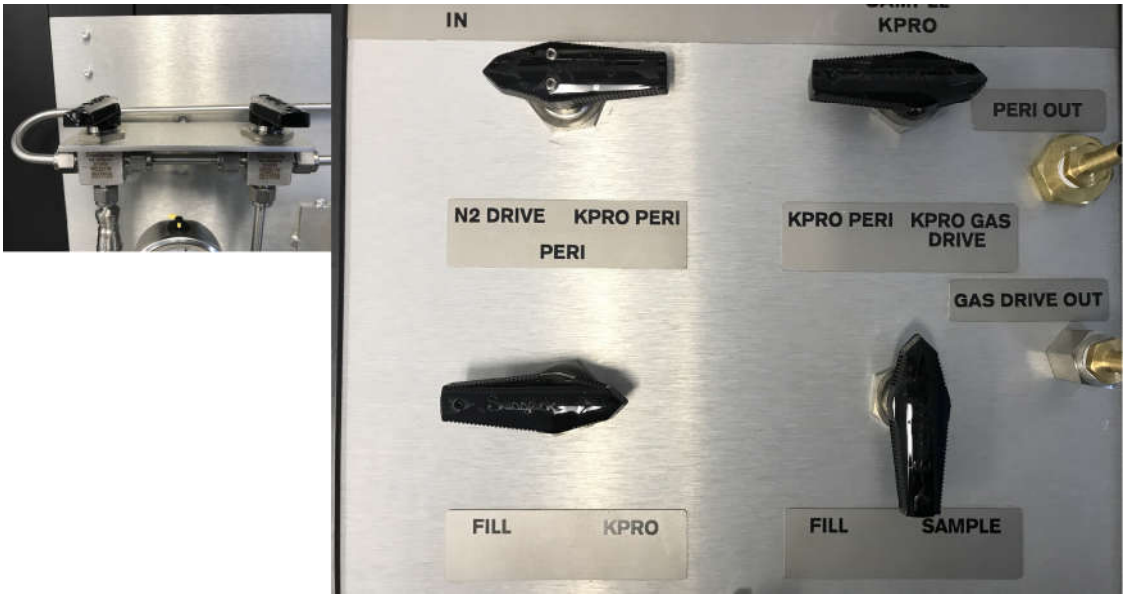
Gas Drive: The pump must be filled with water and pressurized with nitrogen before it can be advanced. Fill the pump by arranging the valves per the photo below and turning on the peristaltic pump:



Gas Drive Fill Pump

When the pump is full and a steady stream of water is flowing out of the Peri Out, lock off the pump (turn the valves on the sample jig so they face the back of the box), pressurize the pump, turn off the peristaltic pump, and turn on the flow

per the following photo (make sure to lock off the pump first). The pump should pressurize at the pressure set on the high range regulator. For advancement the pressure should be set between 50 and 80 psi, this will prevent the KPRO water from flowing up into the pump instead of out the tip.



Gas Drive – Driving

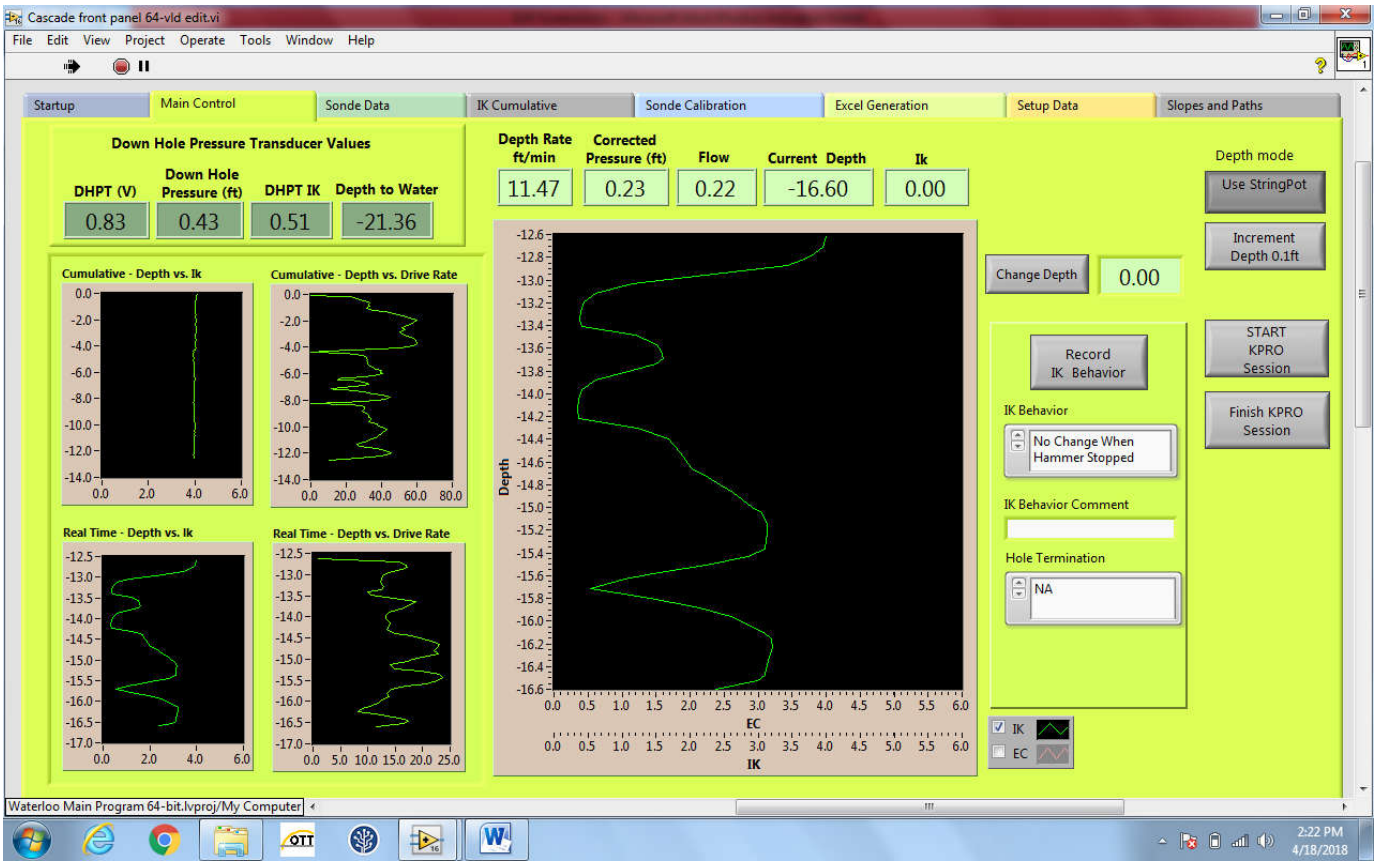
3. With the flow on, put the APS tip / rod assembly into the pre-cleared hole or so that the tip rests vertically. Have the driller lower the head of the probe so that the anvil of the probe rests on the drive cap. At this point the driller will adjust the probe so that the drill rod and probe are straight and level. **Note:** Make sure that the driller has broken through any surface concrete or asphalt. Driving through either of those will damage the tip.
4. Select the “Main Control Tab” on the software. Make sure that the string pot is extended, and the head of the drill rig is resting fully on the drive cap When the flow value stabilizes click on the “Start KPRO Session” button at the top right of the screen. If the flow is zero or unusually low, check for clogs before advancing the tooling.
5. A window will open asking the depth to water. If this is the first drive, the depth provided is the depth entered during the startup procedure. If this is your second drive and the head measurement collected at the first sample location is different from the value originally entered, a new depth can be entered here. Enter a new depth or select OK. A window will open showing

the feet of stainless steel tubing. Set the feet of SS tubing to the correct feet of tubing used, including the 20' harness.

6. Select the "Go" button and then signal to the probe operator that you are ready to commence driving the tooling.

   Notes on the string pot: 1. The APS software will only record data while the string pot is moving. 2. If during a drive the driller needs to lift the head of the probe off the drive cap, there is no need to stop the APS software. The software will only record data once the string pot has moved past the last recorded depth.

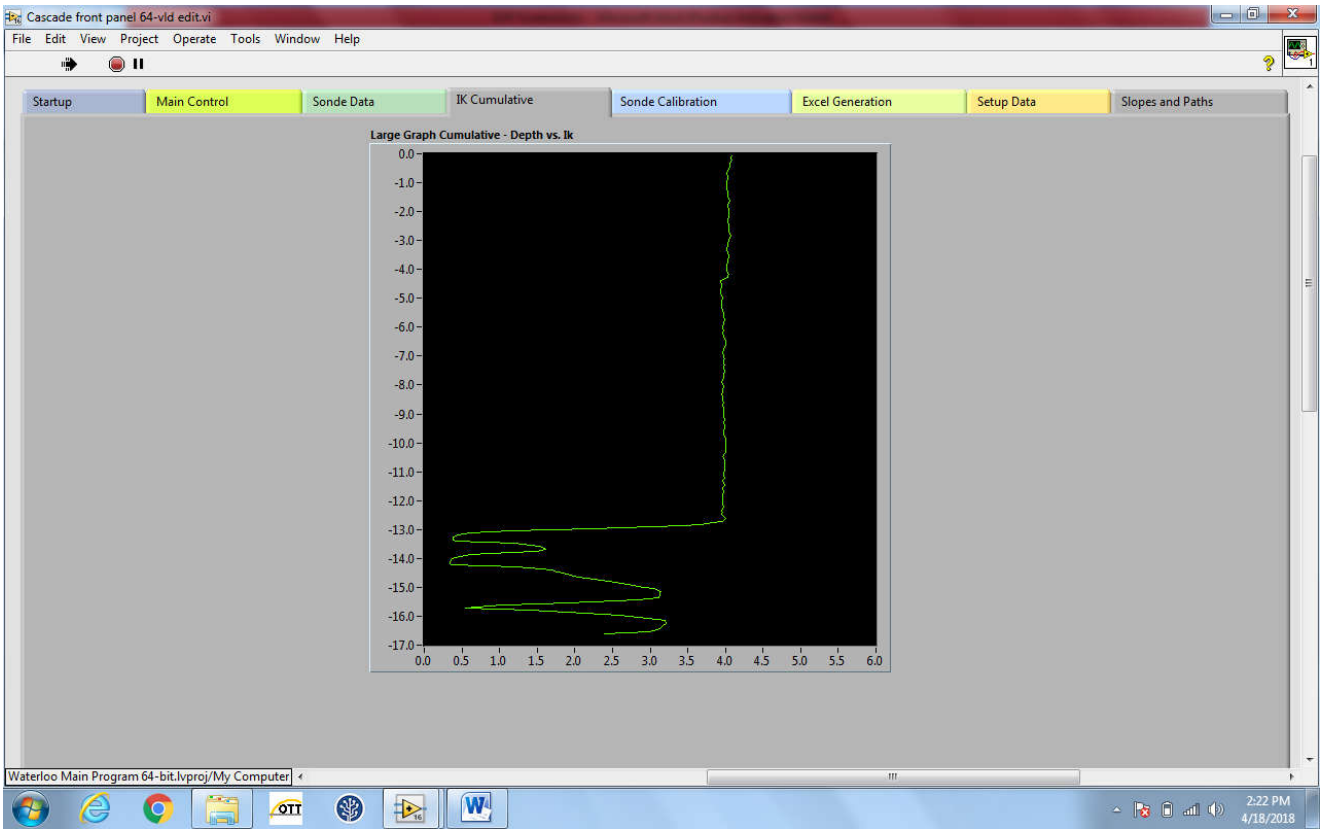
7. Observe the I_k plot on the screen as the tool is advanced as shown in the following figure:



APS Software Screen While Driving

The I_k for the current drive is displayed in real time in the large graph on the right side of the screen. The current I_k, depth, flow, and pressure are displayed above this graph. The cumulative I_k for the entire profile is displayed in the small graph at the top left. The drive rate (feet/minute) for

the current drive is displayed in the small bottom right graph, and the cumulative drive rate is displayed in the small top right graph. A larger cumulative I_k plot can be seen by clicking on the “Ik Cumulative tab”. The screen looks like this:



Large Cumulative Depth vs. I_k

Notes on I_k: The typical I_k range is from 0 to 6. Fine grained soils (silts and clay) or compacted sediment will have an I_k towards the lower end, and sands, gravels and looser material towards the middle to higher end. The software will correct the I_k for the feet of stainless steel tubing using a head loss equation, so I_k should remain relative for the profile regardless of how much stainless tubing is attached (even though the flow is lower and the pressure is higher). I_k is only calculated and recorded by the software if the string pot is moving. In some cases, the flow will drop or rise after hammering has stopped, which results in a different I_k. The software can calculate a “Static” I_k based on the flow and pressure after the probe hammer has stopped by selecting the Record I_k Behavior button. This procedure is described below.

8. When you reach a depth that you wish to sample, signal to the rig operator to stop advancing the tooling. When the drilling stops, select the “Finish KPRO Session” button.

9. **Determining a Sample Interval:** Observe the flow after the probe hammer has stopped. If the flow drops significantly it may be an indication that the sample interval will not yield a timely sample. If the flow stays high or increases, then it is probably a good interval to sample.

   I_k Behavior: Each time the hammer is stopped (to add rod, sample, determining whether to sample), the I_k Behavior must be recorded. The software can record this data. There are two places that this data can be collected, one place is for during a drive and the other is at the end of the drive.

   If you are not sure if the interval is going to produce a good sample, stop the Geoprobe but do not select the “Finish KPRO Session” button. Keep the flow on and observe, if the flow falls to where a sample does not seem possible, select the appropriate I_k Behavior from the drop-down menu on the “Main Control” tab (located to the right of the large graph). The choices in the drop-down menu are “No Change When Hammer Stopped”, Ik Decreased” or “IK Increased”. If desired, a comment can be entered in the comment box located below the drop-down menu. Select the “Record Ik Behavior” button and record the depth and I_k behavior on the paper field log. The I_k behavior data is written by the software to the ProfileID_Ik failure.csv file. Instruct the Geoprobe operator to drive the tooling.

   If the sample interval looks like it will produce a sample, select the Finish Kpro Session button. See Step 12 for recording Ik Behavior at the end of a drive.

   It will take experience to get a feel for which intervals will yield fast samples and which will not. The I_k and flow are a good indication as to which samples will be fast or slow but remember that the flow decreases with the amount of stainless tubing that is attached. So at shallower depths a flow of 60 ml/min may be slow but at a depth of 60 feet it may be fast.

10. Turn off the flow by turning the rotating left valve from the “KPRO” label one quarter turn to an off position (not labelled).

11. Measure the stick up from the ground surface to the shoulder of the rod in tenths of feet. Subtract the stick up from the total length of rod in the ground including tip and/or pump. For peristaltic, the tip length used is 0.3 feet. For gas drive, the length of the tip and pump is 3.1’, so add this to the length of

rod in the ground. **Note:** The length of the tip/pump is always measured from the center screw on the tip.

12. Compare the measured value to the depth reading on the screen:

Correct Depth

If the measured depth is different than the depth given in the “Original Uncorrected Depth” box, enter the correct depth into the “Input Corrected Depth” box and select the “Enter New Depth” button. You can also change the feet of stainless if required.

Ik Behavior – on the right side of the window there is a drop down for Ik Behavior, a comment box and a drop down for Hole Termination. Before selecting the “Done Entering Data” button, select the IK Behavior from the drop down. If this is the last drive of the APS location, select the Hole Termination and enter a comment if needed. The choices for Hole Termination are “ROP Below Threshold” (ROP is Rate of Penetration), “Sudden Hard Refusal”, “Reached Target Depth”, “Broken Down Hole Equipment” or “NA”. “NA” is the default value, if the drive is not the last drive leave the value as the default.

If no other data needs to be corrected, select the “Done Entering Data” button on the software. **Note:** It is common practice to round to the nearest tenth of a foot when correcting the depth. This is done not only for ease, but because we do not want to mislead the client into thinking we have accuracy to the hundredth place.

13. **Measuring Hydraulic Head**: Turn off the flow and observe the Corrected Pressure (ft) box. When this value equilibrates, record the value on the field form along with the depth (Attachment 2). The water in the stainless steel tubing will equilibrate to the head of the groundwater when the flow is turned off. Turn on the flow and leave it on for 30 seconds. Turn off the flow and again observe the Corrected Pressure and wait for equilibration. If this value matches the first value, the head measurement is valid. If it is different, repeat turning the flow on / off until two successive head readings are obtained. Be sure to also record the head manually on the paper field form.

    Recording the head value with the software: When the head measurement has equilibrated, select the “Sonde Data” tab. Located on the bottom left of the tab is the Record Head Pressure button and Head Pressure variable. If using the uphole transducer (Peri mode) make sure that the button displays “Use Up Hole Pressure”. If it does not, select the button to change it. Select the “Record Head” button. The Head Pressure variable will be updated to match the Corrected Pressure from the Main Control tab and the Head Pressure will be recorded to the ProfileID_SondeData.csv.

    Note: When the water table is at a depth of more than 25’ the head value is not valid. When using gas drive mode this is often the case. If so do not record the head value. However, using the DHPT in gas drive mode will allow you to collect head values no matter how deep the water table is.

14. **Missing a sampling interval**. It may be required to pull the tip up to sample an interval that was passed on the way down. To do this first make sure that the “Finish KPRO Session” button has been selected. For Peri mode make sure that the flow is on, and in gas drive mode make sure that the pump is pressurized and the flow is on before pulling the tooling up.

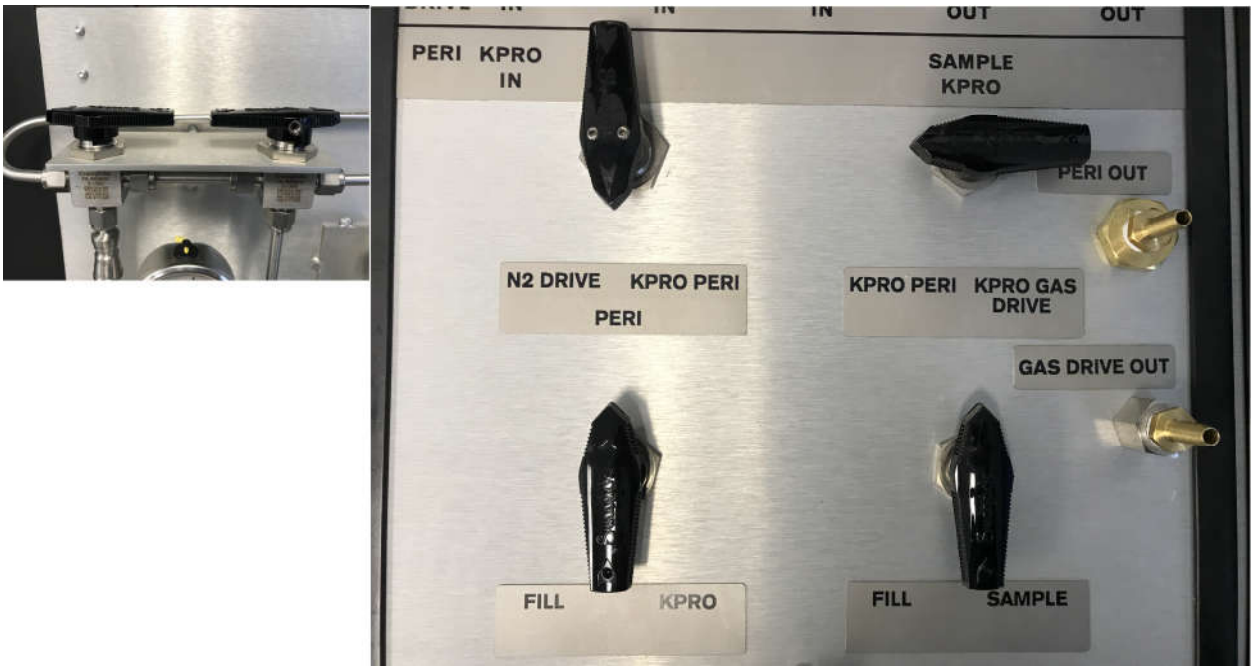
    Determine the interval you would like to sample. Hold a measuring stick next to the drill rod as the driller pulls back on the rod and have the operator stop when the depth is achieved. Check the flow on the software to be sure that the interval will yield a timely sample. It is also possible to watch the flow on the APS software as the driller pulls the rod up. When the flow

increases, tell the driller to stop. Measure the stickup and record in the paper log that the profiler was pulled up and record the new depth. Before your next drive you will have to correct the depth in the APS software. To change the depth, enter the new depth in the “Update Depth” box and select the “Update Depth” button. This will create duplicate data in the KPROcumulative.csv file that must be deleted when the location is finished. You can also mark the rod before pulling it back and then drive the rod back to that depth (with the flow on) before starting the program.

5.7 Purging and Sample Collection

5.7.1 Purging in Peristaltic Mode

1. Turn on the peristaltic pump.
2. Set the valves to the positions shown below.

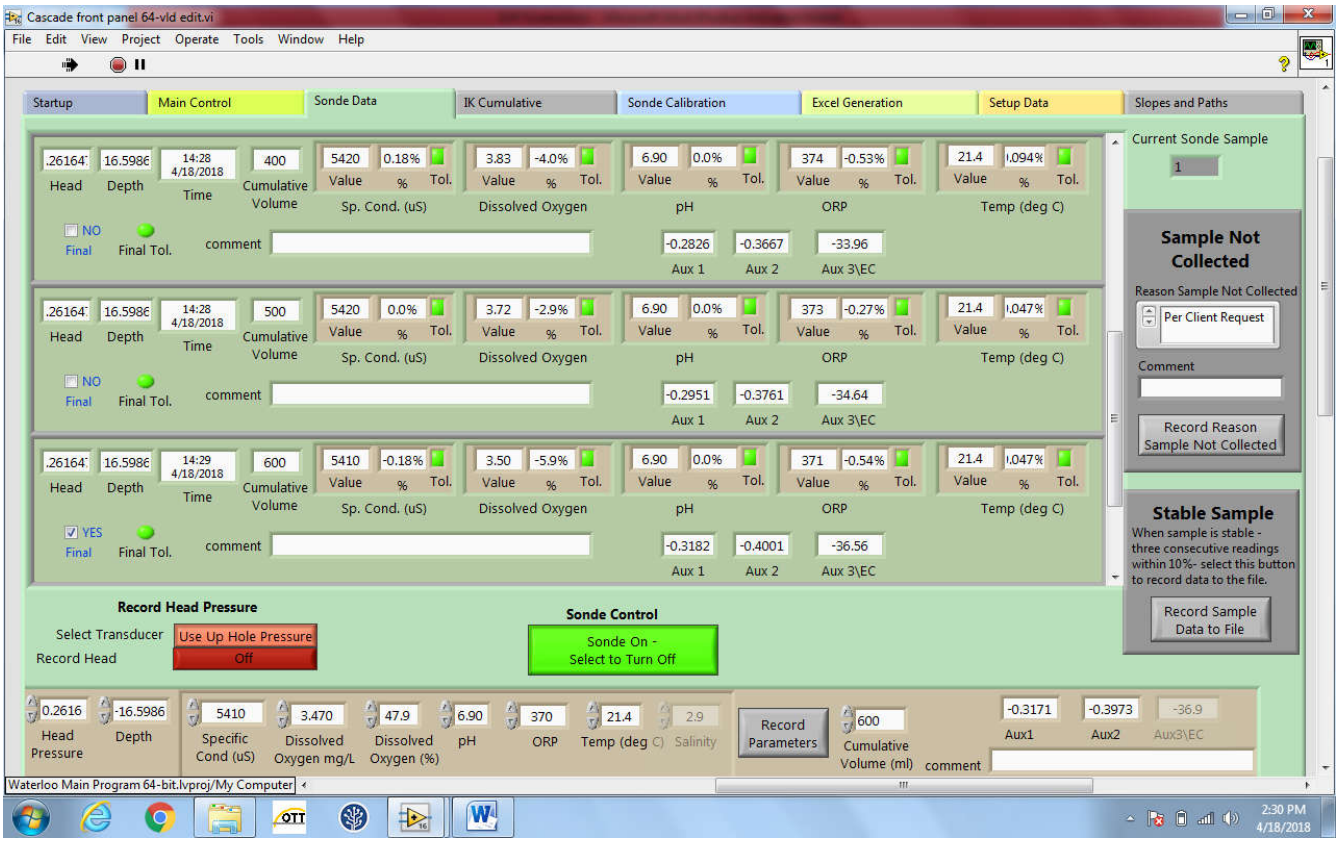


Peri Mode Purging

3. Observe the vacuum gauge. A vacuum should build toward -30 inches of mercury
4. Observe water flowing through the bottles. The water will be clear at first but should become silty. This is because there is some KPRO water still in the tubing.

5. If vacuum does not build and water does not flow it is possible that there is a leak in the system. Refer to the Problem Solver's Guide on how to proceed.
6. Select the "Sonde Data" tab. Click the red "Sonde On/Off" button to turn on the sonde (button will change from red to green).
7. Observe that the parameters at the bottom of the screen are updating. They will briefly all change to zero before the live parameters are displayed. Readings can be recorded every 50 or 100 ml for Peri mode. Enter the volume of water in the graduated cylinder into the Cumulative Volume box and select the "Record Parameters" button. The current values for the parameters will be entered by the software into the embedded spreadsheet on the screen. It may take several seconds for the line of data to be written to the embedded spreadsheet.
8. Observe the volume of water in the graduated cylinder into which the purge water discharges. If the sample purge rate is slow (less than 50 ml after waiting 5 minutes) then the sample interval may not produce a sample in a reasonable amount of time. It may be necessary to pull up the rods or drive to a better sampling interval. Consult with the client on how to proceed.

9. When all the physico-chemical parameters stabilize on three successive readings (indicated by a green light next to the parameter value) select the Final Value check box on the left-hand side of the last line of data in the embedded spreadsheet. Select the "Record Sample Data to File" button. The sample data will be written to the ProfileID_Sonde Data.csv file. You should also record the depth, time, head value, total volume purged and the final values of the physico-chemical parameters on the paper field form. The paper log serves as a backup in case there is a problem with the electronic files. The following photo illustrates what the data looks like for a sample that has equilibrated.



Sample Log Showing Equilibrated Sample

Notes on Purging the Sample: Make sure to purge at least 500ml before collecting a sample. The first few physico-chemical readings may indicate that the sample has equilibrated but that is because the tubing contains the analyte free water and there is still water from the previous sample interval in the flow cell of the sonde. The volume of the flow cell is 200 ml, so it will take some time for the groundwater from the current interval to replace the water in the flow cell from the previous sample.

There are conditions where stabilization of Dissolved Oxygen and ORP values may not be practical. When Dissolved Oxygen values are less than 1 mg/L and ORP values approach 0 after an acceptable volume of water has been purged (usually 500ml for peristaltic and 600ml for gas drive), a small change in the value can result in a change greater than the stabilization criteria of 10%. In these situations, the sampler can collect the sample before these values have stabilized if Specific Conductance and pH are stable.

10. If no sample was collected and parameter values have been recorded to the embedded spreadsheet, select the “Record Sample Data to File” button located on the right-hand side of the screen. Record the volume purged, depth, time and a comment on the paper field log. On the right side of the screen is a dropdown menu where the reason for not sampling and a comment can be entered. Select from the dropdown menu, type in a comment and then select the “Record Reason Sample Not Collected” button. This data is written to the ProfileID_Sample failure.csv.

    If no parameters were collected, select the reason from the dropdown menu, enter a comment is needed and select the “Record Reason Sample Not Collected” button.

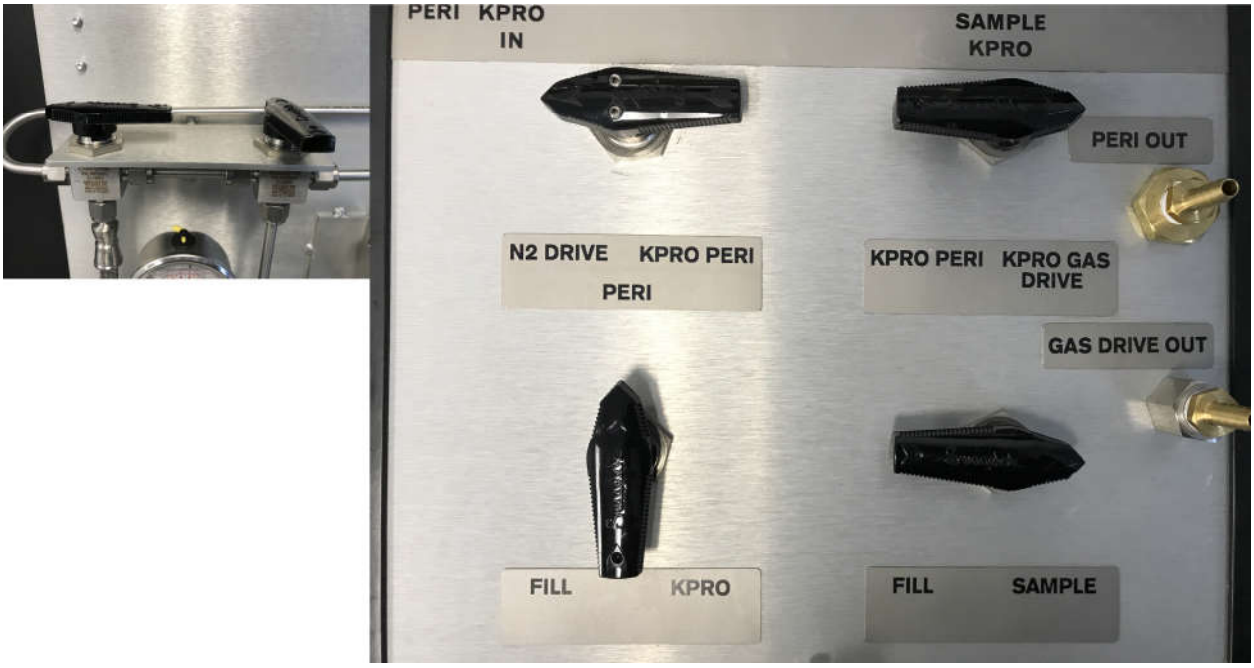
5.7.2 Collecting the Sample in Peristaltic Mode

1. Turn the top right valve on the sample jig so that it is locked off (pointing towards the back of the box). There are two options to collecting the sample.
2. Option 1:
    1) Reverse the direction of the pump.
    2) Run the pump backward for 2 to 3 seconds
    3) Shut off the pump
    4) Remove the VOA vial on the left-hand side of the sample jig.
    5) Hold the VOA vial under the stem and run the pump in reverse slowly until you have a mounding of water on top of the vial. If the vials are to be preserved with HCL, add 5-6 drops of HCL to the VOA before topping it off.
    6) Repeat for other vials. Typical VOC analysis requires two VOAs, but be sure to check with the client on how many vials they require.
3. Option 2:
    1) Remove the third VOA vial from the left first. It is important to remove this vial first to prevent air bubbles from flowing through your sample due to depressurization.
    2) Remove the second VOA vial from the left.
    3) Remove the first VOA vial.
    4) Top off the sample vials with the first vial that you removed.

4. Carefully screw the cap on the vials. The vial cannot have any air bubles trapped under the cap. To check, turn the vial upside down and tap the vial lightly on the palm of your hand. If there are any bubbles present, you must uncap the vial and repeat the procedure
5. Label the vials appropriately.
6. Replace the vials with new vials. Prepare to drive as before after adding tubing and rod as necessary.

5.7.3 Purging in Gas Drive Mode

1. At this point the pump is already pressurized from advancing the APS tooling. Arrange the valves per the following photo:



Pressurized Gas Drive Pump Ready to Purge

Turn the top right valve on the sample jig slowly to the right. This allows the nitrogen to push the water up from the pump and through the sample jig. The pressure on the gauge will drop and stabilize as the water flows.

2. Observe the pressure gauge. Just before the pump body is completely emptied, the pressure will start to rise. When you observe the rise, turn the top left valve on the APS box one quarter turn clockwise, which will stop the flow of nitrogen and vent the gas out of the pump (you will hear a hissing sound).

3. Watch the pressure gauge and when the pressure drops close to zero, lock off the right valve on the sample jig and spin the top left valve on the APS box clockwise to Peri. Make sure that the peristaltic pump is on. At this point the pump is depressurized and is filling with groundwater. These three steps complete one pump purge, or “whack”.
4. Observe the volume of water in the graduated cylinder into which the purge water discharges.
5. Select the “Sonde Data” tab. Click the red “Sonde On/Off” button to turn on the sonde (button will change from red to green).
6. Observe that the parameters at the bottom of the screen are updating. They will briefly all change to zero before the live parameters are displayed. Readings can be recorded after each whack for gas drive mode. Enter the volume of water in the graduated cylinder into the Cumulative Volume box and select the “Record Parameters” button on the right of the screen. The current values for the parameters will be entered into the embedded spreadsheet on the screen.
7. Observe the volume of water in the graduated cylinder into which the purge water discharges.

   This data is used as a benchmark for future readings. The first whack will be larger than most because the pump and lines are already filled with water. If after the second whack the amount of sample discharged is less than 80 ml then you need to wait longer between evacuations (3-4 minutes). If after waiting 5-6 minutes the pump evacuation yields less than 50 ml, it may not be prudent to collect a sample at that location. Check with the client oversight to see if they want you to continue sampling or drive to a better sampling interval. If the volume is significantly larger (150-200ml) you can evacuate the pump more often (1-2 minutes). If no sample was collected, select a reason for ending the sample attempt from the drop-down menu and select the “Record Reason Sample Not Collected” button.

   Note on purge volume: The volume of the gas drive pump is 100 ml. The volume of the stainless steel tubing is 0.8 ml/ foot, and there are two lines (the sample and gas lines) that are full of water (water from the previous sample and water used to fill the pump). For example, if you have 60 feet of tubing attached, the volume would be 100ml + (2 *60*0.8), for a total of 196 ml. When purging a sample this water will be purged first so the physico-chemical parameters may appear to be stable. It is common to see the parameters rise (previous sample water left in pump), then fall (analyte free water used to fill the pump) before starting to equilibrate (fresh groundwater

8. After the previous whack, allow some time (as explained in step 7) for the pump body to fill such that you receive at least 50 mL of sample on subsequent evacuation (Step 7).

9. To purge the pump, turn the top left valve on the APS box to N2 and watch the pressure gauge. When the pressure crosses zero, turn the top right valve on the sample jig to the right. You are now back at Step 1. Follow the rest of the steps to complete the whack and record the parameters.

10. When all of the physico-chemical parameters stabilize on three successive readings (indicated by a green light next to the parameter value) select the Final Value check box on the left-hand side of the last line of data in the embedded spreadsheet. Select the “Record Sample Data to File” button. You should also record the depth, time, head value, total volume purged and the final values of the physico-chemical parameters on the paper field form. The paper log serves as a backup in case there is a problem with the electronic files. The following photo illustrates what the data looks like for a sample that has equilibrated.

    Note: There are conditions where stabilization of Dissolved Oxygen and ORP values may not be practical. When Dissolved Oxygen values are less than 1 mg/L and ORP values approach 0 after an acceptable volume of water has been purged (usually 600ml for peristaltic and 800ml for gas drive), a small change in the value can result in a change greater than the stabilization criteria of 10%. In these situations the sampler can collect the sample before these values have stabilized as long as Specific Conductance and pH are stable

11. If no sample was collected and parameter values have been recorded to the embedded spreadsheet, select the “Record Sample Data to File” button located on the right-hand side of the screen. Record the volume purged, depth, time and a comment on the paper field log. On the right side of the screen is a dropdown menu where the reason for not sampling and a comment can be entered. Select from the dropdown menu, type in a comment and then select the “Record Reason Sample Not Collected” button. This data is written to the ProfileID_Sample failure.csv.

    If no parameters were collected, select the reason from the dropdown menu, enter a comment if needed and select the “Record Reason Sample Not Collected” button.

5.7.4 Collecting the Sample in Gas Drive Mode

1. Arrange the valves as you would for purging the pump. When the pressure builds do not open the valve on the sampling jig.
2. Remove the sample bottle on the left most vial on the sample jig.
3. Hold the sample vial under the straw for the first vial holder on the sample jig. Slowly open the right valve on the sample jig. Water will flow out of the straw and into the vial. When you have a mounding of water on the top of the vial, shut the valve and cap the vial. Repeat this process for subsequent vials. Check for bubbles by inverting the vial and lightly tapping it on the palm of your hand. If there are bubbles, uncap the vial and fill again. If the vials are to be preserved with HCL, add 5-6 drops of HCL to the VOA before topping it off.
4. Label the vials appropriately.
5. Replace the vials with new vials.
6. Prepare to drive as before after adding tubing and rod as necessary by filling and pressurizing the pump. Refer to section 4.6 above for the procedure.

5.8 How to Determine the End of the Profile

There are several ways to determine the end of a location. Some locations may have a predetermined depth set by the client. The end of the profile location is most often determined by the Drive Rate. As the profiler is advanced into the ground the drive rate will decrease as the skin friction of the rod in the ground increases. There are also stratigraphic layers that are more compact than others (clays, tills) that can slow the drive rate. It is important not to drive the profiler once the drive rate gets below 1.0 ft per minute. If the rods, tips and drive hardware are hammered on too much they can fatigue and break, crack or bend. The skin friction can also become too great so that the profiling rods cannot be pulled back out of the ground. Consult with the driller/probe operator during profiling to determine when to stop drilling.

It is also possible to drill into bedrock or other subsurface objects (boulders, cobbles, concrete chunks or slabs, etc.). In this case the drive rate can drop very quickly or stop suddenly. Stop hammering immediately and discuss with the driller and client how to proceed.

After a hole is complete, select the Hole Termination type from the drop down menu when selecting the IK Behavior. Record the hole termination type on the paper field log.

Excel File Creation. The software combines all of the data saved in the associated csv files for the APS location into one file. See Section 5.10 for instructions.

5.9 Decontamination

The only decontamination step required between samples in the same hole is to flush the line with analyte free water (distilled or spring water) while driving to the next depth. There are required decontamination procedures for the tip and pump, drill rod, stainless steel tubing and APS box that need to be completed at the end of a profile. Some sites and clients may require that all the down-hole tooling be decontaminated using a steam cleaner. If this is the case remove the plates and screens from the tip and take the pump out of the housing so that all of the parts can be cleaned. Often the drillers will provide the steam cleaner and will have a decontamination pad set up on site.

5.9.1 Tip and Pump Decontamination

The tip and pump need to be disassembled and cleaned prior to reuse. For the tip, remove the plates and screens. The screws can be reused if they are not rusted or stripped. It may be required to use an impact driver to remove the screws if they are stuck. Rinse out the inside of the tip (through the sampling ports and the fitting on the top) the screens and plates with Alconox and water to remove all sediment. Scrub the tip and plates with a firm brush or use a pipe cleaner to clean the inside of the tip. Carefully check the plates to make sure that the sampling ports are clear. Use a pick to remove any sediment from the sampling port holes. Remove and replace the FEP tubing. The piston for the gas drive system can be reused unless it shown sign or wear or is bent.

For the pump: unthread the tip from the pump housing and unthread the top and bottom housing pieces. Remove the pump body from of the housing. Use a brush and bucket of Alconox and water to clean the inside and outside of the housing pieces and pump as well as the springs and plastic bushing. Disassemble the pump body and discard the o-rings, reed valve and Teflon tape. Rinse out the inside of the pump with Alconox and water followed by clean water. Check the small o-rings at the narrow end of the pump bottom and replace if necessary.

5.9.2 Drill Rod and Stainless Steel Tubing Decontamination

Upon completion of the sampling and grouting of the hole, the drill rods should be cleaned by steam cleaning, pressure washing or by washing with Alconox and water. It is important to clean the inside, outside and threads of the rod. The stainless steel tubes should be clear of any grout, drilling mud or soil removed from the outside using a steam cleaner, pressure washer or Alconox and water. The inside should be rinsed with analyte free water (distilled or spring water). It is very important that before the stainless steel tubing is reused that it is checked for clogs by using a garden sprayer with an adaptor.

5.9.3 APS Box Decontamination and Equipment Blank Procedure

The APS box should be decontaminated at the end of each profiling location to make sure that there is no possibility of cross contamination between profiles.

1. The four o-rings located at the top of each bottle holder on the sample jig should be replaced at the completion of the profile. Remove any vials from the sample jig and discard them. Remove the o-rings located at the top of each bottle holder with a straight or slightly angled pick, being careful not to score the threads on the plastic bottle holder. Alconox and water should be squirted up into the top of each bottle holder before the new o-rings are installed.

2. After changing out the o-rings on the sample jig, the box and jig should be flushed out with at least 1L of Alconox and water and 1L of clean water. This can be done in conjunction with the collection of an equipment blank (as required). All analyte free water used to fill the KPRO reservoir and for equipment blanks needs to be assigned a lot number. Each time a supply of water is purchased a new lot number is to be assigned to all containers purchased at that time. The lot number, date of purchase, manufacturer and place of purchase need to be recorded on the field form, and the lot number is to be written on all containers from that lot. When collecting an equipment blank the date and lot number of the water should be recorded on the field form.

3. For peristaltic mode, connect a clean APS tip to the APS box via the harness. Place the tip into a clean vessel containing Alconox and water (the vessel needs only to be as deep as to make sure all of the ports on the tip are submerged). Screw four new vials into the sample jig and arrange the valves on the box to the same orientation for sample collection. Turn on the peristaltic pump. Top off the water in the vessel as the water is pumped through the box. Once you have pumped 1L of Alconox and water, place the profile tip into a second clean vessel containing only clean, analyte free water and pump 1L of clean water through the box.

4. For gas drive mode, connect all three stainless steel tubes from the pump to the corresponding tubes on the harness and place the tip of the pump in a clean vessel containing Alconox and water. Screw four new vials into the sample jig and arrange the valves on the box to the same orientation for sample collection in peristaltic mode. Disconnect the N2 Out quick connect from the APS box. Disconnect the Sample In quick connect and connect it to the N2 Out quick connect and turn on the peristaltic pump. Top off the water in the vessel as the water is pumped through the box. Once you have pumped 1L of Alconox and water, place the profile tip / pump into a

second clean vessel containing only clean, analyte free water and pump 1L through the box.

5. If an equipment blank is required, simply collect the required number of VOA vials from the sample jig as you would if you were collecting a groundwater sample using the peristaltic mode. If no equipment blank is required, the decontamination process is complete.
6. Record on the paper Groundwater Profile Log that the box has been decontaminated with 1L of Alconox and water and 1L of clean water. Record the date, time and name of the equipment blank (if required).

5.10 APS Field Data Deliverables

One of the biggest advantages to using the Waterloo ^{APS} is that field data can be quickly processed in the field and given to the client in a matter of minutes. At the end of the profile the raw data needs to be processed so that a field log can be sent to the client or entered into gINT.

The data should be processed as soon as possible after finishing a profile; either during the decontamination of the APS box or during the collection of the first few samples of the following profile. All efforts should be made to get the data to the client by the end of the working day unless otherwise directed. These are the steps:

1. At the completion of the APS location and before the software is closed, select the "Save Files and Write Create Excel" button located on the "Excel Generation" tab. **NOTE – Only do this when the location is complete and no more data is to be collected. Selecting this button will shut down the software.**
2. The software will combine the data from the 5 csv files into one file named "ProfileID_Groundwater Profliling Log.xlsx" that is saved in the associated folder for the APS location. This process can take several minutes if there is a lot of data. After selecting the button, you will see the Excel icon in the bottom menu bar flash twice. Do not select this icon or open excel. Screenshots of the excel workbook tabs are included below:

GROUNDWATER PROFILE LOG

Client: CTS

CASCADE
DRILLING | TECHNICAL SERVICES

Profile Location: APS-100

	Started	Completed					
Dates:	3/17/2018	3/17/2018	KPRO Box Serial # / Acquisition Laptop:	481APS4	Gas Drive or Peri Pump:	Peri Pump
Location:	Montpelier, VT		Sonde Serial #:	ZCRQT7057	Atmospheric Pressure:	34.00
CTS #:	205189999		Drilling Contractor:	Cascade	KPRO N_2 Pressure (set via P transducer):	70.00
Sampler(s):	VLD		Average Depth to Water:	-7.21	Gas Drive Pump N_2 Pressure:	NA

PHYSICOCHEMICAL PARAMETERS

Depth (ft)	Date / Time	Volume Purged (mL)	Head (ft)	SC (uS/cm)	DO (PPM)	pH	ORP (mV)	COMMENTS
-7.30	03/17/2018:10:03:13	550	-6.83	857	3.28	4.38	212	
-10.20	03/17/2018:10:50:00	1000	-7.09	2320	0.77	6.78	93	
-13.20	03/17/2018:11:16:38	1000	-7.12	1650	0.76	6.65	73	
-16.20	03/17/2018:11:54:46	1000	-7.22	1257	0.73	6.66	60	
-19.20	03/17/2018:12:22:14	1000	-7.21	1473	0.69	6.68	65	
-22.20	03/17/2018:12:53:29	1000	-7.29	1348	0.65	6.74	48	
-25.10	03/17/2018:13:23:13	1000	-7.20	2230	0.64	6.96	29	
-28.40	03/17/2018:13:56:41	1000	-7.26	9640	0.63	6.83	36	
-30.10	03/17/2018:14:37:43	900	-7.26	11850	0.68	6.82	31	
-32.80	03/17/2018:15:16:43	900	-7.28	5390	0.67	6.95	26	
-35.80	03/17/2018:15:53:49	900	-7.27	5090	0.75	6.97	-55	
-39.10	03/17/2018:16:19:17	900	-7.29	11010	0.62	6.74	-18	
-42.10	03/17/2018:16:49:11	800	-7.33	25800	0.64	6.57	-13	
-45.20	03/17/2018:17:18:26	800	-7.35	35700	0.68	6.79	-90	

Front Tab

Ik Behavior Log

CASCADE DRILLING | TECHNICAL SERVICES

Client:	CTS			Profile Location:	APS-100
Date:	3/17/2018	KPRO Box Serial #:	481APS4	Gas Drive or Peri Pump:	Peri Pump
Location:	Montpelier, VT	Troll Serial #:	ZCRQT7057	Atmospheric Pressure:	34.00
CTS #:	2051819999	Drilling Contractor:	Cascade	KPRO N_2 Pressure (set via P tranducer):	70.00
Sampler(s):	VLD	Depth to Water:	-7.21	Gas Drive Pump N_2 Pressure:	NA

Depth (ft)	I_K Behavior Type		Flow		Feet of Stainless Steel	Static IK	Time	COMMENTS	Hole Termination Type
-5.20	No Change When Hammer Stopped		135		60	3.18	3/17/2018:09:21:06		
-7.30	No Change When Hammer Stopped		122		60	2.67	3/17/2018:09:22:22		
-10.20	No Change When Hammer Stopped		139		60	3.20	3/17/2018:10:07:39		
-10.20	No Change When Hammer Stopped		124		60	2.71	3/17/2018:10:30:31		
-13.20	IK Decreased		112		60	2.36	3/17/2018:10:57:05		
-15.20	No Change When Hammer Stopped		116		60	2.47	3/17/2018:11:34:04		
-16.20	No Change When Hammer Stopped		120		60	2.61	3/17/2018:11:35:45		
-19.20	No Change When Hammer Stopped		133		60	3.01	3/17/2018:12:05:53		
-22.20	No Change When Hammer Stopped		133		60	3.02	3/17/2018:12:37:39		
-25.10	No Change When Hammer Stopped		133		60	3.02	3/17/2018:13:08:09		
-28.40	No Change When Hammer Stopped		133		60	3.02	3/17/2018:13:38:31		
-30.10	IK Decreased		111		60	2.34	3/17/2018:14:11:10		
-32.80	No Change When Hammer Stopped		117		60	2.51	3/17/2018:14:58:36		
-35.10	IK Decreased		97		60	1.95	3/17/2018:15:26:31		
-35.80	IK Decreased		99		60	2.02	3/17/2018:15:28:43		
-39.10	No Change When Hammer Stopped		126		60	2.78	3/17/2018:16:01:03		
-42.10	No Change When Hammer Stopped		130		60	2.92	3/17/2018:16:33:10		
-45.20	No Change When Hammer Stopped		121		60	2.63	3/17/2018:17:00:02		Reached Target Depth

IK Behavior Tab – Displays Ik Behavior and Hole Termination Type as well as the Static IK

Sonde Sample Attempt Log

Client: CTS

CASCADE DRILLING | TECHNICAL SERVICES

Profile Location: APS-100

Date:	3/17/2018	KPRO Box Serial #:	481APS4	Gas Drive or Peri Pump:	Peri Pump
Location:	Montpelier, VT	Troll Serial #:	ZCRQT7057	Atmospheric Pressure:	34
CTS #:	2051819999	Drilling Contractor:	Cascade	KPRO N_2 Pressure (set via P tranducer):	70
Sampler(s):	VLD	Depth to Water:	-7.21	Gas Drive Pump N_2 Pressure:	NA

Depth (ft)	Time		Unsuccessful Sample Attempt				COMMENTS
-10.00	3/17/2018:09:21:06		Could Not Yield Water				Sample stopped coming in after 15 minutes
-15.00	3/17/2018:12:20:06		Yield Deemed Too Slow				

Sample Attempt Tab

PARAMETER EQUILIBRATION LOG

Client: CTS

Profile Location: APS-100

Location:	Montpelier, VT	KPRO Box Serial #:	481APS4	Gas Drive or Peri Pump:	Peri Pump
CTS #:	2051819999	Troll Serial #:	ZCRQT7057	Atmospheric Pressure:	34.00
Sampler(s):	VLD	Drilling Contractor:	Cascade	KPRO N_2 Pressure (set via P tranducer):	70.00
		Depth to Water:	-8.00	Gas Drive Pump N_2 Pressure:	NA

PHYSICOCHEMICAL PARAMETERS

Depth (ft)	Head (ft)	Date and Time	Volume Purged (mL)	SC (uS/cm)	SC %Change	DO (PPM)	DO %Change	pH	pH %Change	ORP (mV)	ORP %Change	Temp deg C	Temp %Change	COMMENTS
-10.20	-7.09	03/17/2018 10:38:24	200	534	-37.7	3.76	14.6	4.86	11.0	192		20.4	-0.9	
		03/17/2018 10:39:53	300	603	12.9	4.18	11.2	4.82	-0.8	183	4.7	20.4	0.0	
		03/17/2018 10:41:33	400	970	60.9	3.64	-12.9	5.15	6.8	168	8.2	20.3	-0.6	
		03/17/2018 10:42:44	500	1700	75.3	2.68	-26.4	6.05	17.5	133	20.8	20.2	-0.1	
		03/17/2018 10:44:18	600	2120	24.7	1.70	-36.6	6.52	7.8	114	14.3	20.2	-0.1	
		03/17/2018 10:45:41	700	2290	8.0	1.24	-27.1	6.69	2.6	105	7.9	20.2	0.0	
		03/17/2018 10:47:21	800	2310	0.9	1.02	-17.7	6.74	0.7	99	5.7	20.2	0.0	
		03/17/2018 10:48:32	900	2320	0.4	0.89	-12.7	6.75	0.1	96	3.0	20.3	0.1	
		03/17/2018 10:50:00	1000	2320	0.0	0.77	-13.5	6.78	0.4	93	3.1	20.3	0.1	

Sample Tab Showing Stabilization Parameters

3. The new file needs to be quality control checked.
    a. Check the header cells of the “Front” tab. Make sure all of the data is correct.
    b. Check the “I_k Behavior” tab and “Sample Attempt” tabs. Make sure the depths and comments are correct.
    c. Check the sample tabs for correct dates and times, head values and parameter values and comments.
    d. Check the “Processed I_k” tab.

4. This is where alterations or corrections can be made to the Processed I_k data. You can revise the depth to water, feet of stainless or other parameters that the software uses to calculate the I_k. You can also edit and delete any inaccurate I_k data.

5. Carefully check the I_k plot for any errors or inaccurate data. Inaccurate data can be generated a variety of ways and should be deleted from the plot. Examples of this data are: driving the tooling with the flow off (flow is zero), driving the tooling without starting the KPRO Session (no data is recorded), not stopping the KPRO Session after a drive, entering the wrong depth after a drive, large I_k jumps when drilling stops, etc. If any of these things happen, delete or revise the data from the Processed I_k tab. Leave a blank row where the data was deleted so that the I_k Plot does not connect the data with a straight line.

   There are other cases where after adding a length of stainless tubing the flow drops resulting in a horizontal line on the plot. Sudden jumps in I_k can be changed by scaling data up or down so it aligns with the other data. Consult the Data Manager or Project Manager on how to correctly edit the I_k data.

At the end of the day email the data (Groundwater Profiling Log excel document, all associated csv files, and a scan or photo of the paper field form) to the Project Manager and/or Data Manager and back up the entire project folder to a data stick. Draft data can be given to the client in the field. Make sure that the file is named with the suffix "_Draft".

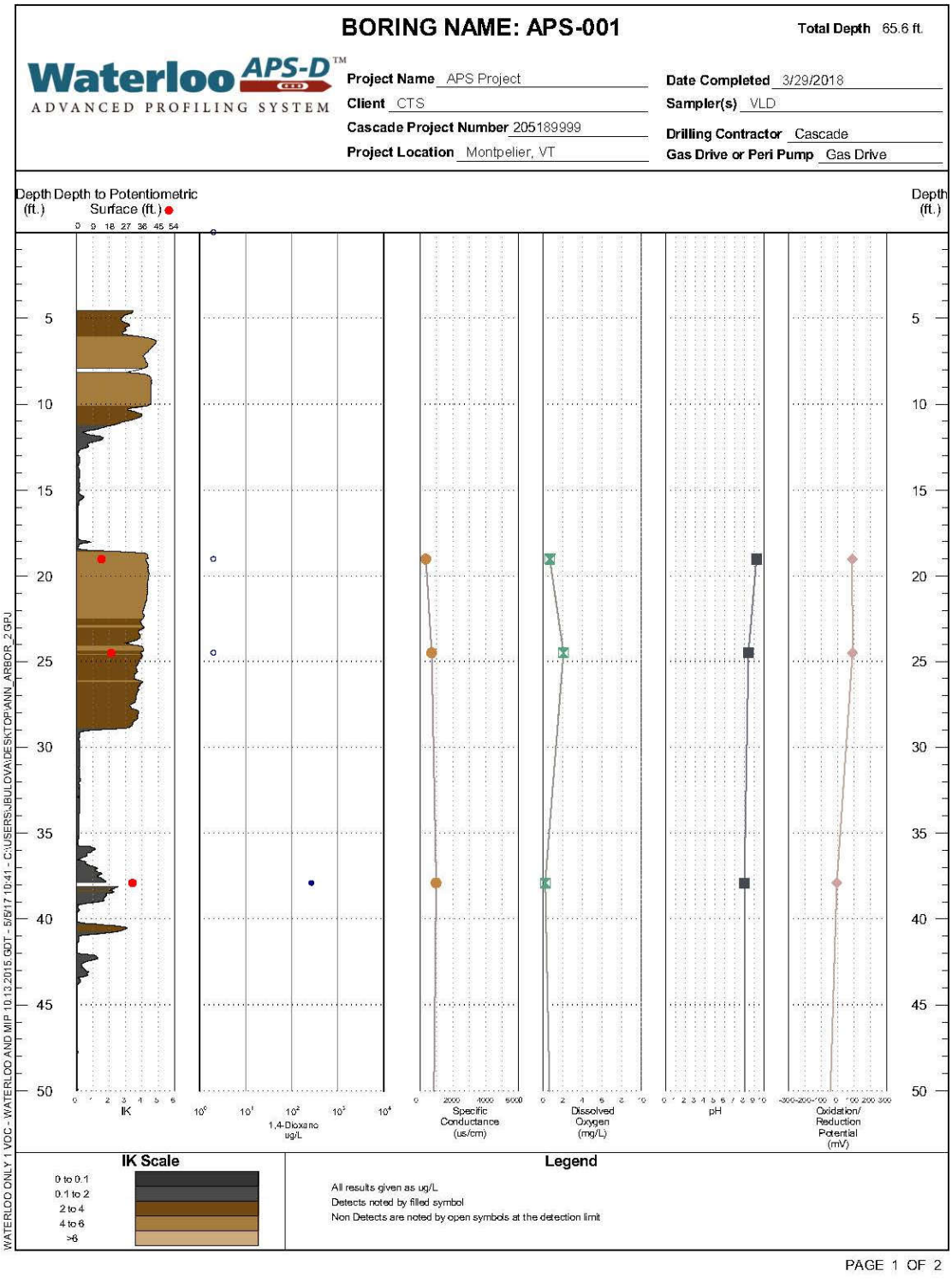
5.11 End of Project of Shift

At the end of a project or a work shift, the APS consumables need to be inventories, any broken equipment needs to be accounted for, and the APS equipment and vehicle need to be cleaned and organized. The Waterloo^{APS} End of Shift Checklist is included as Attachment 2. This form must be completed at the end of a shift or at the end of a project when the equipment returns. For the end of the shift, the form must be completed and left in the sampling vehicle for the next APS operator. A scan or photo of the form must be sent to the APS service line manager. If it is the end of a project, the original form can be submitted.

5.12 Final Data Deliverables

The final data package is completed by the APS Data Manager and consists of a brief narrative describing the scope of work, a table that lists the deviations from the standard operating procedure, copies of the stabilization parameter page of the Physchem Log, gInt plots of the I_k, physico-chemical parameters and I_k behavior. The

final data package goes through a secondary review process by the APS Data Manager before it is delivered to the client. The secondary review is documented in the “Waterloo APS Secondary Data Reviewer Checklist”. The completed checklist is maintained with the project file and can be made available for external review.



gInt Plot of Final APS Data

5.13 Cold Weather Operation

During the winter months when temperatures fall below freezing special precautions need to be taken to protect and successfully operate the Waterloo^{APS} equipment, APS box, and associated equipment.

5.13.1 Exposed Stainless Steel Tubing and Rods

While attempting to collect a groundwater samples with below freezing temperatures a cold weather harness may be required. The cold weather harness is a combination of heat tape and pipe insulation wrapped around the stainless steel tubing exiting the APS Box. In extreme cold the rod stickup and stainless steel tubing exposed between the cold weather harness and the ground may need to be heated using either a brush-burner or torpedo heater. Flexible duct work can be used to cover the stainless steel and exposed rod to direct the heat from the torpedo heater and to help insulate.

5.13.2 Leaving the Site Overnight

If freezing conditions will occur overnight the APS Box needs to be winterized. The flow meter and pressure transducer should be removed and stored where temperatures will not fall below freezing. The APS box and cold weather harness should be drained of water:

1. Disconnect the stainless steel tubing harness from the down-hole tubing.
2. Place the “U” piece of steel tubing with male quick connects on each end where the flow meter and pressure transducer were.
3. Disconnect the nitrogen “in” (white) KPRO vessel quick connect.
4. Remove the water “out” (black) KPRO vessel quick connect.
5. Turn the regulator dial counter clockwise so that regulator is off. Attach the stainless steel piece that was connected to the “out” (black) quick connect to the low pressure regulator on the nitrogen tank.
6. In the peristaltic pump mode set up the valves on the box as if you were in drive mode and slowly turn the knob on the regulator clockwise slowly until a small amount of nitrogen is flowing. After a few seconds you should see water being pushed out of the harness. After all of the water has been pushed out turn off the nitrogen regulator.
7. In gas drive mode you need to blow out the APS box as well as all three of the harness lines. To blow out the nitrogen line, simply turn the 5 way valve to the N2 Out and wait for all of the water to be pushed out of the nitrogen line on the harness. To blow out the sample line (middle tube on the

harness), arrange the valves as you would if you were filling the pump. Disconnect the N2 In and KPRO in quick connects on the APS box. Connect the N2 In to the KPRO In. Slowly turn the knob on the regulator clockwise slowly until a small amount of nitrogen is flowing and wait for all of the water to be pushed out of the sample line. To blow out the KPRO line, set up the valves on the box as if you were in drive mode and slowly turn the knob on the regulator clockwise slowly until a small amount of nitrogen is flowing. After a few seconds you should see water being pushed out of the harness. After all of the water has been pushed out turn off the nitrogen regulator.

The flow meter and pressure transducer, KPRO vessel, “out” (black) quick connect, Sonde water quality monitoring system, and calibration solutions should be stored where temperatures will not fall below freezing.

5.14 Other Profiling Configurations

It is possible to set up the APS box on a table, cart, tailgate or other surface in order to profile in locations that cannot be accessed with the truck. A portable gasoline powered generator is the preferred power source. If a generator is not available, it may be necessary to power the equipment using a battery. Do not use a standard car battery as repeated draining and charging will diminish its capacity over time. It is better to use a deep cycle RV or similar battery that is designed to power devices and not for starting engines. It is possible to power the APS box (including peristaltic pump) and field computer off of a battery for an entire 10 hour day as long as the battery is charged at night. The APS Box and computer will need to be connected to a DC to AC power inverter that is connected to the battery.

5.15 Sampling for PFCs

A few alterations must be made to the KPRO system when sampling for Perfluorinated Chemicals (PFCs). When using the peristaltic collection method, the FEP tubing connected to the profiling tip must be replaced with a High Density Polyethylene Tubing (HDPE). Any Teflon tape must be American-made or an alternative must be found. Any plastic (poly or Tygon tubing) must be replaced with HDPE or stainless steel tubing. Any water that is to be used either as injection water or decon water must be from a PFC free source (i.e. Spring water purchased for the project must be tested and approved).

6.0 DOCUMENT CONTROL SYSTEM

All logbooks, paper field forms, Certificates of Analysis for sonde calibration solutions and electronic field forms will be tracked in the Document Control System.

6.1 Maintenance Log Books

All maintenance log books associated with the APS boxes and water quality sondes will be numbered and recorded in the “Document Control Record” spreadsheet that is maintained in the “GLP_NELAP\Controlled Document Management” folder on the Cascade network. Logbooks will be tracked based on the following:

1. Assign a unique Document Control Number to each logbook that records a specific activity - this ID does not change for the life of the activity. Maintenance logs will be named “NFS” for “Notebook, Field Sampling” followed by a number (example: NFS001).

2. For an activity that has been assigned a specific Document Control Number, the first book issued is revision "0", the second book issued is revision "1", and the third book issued would be revision "2" and so forth. The ID does not change but the date and revision number do change with each book issued. For example, the first book issued would be NLB001.04.20.2017.00 (assigned on April 20, 2017), the second book issued for the same piece of equipment would be NLB001.07.20.201701 (assigned on July 20, 2017).

3. Print a label or handwrite this Document Control Number on the front cover of the logbook.

4. Enter the date issued in the spreadsheet; this is the date the book was created. The date issued and closed do not need to be recorded on the book, but do need to be recorded in the tracking system.

5. Enter the closed date in the spreadsheet - this is the last date the book was used.

6. Date issued and closed date do not need to be the same day; however, there should be no gaps in the chronological record.

7. Archive Location – retired logbooks will be kept in a file drawer in the Lab Quality Assurance Manager’s office.

8. Disposal Date - the earliest date the book can be disposed of, which is 10 years for books that recorded analytical or field procedures.

9. Once a book is archived, if the book is removed from the file cabinet, it should be signed out and back in again when it is returned. A sign in/out sheet will be located in the file cabinet where the logbooks are archived.

6.2 Paper and Electronic Field Forms

All paper field logs will be scanned or photographed and emailed to the APS Data Manager at the conclusion of each APS location. These electronic versions will be saved in the project folder on the Cascade network, along with any other electronic data pertaining to a specific project (e.g., electronic spreadsheets and raw data). The original forms will be returned to the APS Data Manager at the conclusion of the project and will be stored in a folder dedicated to that project. The folder will be labelled with the project name, number and date and will be stored in a dedicated file cabinet in the archive room.

6.3 Certifications of Analysis for Calibration Solutions

Certifications of analysis (COA) will be retained for each lot of calibration solution received. This certification applies to a particular lot number, which is printed on the side of the calibration solution bottle. This certificate will be scanned or photographed and stored in a file on the Cascade network. The lot number of the calibration solution used must be recorded in the Maintenance and Calibration Logbook for each sonde.

6.4 Electronic Field Forms

Versions of electronic field forms will be tracked in the "Document Control Record" spreadsheet that is maintained in the "GLP_NELAP\Controlled Document Management" folder on the Cascade network. Each version of the form will be recorded on the spreadsheet and given a unique ID. The current version of the forms will be stored on the Cascade network and made available to all field sampling staff.

7.0 TRAINING DOCUMENTATION

A Waterloo^{APS} Training Outline and Checklist will be completed by the trainer for each trainee. The completed checklist will be scanned and saved in the employee's training folder on the Cascade network and a hard copy will be stored in the employee's physical training folder.

8.0 RESPONSIBILITIES

1. It is the responsibility of the individual employee to read SOPs and document training associated with the area of work they are performing.
2. It is the responsibility of the individual employee to follow SOPs covering activities in his/her work area or to identify a deviation from the written SOP.

3. All personnel will legibly record data and observation to enable others to reconstruct project events and provide sufficient evidence of activities conducted.
4. All personnel will label each page with the date, the signature of the person taking notes (initials may also be appropriate), and the page number. All notes, signatures, and other observations should be entered in the field at the time the notes are taken.
5. CTS field staff should take care to ensure proper data management and integrity of samples.

9.0 REFERENCES

None

10.0 ATTACHMENTS

Attachments:

1. Attachment 1: APS Equipment List
2. Attachment 2: APS End of Shift Checklist
3. Attachment 3: APS Quick Reference Guide

11.0 AUTHORIZATION

Revised by:_____ Date:_____

Casey Moore, Waterloo^{APS} Service Line Manager

Approved by: _____ Date:_____

APPENDIX B STANDARD OPERATION PROCEDURE FOR SOIL BORINGS AND SAMPLING

Standard Operating Procedure #10
Soil Boring, Temporary Well Installation, Soil Sample Collection and Temporary Well Groundwater Sample Collection

This Standard Operating Procedure (SOP) details the procedures to be used to install and sample soil borings and temporary wells and to survey the sampling locations.

Equipment and Supplies

The following is a listing of equipment and supplies to use during drilling of borings and installation of temporary wells (if applicable). Other unspecified equipment may also be used either in addition to or as a replacement (if it is functionally equivalent) for the following list.

- Site map with the locations of the soil borings marked and a table with the Geographic Position System (GPS) coordinates of each boring.
- A copy of the Health and Safety Plan (HASP) and a copy of the Quality Assurance Project Plan (QAPP).
- Hollow-stem drill rig, sonic drill rig, or Geoprobe® and stainless steel samplers equipped with disposable acetate liners.
- Phoionization detector (PID) or flame ionization detector (FID).
- Trowel, zip-lock bags, VOC sampling equipment.
- Disposable gloves.
- Peristaltic pump and Teflon-lined or plastic tubing for grab groundwater sample collection, if applicable.
- Laboratory-supplied containers and shipping coolers.
- Preservatives.
- Ice.
- Indelible-ink markers.
- Labels.
- Chain-of-custody form.
- Field notebook and pens.

Field Documentation

See SOP #110 of the QAPP for field documentation procedures.

Decontamination

Perform sampling equipment and instrument decontamination as indicated in the HASP.

Standard Operating Procedure #10
Soil Boring, Temporary Well Installation, Soil Sample Collection and Temporary Well Groundwater Sample Collection

Sampling Equipment and Instrument Testing, Inspection, and Calibration

If not done before mobilization, perform sampling equipment and instrument testing and inspection as indicated in SOP #100 and perform calibration of the instruments as indicated in Table 2-6 of the QAPP.

Boring Drilling

- Use the GPS coordinates to locate the boring at the Site. If obstacles are present or subsurface clearance indicated the potential for a subsurface structure or utility, move the boring in the direction most appropriate for the purpose of the boring and obtain subsurface clearance for the new location.

- Check the specific boring location for the parameters for which samples are required and the depths at which they are required.

- Ask the driller to begin drilling the borehole.

- Describe and log each soil sample core recovered from each boring. Include the recovery length, composition, structure, grain size, density, sorting, color, and moisture content of the soil sample from visual observation. Use a Munsell® color chart to accurately identify the color of the soil.

- For each soil interval: (1) visually examine and describe the subsurface geology; (2) inspect the soil for visible evidence of contamination; and (3) perform field screening with a PID and/or FID for the presence of organic vapors by following the procedures below.

Field Screening for Organic Vapors

- Place a composite of each 2-foot soil core in a plastic bag that can be zipped and lock it.

- Place each plastic bag in a warm, shady area.

- After approximately 10-15 minutes, open a small portion of the zipper and insert the probe of the PID or FID.

- Record the measurement after it stabilizes.

Standard Operating Procedure #10
Soil Boring, Temporary Well Installation, Soil Sample Collection and Temporary Well Groundwater Sample Collection

Soil Sampling Procedures

- If volatile organic compounds (VOCs) are to be analyzed, follow IDEM's Supplemental Guidance for Sampling Soil and Waste Samples for Volatile Organic Compounds (March 2, 2007) (the "Modified Method 5035), which is included as Appendix B of the QAPP. IDEM's Modified Method 5035A includes using no field preservation and freezing of the sample upon arrival at the laboratory and within 48 hours of sample collection.

- Collect the number of samples from the depth intervals and for the analytical fractions indicated in Section 3.1.1.1 of the QAPP. Depending on the goal of the soil sample collection, they may be collected based on a sample at a specific depth; every pre-determined depth interval; or from the interval exhibiting the highest PID/FID response, staining, petroleum odor, or other intervals with field-observable indications of highest potential contamination.

- VOC sample collection options:
    - Option 1: Collect a soil sample for VOC analysis from the interval with the highest PID/FID reading as follows: (1) place a composite of each 2-foot soil core interval in plastic baggies in the cooler on ice and use another composite to measure organic vapors with a PID/FID; (2) once the interval with the highest PID/FID reading is identified, select the corresponding baggie, remove soil from it to fill out the required vials, and send them to the laboratory for VOC analysis.
    - Option 2: Blind drill a boring within 2 to 3 feet of the one where the PID/FID readings were taken and collect a soil sample from the depth with the highest PID/FID reading.

- Collect soil samples for other analytical fractions (semivolatile organic compounds, polynuclear aromatic hydrocarbons, metals, polychlorinated biphenyls, total organic carbon, etc.) or for geophysical parameters by placing a portion of soil from the core into the appropriate container.

- Preserve the soil samples as necessary. See Table 3-2 of the QAPP for the appropriate containers, sample volume, and preservatives.

- Follow SOP #120 for the contents of the container label and to package, mark and label, and ship the sample containers. The laboratory to which samples will be submitted is listed in Table 2-2 of the QAPP.

Standard Operating Procedure #10
Soil Boring, Temporary Well Installation, Soil Sample Collection and Temporary Well Groundwater Sample Collection

Temporary Well Installation

- Option 1: Insert a temporary 1-inch polyvinyl chloride screen and casing in the soil boring to keep the boring open to collect groundwater samples. Pour sand down the borehole outside the casing to create a minimum sand filter pack around the screen and to form a bridge above the screen to inhibit bentonite from falling to the screened interval.

- Option 2: Insert a temporary 1-inch pre-packed polyvinyl chloride screen and casing in the soil boring to keep the boring open to collect groundwater samples. Pour sand down the borehole outside the casing to create a minimum sand filter pack to form a bridge above the screen to inhibit bentonite from falling to the screened interval.

- Install a bentonite surface seal at each temporary well to prevent any surface water from entering the boring pending groundwater sample collection.

Temporary Well Groundwater Sample Collection

- Purge each temporary well until turbidity visually decreases.

- Collect the groundwater sample by using a peristaltic or vacuum pump and dedicated tubing inserted to the screen inside the temporary well.

- If the well goes dry, allow it to recharge for up to 24 hours before reattempting collection of the samples.

- Pour the groundwater water samples directly into appropriate laboratory-supplied containers and add the appropriate preservative. See Table 3-2 of the QAPP for the appropriate containers, sample volume, and preservatives.

- Follow SOP #120 for the contents of the container label and to package, mark and label, and ship the sample containers. The laboratory to which samples will be submitted is listed in Table 2-2 of the QAPP.

- After sample collection, remove the temporary well casing and screen from the boring and abandon the boring following Indiana's requirements, including the use of an Indiana-certified driller, completion of abandonment within 72 hours of drilling, and borings must be plugged from the bottom of the borehole to the ground surface with an impervioUos grouting material (i.e bentonite slurry or pelletized bentonite).

Standard Operating Procedure #10
Soil Boring, Temporary Well Installation, Soil Sample Collection and Temporary Well Groundwater Sample Collection

Boring Surveying

- Retain a certified land surveyor to survey ground surface elevation to an accuracy of 0.01 foot and the eastern and northern coordinates of each boring with a horizontal accuracy of 0.1 foot.

- Use the State Plane Coordinate system for the boring coordinates.

- Locate the new borings in relation to the existing site surveys.

Quality Control Samples

See Section 3.4 of the QAPP for the quality control samples to be collected for each medium and the procedures to collect them.

APPENDIX C STATEMENT OF QUALIFICATIONS FOR POTENTIAL ISS CONTRACTORS

Attachment

ISS Bench-Scale Study Subcontractor Proposals and SOQs

ENTACT
Proposal and SOQ

March 23, 2022

ATTN: Dwayne Keagy, LPG
Principal Consultant - Geologist
ERM
8425 Woodfield Crossing Blvd, Suite 560-W
Indianapolis, IN 46240

RE: **Revised ISS Bench Scale Study Proposal:**
Taylorville Superfund Site
Taylorville, Illinois

Mr. Keagy,

ENTACT is pleased to provide the following proposal to conduct a bench scale study for a potential in-situ stabilization/solidification (ISS) remedy at the Central Illinois Public Service Company (Ameren CIPS) Superfund Site in Taylorville, Illinois (Site). The following sections detail the specifics of the proposed bench scale study.

PROJECT UNDERSTANDING

ENTACT understands that the Site is a former manufactured gas plant (MGP) site and the contaminants of concern for the soil matrix are primarily volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). The area for the ISS remedy is approximately 200 feet by 200 feet to a maximum depth of 40 feet below ground surface. ISS is typically implemented to depths of 40 feet with a large diameter auger drill rig system that introduces cementitious grout into the target soil and blends the soil and grout into a homogenous mixture that reduces permeability and increases soil strength.

BENCH SCALE STUDY TESTING PROGRAM OVERVIEW

ENTACT will prepare a bench-scale study to identify reagents and dosage rates that will achieve the performance criteria as described below. The following testing will be performed to aid in the evaluation of ISS as a remedial option for the site:

- Index / baseline Testing of a site soil composite from the target remediation area:
    - Soil pH (ASTM D4972)
    - Moisture content (ASTM D2216)
    - Unit Weight (ASTM D7263)
    - Grain size with hydrometer (ASTM D422)
    - Atterberg limits (ASTM D4318)
    - USCS Soil Classification (ASTM D2487)
    - One-Point Standard Proctor (ASTM D698)
    - Organic content (ASTM D2974)
    - Hydraulic conductivity (remolded sample) (ASTM D5084)
- Baseline Composite Soil Analytical – Total VOCs (EPA 8260D) and PAHs (EPA 8270D)

2873 W Hardies Road – Suite 300 | Gibsonia, Pennsylvania 15044
P 412.567.9280 | F 724.939.3023

- Baseline Composite Soil Leaching – SPLP (EPA 1312) VOCs and PAHs and LEAF Method 1316 for VOCs and PAHs
- Mix Water (if necessary) – VOCs analysis (EPA 8260D) and PAHs (EPA 8270D)
- Soil-mix material of each mix - Geotechnical - UCS (ASTM D1633) at 7, 14, and 28-days of cure and hydraulic conductivity (ASTM D5084) at 7 and 28-days of cure
- Soil-mix material of selected mixes - Analytical - Total VOCs (EPA 8260D) and PAHs (EPA 8270D)
- Soil-mix material of selected mixes - Analytical - SPLP (EPA 1312) VOCs and PAHs and LEAF Method 1315 for VOCs and PAHs

ISS LEACHABILITY EVALUATION METHOD SUMMARY

To get a better understanding of leaching conditions post-ISS implementation, assessing leaching data in the bench scale study phase is crucial. In the field, the ISS sample permeability at 28-days of cure is the industry standard to identify the potential for leachability; however, there are three different analytical methods to assess ISS leachability as described below.

- Percent reduction in total concentrations
    - This method analyzes the reduction in target COC total concentrations in the soil-cement samples from the baseline composite soil. This method does not analyze leaching to groundwater from the ISS samples, but rather the reduction in total availability of the target COC's potential to leach to groundwater. Using the percent reduction method is beneficial as a point of reference to compare between ISS mixes and should not be compared to site-specific target leachability concentrations.
- Synthetic Precipitation Leaching Procedure (SPLP) reduction (EPA Method 1312)
    - This method analyzes the reduction in target COC SPLP concentrations in the soil-cement samples from the baseline composite soil. The SPLP method is typically used to determine the mobility of constituents by simulating the leaching effect from exposure to acidic precipitation using a single pH data point. SPLP should only be used to compare the potential for leachability between the ISS mixes and not compared to site-specific target leachability concentrations as the SPLP method requires the pulverization of the ISS samples. The extent of pulverization greatly increases the surface area of the ISS sample and therefore is not entirely representative of the actual leachability to groundwater of the ISS monolith under normal in-situ conditions. Often times, a "modified" SPLP is performed where a section of one of the sample cylinders is not pulverized to more closely represent field conditions of an ISS remedy and compared against the baseline SPLP data and the pulverized SPLP results.
- Monolithic leachability (EPA Method 1315)
    - EPA released the Leaching Environmental Assessment Framework (LEAF) in 2017 that identified more practical methods to assess leachability of the ISS monolith with in-situ conditions. The baseline soil leaching potential is assessed via EPA Method 1316: *Liquid-Solid Partitioning as a Function of Liquid-to-Solid Ratio using a Parallel Batch Extraction Procedure* where the soil is analyzed for leaching over a range of five (5) liquid to solid (L/S) values to establish equilibrium conditions at the natural soil pH. The ISS sample leaching potential is assessed via EPA Method 1315M: Mass Transfer Rates of Constituents in Monolithic or Compacted Granular Materials using a Semi-dynamic Tank Leaching Procedure where the intact soil-cement 2x4 mold sample is analyzed for leaching over a range of nine (9) time intervals ranging from 2 hours to 63 days where the leachate water is replenished each time interval. The 1315 modified method is specifically used for VOCs to fully assess the true leaching of VOCs over time. The reported results can be calculated

into an observed diffusivity that can be used as an input to a groundwater model to further evaluate the in-situ leachability over time of the ISS monolith. The groundwater model results can be compared to site-specific target leachability concentrations at a point of compliance. In addition, the 1315 results can be compared between the ISS mixes to assess the optimal reagent combination and dosage.

BENCH SCALE STUDY TESTING IMPLEMENTATION

ENTACT will require approximately three 5-gallon buckets of site soil targeting the area for the ISS remedy shipped to our lab located at 2873 W Hardies Road, Suite 300, Gibsonia, PA 15044. An additional one to two 5-gallon buckets of the proposed mix water source for mixing purposes if mix water other than city or potable water is anticipated for grout preparation. Otherwise, ENTACT will use potable water available in our lab. DI water is encouraged for the LEAF Methods (1316 and 1315) for a more conservative result and reduce interference with COC concentrations in site groundwater. Boring logs and/or test pit logs from the drilling/excavation of site soils for the bench scale will also be necessary for evaluation of the vertical limits of ISS to optimize the mix designs.

Upon receipt of the soil, ENTACT will homogenize and size down rocks or debris with a 3/8" sieve to create one composite soil that is representative of the vertical mixing limits. The composite soil will be tested for geotechnical index testing and baseline analytical testing as described above.

Phase 1: Initial ISS Testing (6 ISS Mixes)

After compositing, ENTACT will create six ISS mixes for initial testing from the composite soil sample as follows. Portland Cement and Ground Granulated Blast Furnace Slag (GGBFS) were selected as reagents based on previous MGP ISS experience; however, ISS reagents and dosages are subject to change based on receipt of the site soils and boring logs to best optimize the ISS treatment.

- 10% total reagent dosage, 100% Type I/II Portland Cement
- 15% total reagent dosage, 100% Type I/II Portland Cement
- 10% total reagent dosage (75% Grade 100/120 blast furnace slag, 25% Type I/II Portland Cement)
- 15% total reagent dosage (75% Grade 100/120 blast furnace slag, 25% Type I/II Portland Cement)
- 10% total reagent dosage (60% Grade 100/120 blast furnace slag, 40% Type I/II Portland Cement)
- 15% total reagent dosage (60% Grade 100/120 blast furnace slag, 40% Type I/II Portland Cement)

Upon further review of the site investigation information and index testing results, bentonite may be added to the above-mentioned mixes to include an increased fines content.

ISS mixes will be cured in cylindrical molds and placed in an appropriate curing environment. Each mix will be tested for unconfined compressive strength at 3 days of cure via pocket penetrometer and at 7, 14, and 28-days of cure via ASTM D1633. Each mix will also be tested for hydraulic conductivity at 7 and 28-days of cure. Depending on the results of the 28-day UCS and hydraulic conductivity testing, select mixes may be further analyzed for total VOCs and PAHs and leaching via SPLP and EPA LEAF Method 1315 to estimate mass reduction of site constituents. For the purposes of cost estimation, a minimum of two ISS mixes will be selected for analytical testing.

Phase 2: Optimized ISS Testing (3 ISS Mixes)

After review of the geotechnical and analytical results from the Phase 1 mixes, ENTACT will collaborate with ERM in determining the reagent composition and dosages for the Phase 2 testing. Phase 2 will consist of three ISS mixes from the same composite sample used in the Phase 1 mixes and prepared as described above. For the purposes of

cost estimation, a minimum of two ISS mixes will be selected for analytical testing including LEAF 1315 during the optimization phase.

PERFORMANCE CRITERIA

The ISS remedy will target the VOCs and PAHs in the site soil. Performance criteria for the ISS remedy during the bench scale study and full-scale implementation include a monolithic mass containing:

- An average unconfined compressive strength greater than 50 pounds per square inch (psi);
- An average hydraulic conductivity of less than 1 x 10^{-6} centimeters per second (cm/sec) with no single sample higher than 5 x 10^{-6} cm/sec; and,
- No visible presence of free product observed during field implementation after mixing is complete.

Performance criteria will target to be achieved by a cure duration of 7 days due to the smaller nature of the site and limited room for ISS equipment to operate; however, performance criteria will be allowable to be met after a longer cure duration. Leachability will also be assessed during the bench-scale study but will not be performed during field implementation.

SCHEDULE

Upon receipt of samples at ENTACT's laboratory, we estimate up to 21 weeks until results on the Phase 1 ISS mix designs are complete, which includes the time to conduct the leachability testing. Phase 1 mixes will not be performed until baseline test results are received. Upon discussion with ERM, ENTACT estimates that it will take 18 weeks until results of the Phase 2 ISS mix designs are complete, which includes the time to conduct the leachability testing.

The total schedule to conduct both Phase 1 and Phase 2 ISS mixes would be approximately 39 weeks. This schedule can be reduced to a total of 30 weeks by only performing SPLP, UCS, and hydraulic conductivity during Phase 1 and adding in LEAF testing during the Phase 2 optimization.

PRICING

The estimated cost for the bench scale study described herein is presented in **Table 1**. The study will be performed at the unit rates indicated. Should additional or fewer tests or mixes be performed, the total cost of the study will adjust accordingly.

CLOSING

Upon receipt of bench scale sample results, ENTACT will comment on the optimal dosage rates for each reagent in relation to the performance criteria and provide a bench-scale study report summarizing the findings and data reports. After review, if you have any questions or need any additional information, please don't hesitate to contact me at tmoran@entact.com or 412-357-1107 and I will gather my team for a prompt response.

Sincerely,

Tony Moran, P.E.
Project Coordinator – Geotechnical Engineer
ENTACT, LLC

TABLE 1

ERM - Taylorville Superfund Site - ISS Bench Scale Study
Taylorville, IL

Date: **3/23/2022**

ENTACT
2873 W. Hardies Road
Gibsonia, PA 15044

Price Schedule

Item	Description	Method	Unit Of Measure	Est. Qty.	Unit Price	Extended Price
1	**ENTACT Labor**					
	Project Director / Coordinator	-	Hour	30	$ 190.00	$ 5,700.00
	Engineer (s)	-	Hour	120	$ 125.00	$ 15,000.00
	Lab Technician	-	Hour	0	$ 95.00	$ -
					Sub-Total	**$ 20,700.00**
2	**Physical Soil Characterization (1 composite comprised of three 5-gal. buckets each)**					
	Soil pH	ASTM D4972	EA	1	$ 40.00	$ 40.00
	Moisture Content	ASTM D2216	EA	1	$ 25.00	$ 25.00
	Unit Weight	ASTM D7263	EA	1	$ 45.00	$ 45.00
	Grain-size Distribution	ASTM D422	EA	1	$ 180.00	$ 180.00
	Atterberg Limits	ASTM D4318	EA	1	$ 110.00	$ 110.00
	USCS Soil Classification	ASTM D2487	EA	1	$ 25.00	$ 25.00
	One-Point Standard Proctor	ASTM D698	EA	1	$ 200.00	$ 200.00
	Organic Content	ASTM D2974	EA	1	$ 75.00	$ 75.00
	Permeability (remolded)	ASTM D5084	EA	1	$ 340.00	$ 340.00
	Baseline Total VOCs	EPA 8260D	EA	1	$ 90.00	$ 90.00
	Baseline Total PAHs	EPA 8270D	EA	1	$ 175.00	$ 175.00
	Baseline SPLP Method Prep	EPA 1312	EA	1	$ 100.00	$ 100.00
	Baseline SPLP VOCs	EPA 8260D	EA	1	$ 90.00	$ 90.00
	Baseline SPLP PAHs	EPA 8270D	EA	1	$ 175.00	$ 175.00
	Baseline Leaching Method Prep	EPA 1316	EA	1	$ 2,500.00	$ 2,500.00
	Baseline Leaching VOCs	EPA 8260D	EA	5	$ 90.00	$ 450.00
	Baseline Leaching PAHs	EPA 8270D	EA	5	$ 175.00	$ 875.00
	Mix Water VOCs	EPA 8260D	EA	1	$ 90.00	$ 90.00
	Mix Water PAHs	EPA 8270D	EA	1	$ 175.00	$ 175.00
					Sub-Total	**$ 5,760.00**
3	**PHASE 1 - Initial Mix Testing (6 ISS Mixes)**					
	Pocket Penetrometer at 3 days	-	EA	6	$ 25.00	$ 150.00
	Flex wall Permeability @ 7, 28 Days	ASTM D5084	EA	12	$ 310.00	$ 3,720.00
	Unconfined Compressive Strength (7, 14, 28 Days)	ASTM D1633	EA	18	$ 100.00	$ 1,800.00
	Prepare Additional 2"x 4" samples for SPLP testing	-	EA	12	$ 50.00	$ 600.00
	Prepare Additional 2"x 4" samples for Leach testing	-	EA	12	$ 50.00	$ 600.00
	ISS Total VOCs	EPA 8260D	EA	6	$ 90.00	$ 540.00
	ISS Total PAHs	EPA 8270D	EA	6	$ 175.00	$ 1,050.00
	ISS SPLP Method Prep	EPA 1312	EA	6	$ 100.00	$ 600.00
	ISS SPLP VOCs	EPA 8260D	EA	6	$ 90.00	$ 540.00
	ISS SPLP PAHs	EPA 8270D	EA	6	$ 175.00	$ 1,050.00
	ISS Leaching Method Prep	EPA 1315	EA	2	$ 1,750.00	$ 3,500.00
	ISS Leaching VOCs	EPA 8260D	EA	18	$ 90.00	$ 1,620.00
	ISS Leaching PAHs	EPA 8270D	EA	18	$ 175.00	$ 3,150.00
					Sub-Total	**$ 18,920.00**
4	**PHASE 2 - Optimized Mix Testing (3 ISS Mixes)**					
	Pocket Penetrometer at 3 days	-	EA	3	$ 25.00	$ 75.00
	Flex wall Permeability @ 7, 28 Days	ASTM D5084	EA	6	$ 310.00	$ 1,860.00
	Unconfined Compressive Strength (7, 14, 28 Days)	ASTM D1633	EA	9	$ 100.00	$ 900.00
	Prepare Additional 2"x 4" samples for SPLP testing	-	EA	6	$ 50.00	$ 300.00
	Prepare Additional 2"x 4" samples for Leach testing	-	EA	6	$ 50.00	$ 300.00
	ISS Total VOCs	EPA 8260D	EA	3	$ 90.00	$ 270.00
	ISS Total PAHs	EPA 8270D	EA	3	$ 175.00	$ 525.00
	ISS SPLP Method Prep	EPA 1312	EA	3	$ 100.00	$ 300.00
	ISS SPLP VOCs	EPA 8260D	EA	3	$ 90.00	$ 270.00
	ISS SPLP PAHs	EPA 8270D	EA	3	$ 175.00	$ 525.00
	ISS Leaching Method Prep	EPA 1315	EA	3	$ 1,750.00	$ 5,250.00
	ISS Leaching VOCs	EPA 8260D	EA	27	$ 90.00	$ 2,430.00
	ISS Leaching PAHs	EPA 8270D	EA	27	$ 175.00	$ 4,725.00
					Sub-Total	**$ 17,730.00**
5	**Expenses**					
	Shipping	-	Cost +10%	1	$ 500.00	$ 500.00
	Travel	-	Cost +10%	0	$ -	$ -
					Sub-Total	**$ 500.00**
					TOTAL	**$63,610.00**

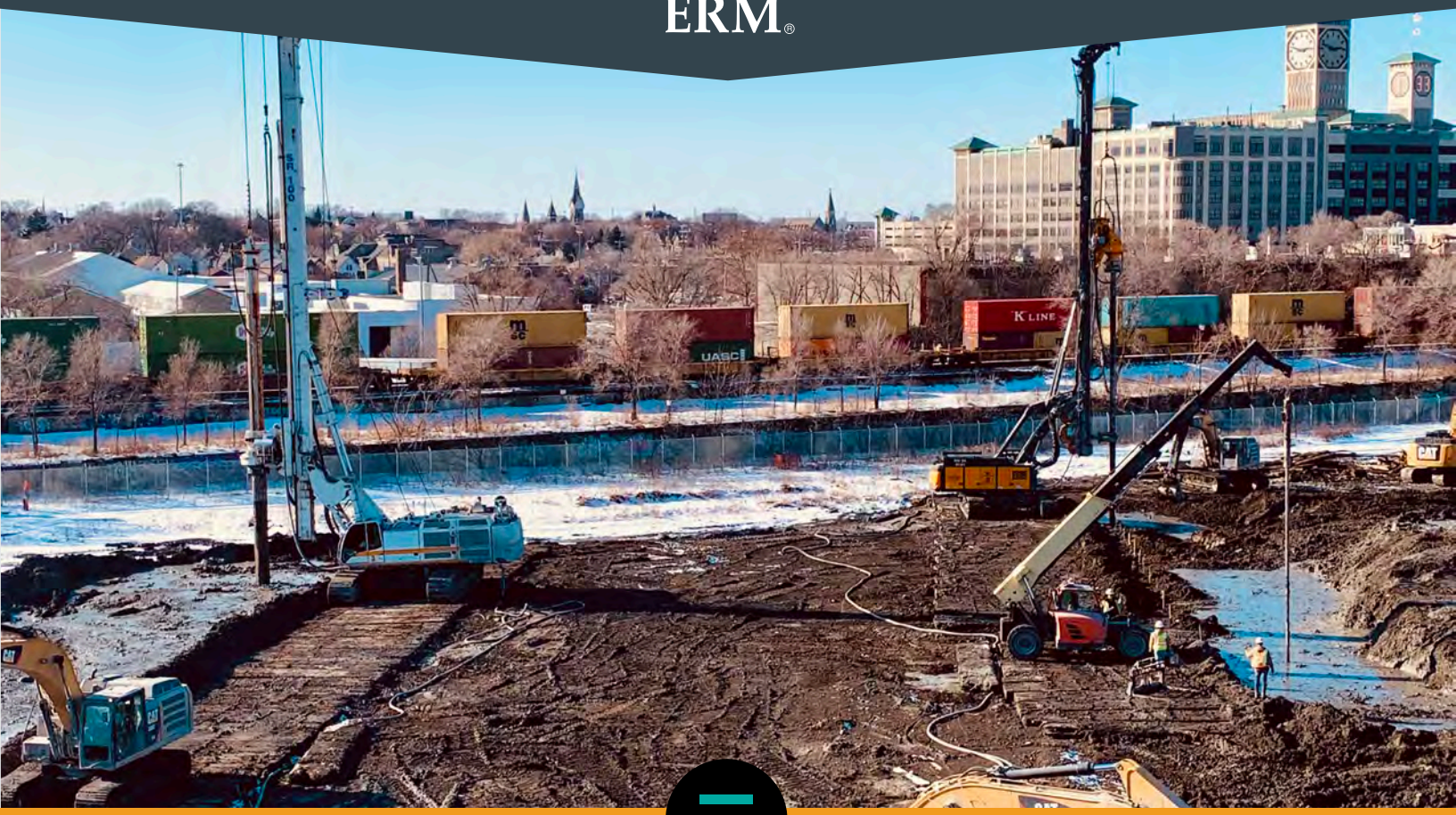
ENTACT

STATEMENT OF QUALIFICATIONS

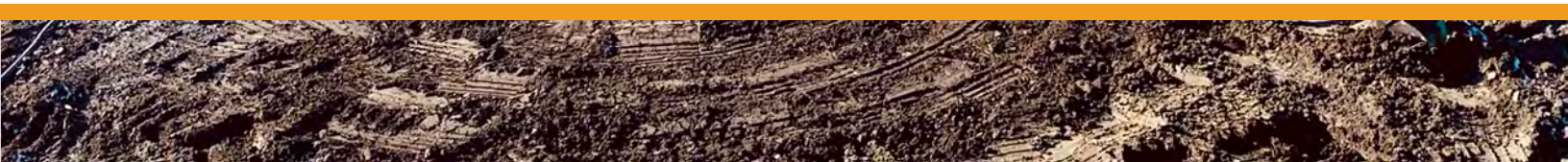
2022

Prepared For:

ERM®



ENVIRONMENTAL REMEDIATION ENTACT® GEOTECHNICAL CONSTRUCTION



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SECTION 1

ENTACT Project Experience

ENTACT PROJECT EXPERIENCE

ERM EXPERIENCE

ENTACT's relationship of providing service on ERM projects spans over 14 years. We are compliant (green status) in Avetta and have on-going or completed remediation and geotechnical construction services at project sites throughout California, Colorado, New Jersey, Oklahoma, South Carolina and Texas. Clients we have served together include FMC, PG&E, Brightfields Development, EVRAZ, AkzoNobel, Danaher, Duke Energy, and Evonik. We look forward to enhancing our existing relationship through continued successful project delivery.

The following project summaries highlight our work with Environmental Resources Management (ERM):

NATURAL GAS SITE REMEDIATION

SOUTHEAST

[MGP & IN-SITU STABILIZATION]

ENTACT was engaged to remediate an approximate 1-acre parcel to address non-aqueous phase liquids (NAPL) present in soil and groundwater at depths of 5 to 40 feet below ground surface (bgs) associated with former manufactured gas plant (MGP) operations. The Site is surrounded by a mix of commercial and light industrial properties and is bordered to the north, west and south by property owned by the City and operated by the City's Water Department. The Site is currently vacant with no structures present on the property. ENTACT's scope of work included conducting a bench scale treatability study; removal and relocation of a power pole; clearing vegetation around a drainage channel; installing cofferdams and sumps to reroute a sanitary sewer; dewatering, water treatment, and discharging to the city sanitary sewer; removal and/or demolition of various debris, piping, a concrete gas holder, asphalt and the existing sanitary sewer; excavating 5,790 cubic yards of impacted soils to 5 feet BGS, and conditioning as necessary for off-site transportation and disposal; in-situ solidification/stabilization of 9,500 cubic yards of impacted soils from 5 to 10 feet deep, and 15 to 30 feet deep, utilizing a DELMAG RH-34 caisson-type drill rig equipped with 11-foot and 8-foot diameter augers, respectively; installing a new sanitary sewer line and stormwater drainage features; importing, placing, grading and compacting a soil grading layer in excavated areas; restoring the drainage channel with geotextile and rip rap; installing asphalt pavement; and other site restoration activities.

FORMER WEST COAST MGP SITE

WEST COAST

[MGP & IN-SITU STABILIZATION]

ENTACT was engaged to perform remediation activities to address soil impacted by MGP-related constituents to restore the site for future development. Scope of work included: excavation and screening of MGP-impacted soils to remove wood and metal debris; recovery and disposal of MGP-related fluids from underground piping; cutoff and bentonite sealing of wooden foundation piling; removal of piping and ACM transite conduit banks; and selective removal and disposal of highly impacted soils. The screened soil area was then in-situ mixed with a cement/ground blast furnace slag slurry to achieve in-place hydraulic conductivity and strength requirements; including 15,000cy mixed using an excavator, and 600cy mixed using a large diameter auger. The work was performed using an automated batch plant, conducted within a ventilated tent structure, and comprehensive odor controls were implemented to enable the work to be conducted without impact to the surrounding neighborhood.

FORMER WOOD PRESERVING SITE REMEDIATION

MIDWEST

[IN-SITU STABILIZATION]

ENTACT performed remediation activities at this former wood treating CERCLA site under the Oklahoma DEQ VCP. Scope of work included confirmation sampling to define remediation area extents; dewatering and management of surface waters in ponds; onsite water treatment of over 38 million gallons of contact water, swales or other site features in advance of excavation and stabilization activities; excavation and consolidation of over 24,000 cubic yards of impacted upland soil into an onsite consolidation cell; closing the consolidation cell with a soil cover system; covering impacted sediment within an Ephemeral Stream and saturated impacted soil with cover soil; construction of a HDPE barrier wall (Gundwall) to prevent migration of Light Non-Aqueous Phase Liquid (LNAPL); construction of coffer dams / surface water control dikes within an Oxbow Lake, dewatering, and treatment and discharge of Oxbow Lake water; in-situ solidification and stabilization of over 33,000 cubic yards of impacted and non-impacted sediment within the lake; and placement of cover soil over the stabilized sediments. In total, over 73,000 cubic yards of soil cover materials were excavated and placed from an onsite borrow source. Restoration elements included hydroseeding, installation of various erosion matting and culverts, and rip rap channel improvement.

FORMER PAINT SITE SOIL SOLIDIFICATION

NORTHEAST

[IN-SITU STABILIZATION]

ENTACT was engaged to perform remediation of free product (coal tar and paint) and metals impacted soil at this former paint manufacturing site. Scope of work includes abandonment and removal of monitoring wells and multi-phase extraction/in-situ air sparge piping; removal, sizing and off-site disposal or recycling of 6,500 tons of surficial concrete and asphalt; consolidation, sampling, and waste classification of 4,200 cubic yards of surficial soil (0.5-feet to top of mix mass depth) within each soil mixing grid and transportation of 2,100 cubic yards of non-hazardous materials to staging area prior to off-site disposal; in-situ solidification of 16,800 cubic yards of impacted soils utilizing two ALLU horizontal auger mixing attachments affixed to excavators; screening and segregation of 18,900 cubic yards of surface and subsurface debris (paint cans, pallets, concrete) encountered during SS activities; management and grading of swell to achieve design grades; construction of capping systems over the SS areas using crushed stone/dense graded aggregate (DGA) and asphalt paving; installation of a concrete trench plug along the existing storm and sanitary sewer lines; on-site waste segregation, staging, waste classification, and off-site disposal (or recycling) at Owner approved disposal facilities; and site restoration including frontage stormwater diversion and beautification.

STEEL MILL ENVIRONMENTAL SUPPORT PROGRAM

ROCKY MOUNTAINS

ENTACT is providing environmental and remediation services to support the General Contractor in preparation for the construction of a new, modernized steel mill facility. As environmental impacts are found in advance of construction, ENTACT's team is dispatched to perform the identified work. Scopes of work include dismantling, cleaning, and loadout of WTP Equipment; abatement and disposal of ACM impacted pipe and gaskets; excavation, loadout, and transport of coal tar impacted soil; hydro-excavation of existing utilities and new utility corridors; excavation of utility corridors; and evaluation of historical facility warehouses and improvements needed for occupancy.

FORMER CARBON BLACK FACILITY CLOSURE REMEDIATION OF PONDS AND SITE SOILS

GULF COAST

ENTACT was engaged to perform closure activities at a former carbon black production facility in preparation for future redevelopment. Scope of work included: clearing and grubbing; relocation of conveyance storm water piping; closure of the on-site waste water system; dewatering four permitted storm water and process water ponds; in-situ solidification, excavation, transportation and off-site disposal or placement in the on-site landfill of 27,100 tons of pond solids; excavation, transportation and off-site disposal of 8,616 tons and on-site placement and consolidation of 11,806 tons of former tank pad and production area soils; re-grading and/or placement and compaction of approximately 8,000 tons of structural fill in affected areas to promote positive drainage; and revegetation with native grasses. ENTACT developed the mix designs in our bench-scale treatability laboratory and accomplished in-situ solidification utilizing bucket mixing techniques and pneumatic delivery of Portland cement and Calcium Oxide in varying percentages to the respective ponds.

MGP REMEDIATION EXPERIENCE

ENTACT and our personnel possess significant national MGP remediation experience. Within each ENTACT service region there are Project Managers, Site Superintendents, Health and Safety Officers, Hazardous Material Technicians, and Equipment Operators who successfully execute these challenging projects. Our comprehensive experience includes demolition of above grade structures and buildings, concrete foundations and slabs, and subsurface gas holders, containment structures, tar wells, and piping; utility abandonment, removal and re-installation; erection and operation of temporary containment structures; sizing, installation and operation of air handling and water treatment equipment; in-situ solidification/stabilization; ex-situ solidification and soil conditioning for disposal; installation of slurry walls, sheet pile, and complex earth retention and cofferdam systems; and various site and civil construction restoration efforts. ENTACT is particularly accustomed to high profile MGP remediation projects in metropolitan environments where odor, noise, dust and traffic control are critical priorities to ensure meeting our clients' project objectives.

ENTACT HIGHLIGHTS AND NOTABLE ACHIEVEMENTS

- Services Provided at over 35 Complex MGP Sites Throughout the Nation
- ISS Treatment of over 1,200,000 CY of MGP Impacted Waste
- Multiple MGP Site Engagements for National Grid, WEC Energy, Exelon, Dominion, NiSource, and PG&E
- Sole Source Engagement by First Time Utility Client for Phase II Remediation at an MGP Site in Downtown Racine after Successful Completion of Phase I Activities. Phase I Activities Resulted in Nomination for the Client's Annual Supplier Award
- Completed (2) of the Largest ISS Remedies at Former MGP Sites in the Northeast and Midwest

IN-SITU SOLIDIFICATION/STABILIZATION EXPERIENCE

ENTACT has been designing effective solidification/stabilization programs for on-site waste treatment remedies for over 30 years, treating millions of tons of impacted materials with our own recommended reagent blends and specialty equipment, as well as implementing conventional solidification/stabilization with more commonly known additives. ENTACT holds several mixing equipment and reagent patents for the treatment of various wastes. We have utilized both our proprietary technologies as well as other common applications (e.g. Portland cement, bentonite, etc.) to treat contaminated soils, sludges, and sediments in an effort to control valence states, buffer pH's, increase bearing capacities, reduce leachability, reduce permeability, prevent durability impacts, and remove the ability to produce a visible sheen on a multitude of contaminated soils.

TREATABILITY LAB

ENTACT's in-situ solidification/stabilization solutions are supported by our in-house bench scale treatability lab. This resource enables ENTACT to obtain first hand visual knowledge of the waste's treatment characteristics while closely matching the equipment selection to that envisioned for the full-scale operations. These critical variables provide real world solutions that are reproducible on a much larger scale.

ISS EQUIPMENT

ENTACT has completed some of the most complex ISS projects utilizing excavator bucket, horizontal auger, and vertical auger mixing technologies. ENTACT owns a Delmag RH-34 Vertical Auger Drill Rig and a Soilmec SR-100 Hydraulic Rotary Rig for the implementation of deep ISS solutions. This includes associated batch plants and drill attachments. We maintain spare parts for all high-wear items to insure minimal production interruptions in the event of any break downs during drilling operations. Our specialty equipment is among the newest and best maintained in the industry. This is complemented by a team of soil improvement/deep soil mixing personnel. Over the last ten years, our teams successfully treated over 10M cubic yards of material, which includes ISS of over 1.2M cubic yards using Vertical Auger mixing technology.

The following are select project examples representing our MGP remediation project experience.

FORMER MGP SITE ISS PHASE
NORTHEAST

ENTACT was engaged to perform a multi-year MGP site remediation for this major northeast utility. Site constraints included gas holders, concrete footings, foundations and subsurface utilities that required abandonment and removal prior to ISS, as well as overhead power lines which required minimum OSHA clearance and line shielding. Scope of work included excavation, transportation and disposal of 52,000 tons of MGP impacted soils; in-situ solidification/stabilization of approximately 169,000 cubic yards of impacted material using cement-bentonite-slag grout to a maximum of 47 feet deep via 8-foot diameter vertical augers; management, transportation and disposal of 15,750 tons of DSM derived spoils; excavation, stockpiling, and reuse of 30,000 tons of lesser impacted on-site material; placement and compaction of 60,000 tons of backfill; installation of a soil-crete retaining wall; construction, demolition, and reconstruction of a parking facility; utility removal, relocation and replacement; and site restoration. Excavation and spoils management activities were performed under a temporary containment building equipped with a vapor management system.

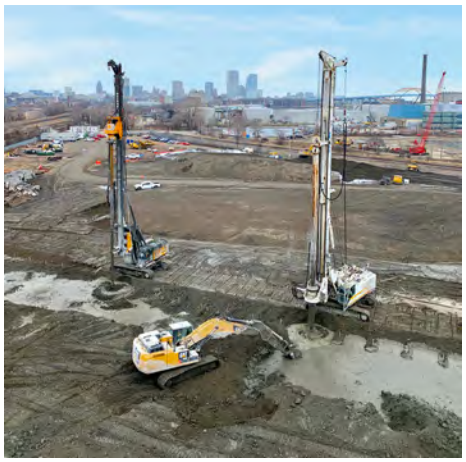
FORMER MGP SITE ISS - PHASE I AND II
MIDWEST

ENTACT completed remediation of the Office Building Property at this former MGP Site in preparation for future redevelopment by the City. The Site is located in a mixed-use downtown area nearby a major Lake, with current commercial and residential site uses that include a hotel, restaurant, condominiums, a boat mooring facility, and a city parking structure. Through two phases of work, ENTACT performed demolition, removal and off-site disposal or recycling of building slabs and subsurface structures, including gas holders, purifier boxes, a power house outlet, piping, over-sized debris, and timber piles; collection, management, treatment and discharging of MGP contact water; removal, re-installation or protection of utilities; plugging and grouting abandoned pipes; excavation and off-site disposal of 26,262 tons of MGP impacted soils; in-situ solidification/stabilization (ISS) of 58,039 CY of MGP impacted soils up to 34 feet deep; management of 9,608 CY of swell through immediate in-place grading or reconditioning and placement in a former building footprint; and site restoration.

ISS was accomplished by installing 10-Foot diameter overlapping soil-cement-slag columns using ENTACT's Delmag RH-32 Caisson Type Drill Rig equipped with a 10-Foot Auger and ENTACT's customized grout batch plant. Areas that overlapped the Phase I stabilized monolith were treated using excavator bucket mixing.

"A brief note of recognition and thanks for the excellent performance, value and support the ENTACT RGO project team provided in making the project a resounding success. ENTACT could not have provided better or more professional and safe service in all phases of the project from planning and through demobilization. In recognition of your efforts, Tom and I have nominated ENTACT for a We Energies Supplier Appreciation Award. Please convey our sincere gratitude to your project team for all their efforts and professionalism."

– Frank Dombrowski, WEC Energy (formerly WE Energies), Environmental Dept.



COKE & GAS SITE UPLANDS REMOVAL ACTION

MIDWEST

ENTACT was engaged to perform a Non-Time Critical Removal Action of 45-acres of the uplands area of this former coke and gas site located along a harbor in preparation for commercial redevelopment. Scope of work included demolition and removal of 38,000 cubic yards of surface and subsurface structures, including asbestos inspection and abatement; removal of 3900 wooden pilings; resizing, crushing and screening of 53,000 cubic yards of stockpiled debris down to 36" and 3" for reuse on site; excavation of 30,000 cubic yards of non-affected overburden soil for on-site stockpiling and use; excavation and consolidation of 50,000 cubic yards of source material for in-situ solidification/stabilization (ISS); ISS treatment of 230,000 cubic yards of designated soils; placement of 13,000 cubic yards of backfill in excavated areas outside of the ISS areas; dewatering and management of contact water; control of odors; management of stormwater; and grading of disturbed areas.

FORMER MGP SITE REMOVAL ACTION

GULF COAST

ENTACT completed a removal action at this 3.5-acre MGP Site located in a mixed industrial and residential area bordered by a creek, an unnamed ditch, and a Norfolk Southern Railroad (NSR) rail line. Scope of work included installation of excavation support systems (slide rail shoring); dewatering and water treatment; excavation, solidification, and off-site transportation and disposal of approximately 12,500 CY of MGP impacted material; demolition of existing driveways, sidewalks, roads, and underground structures within the removal areas; re-installation of disturbed storm drains, water utilities, and site appurtenances; construction of a rip-rap enforced bank along the ditch (within the railroad ROW) and basketball court; and backfilling and revegetation.

Several structures resided on the former MGP Site footprint including one office building and five duplex residential units. The slide rail excavation support system was utilized to protect the integrity and stability of the structures during excavation activities.

FORMER MGP SITE REMEDIATION

NORTHEAST

ENTACT completed remediation at this complex, 11-acre former MGP Site bounded by active businesses and residential communities. Scope of work included installation of 2,100 linear feet of sheet pile driven to depths of 40 to 50 feet to enable removal of 107,000 tons of MGP derived waste near an active rail line; natural decanting, soil conditioning, and off-site disposal of the sand; backfilling and restoration of the affected area; pre-trenching 450 feet of drive-line for the installation of a Waterloo Barrier by another contractor; management of multiple site utilities (fiber optic, phone, gas, sewer, and water); implementation of a complex traffic management plan; and removal of subsurface structures left in-place after the original facility was demolished. All excavation and load out activities were performed under a custom designed, crane liftable, draggable, temporary fabric structure with an air handling system. Upon completion of activities, the site was backfilled and restored and sheet pile configurations were extracted.

MGP SITE REMEDIATION
SOUTHWEST

ENTACT performed remediation of this former MGP Site/Electric Plant in preparation for redevelopment. Scope of work included excavation and management of 550,000 cubic yards of metals, PAH, and TPH impacted soils; removal of 34,000 square feet of asbestos containing material and demolition of a 15,000 square foot 4-story building; removal and relocation of a sewer and storm drain; construction of roads, ramps, right-of-ways and parking lots; designed and built over one mile of access road; and site backfill, grading and restoration activities. In addition, ENTACT designed and implemented a soil reuse plan that minimized off-site disposal to 200,000 cubic yards resulting in significant cost savings to the project stakeholders.

FORMER MGP SITE
MIDWEST

ENTACT remediated this former MGP site located along a navigable waterway and adjacent to a residential neighborhood. Scope of work included decontamination and demolition of various above-ground structures, subsurface tar wells, gas holders, and pier; installation of sheet pile and cofferdam system to prevent failure of riverbank and ensure structural integrity of an on-site building during excavation activities at depths up to 26 feet below the river level; dewatering of excavation areas, containment, and transport to an on-site water treatment system; excavation, on-site solidification, and off-site disposal of over 80,000 tons of coal tar impacted materials and MGP wastes; and site backfilling and restoration. Additional activities included removal of a gas holder, soils, and sludges from inside a warehouse that required level B PPE.

FORMER MGP SITE REMEDIATION
SOUTHWEST

ENTACT was engaged to perform remediation activities to address soil impacted by MGP-related constituents to restore the site for future development. Scope of work included: construction of temporary site infrastructure; installation of erosion and sediment control measures and perimeter dust control systems; location of public and private utilities, and coordination of removal or abandonment of designated utilities; excavation of soil test pits; demolition and removal of concrete foundations, brick and asphalt pavement for off-site disposal or recycling; excavation of 60,000 tons of MGP impacted soils, including large diameter auger excavation of approximately 4,000 cubic yards of subsurface soils in hot spot areas up to 50 feet bgs, and loading for off-site disposal; excavation, segregation and testing of potentially hazardous soils prior to loadout for off-site disposal; removal of 1,000 linear feet of coal-tar impacted pipelines that ran off-site beneath streets and sidewalks, and restoration of affected neighborhood areas; placement of 55,000 tons of various backfill types within the excavated areas; and restoration of unpaved areas with landscape gravel.

Final site restoration included disconnection of temporary utilities, removal and disposal of construction infrastructure, and removal of erosion control measures once stabilization was achieved.

FORMER MGP SITE REMEDIAL ACTION
MIDWEST

ENTACT performed remediation of this former MGP Site where historical releases of MGP residuals resulted in impacts to soil, groundwater, and an isolated area of sediment along the shoreline of the shallow river adjacent to the site. Scope of work included clearing and grubbing; demolition of concrete footings and slabs; removal of a gas holder; excavation and off-site disposal of approximately 10,500 tons of impacted soil; temporary bypass of a storm sewer line; installation of 180 linear feet of 36-inch reinforced concrete pipe, manhole, and headwall; ISS through vertical auger mixing of 29,762 cubic yards of impacted materials across the site, adjacent to and beneath the existing BNSF rail line, down the steep terrain towards the river, and 10 to 20 feet from the bank in the river bed; restoration of the site to natural grade with topsoil, native grasses and trees; and stabilization of the river bank through rip rap placement.

ENTACT installed temporary dams to divert water flow around the work area, along with a retaining wall made of ISS columns along the bank, to enable the excavation and treatment of impacted sediments located on the shoreline.

FORMER MANUFACTURED GAS PLANT
MIDWEST

ENTACT was engaged to remediate this former MGP Site located adjacent to a major roadway, an existing building, and fiber optics line. In order for removal activities to occur, ENTACT installed approximately 700 lineal feet of an earth retention system to protect the structural integrity of site features. Interlocking panels of sheet pile were driven to an approximate depth of 40 feet below ground surface (bgs) to accommodate the excavation of 60,000 tons of coal tar impacted soils to a depth of 28 to 30 feet bgs. An internal bracing system consisting of 24-inch to 36-inch horizontal wales with corner bracing was installed in stages at various depths as excavation progressed. Impacted materials were solidified with saw dust prior to transportation and off-site disposal. Upon completion of removal activities, the site was backfilled and restored.

FORMER MGP SITE IRM
NORTHEAST

ENTACT completed an Interim Remedial Measure at this former 7.5-acre MGP site to address impacts to soil, groundwater and source material resulting from former MGP operations. Scope of work included clearance of an existing 16-inch gas main; excavation of approximately 4,430 cubic yards of impacted soils and source material; conditioning of wet soils for transport with calcium oxide; removal of former MGP features such as footings, piers, beams, and other support structures; recovery of NAPL; backfilling of excavated areas and installation of surface cover; and off-site disposal of impacted soils, demolition debris and wastewater. All excavation and loadout activities occurred under a crane liftable temporary fabric structure equipped with a vapor management system.

FORMER MGP SITE NORTHERN PARCEL REMEDIATION

MIDWEST

ENTACT was engaged to perform remediation at this former Manufactured Gas Plant (MGP) to address potential risks posed by MGP residuals. Scope of work included abandonment of monitoring wells; installation of erosion and sediment control measures; demolition and removal of an existing subsurface gas holder wall to 3-feet below ground surface (bgs); removal of gas holder contents; excavation of impacted soil to depths of 2 to 3 feet bgs; removal and disposal of an underground storage tank (UST); off-site transportation and disposal of excavated soils, gas holder contents and debris, UST contents, and construction water; installation of a geotextile demarcation barrier in the limits of excavations; backfilling and compaction of excavated areas with various types of fill material; restoration of disturbed surfaces; and implementation of effective dust, odor and stormwater controls throughout project duration.

FORMER MGP SITE REMEDIATION REDEVELOPMENT

NORTHEAST

ENTACT was engaged to perform remediation activities at this 3.2-acre former Manufactured Gas Plant (MGP) site located in the Northeast. Remedial activities were conducted to address surface and subsurface soils impacted with coal tar and purifier waste from former MGP operations. General scope of work included excavation, screening and stockpiling of approximately 15,000 cubic yards of overburden material for eventual re-use as backfill; utilization of a trench box and/or sloping as necessary to support deep excavations of coal tar impacted materials; excavation, blending and off-site thermal treatment and disposal of 15,308 tons of coal tar impacted materials; design and construction of a 36-inch wide, 18,955 square-foot soil-bentonite slurry wall; design and implementation of in-situ stabilization of 15,583 cubic yards of purifier waste within the soil-bentonite wall and 7,398 cubic yards of coal tar; control and treatment of groundwater; backfilling with screened overburden and covering for future development; and management of wastewater and stormwater.

This work is part of a larger revitalization program that will address the following goals: optimizing land use including redevelopment of brownfields and special district rezoning that expands opportunities for industrial and large retail uses; creating jobs for the surrounding communities; improving traffic safety and efficiency; and creating connections that include greater access to the waterfront, streetscape enhancements, and intersection improvements for pedestrian safety.

FORMER MGP SITE SERVICE CENTER REDEVELOPMENT

MIDWEST

ENTACT was engaged to perform remediation of former MGP wastes present at this major utility's service center that was planned for expansion. The site was bordered by an active rail line, a major river, and a high pressure natural gas line. Scope of work included removal and stockpiling of overburden; design and installation of a soldier pile and lag wall consisting of 390 linear feet of H-piles up to 24-foot depths; excavation of 21,046 cubic yards of MGP impacted soils up to 12 feet bgs, with one area up to 35 feet bgs; in-situ solidification/stabilization of 3,600 cubic yards of MGP soils at depths up to 6 feet deep beyond the limits of the excavation support wall; removal and off-site disposal of 893 tons of concrete and 2,044 tons of asphalt; loading, transportation and off-site disposal of 34,262 tons of impacted soils and 112,343 and 9,946 gallons of impacted and hazardous liquids, respectively; importation and placement of 37,940 tons of gravel; and site restoration including installation of a swale at the western portion of the site. Even with the added scope to accommodate the upcoming redevelopment, ENTACT completed the project a month ahead of schedule. Post remediation, additional parking space and fleet storage and maintenance facilities were constructed on the remediated areas.

FORMER MGP SITE ISS

NORTHEAST

ENTACT was engaged to perform remediation of this former MGP Site to address impacted soils resultant from historical gas plant operations. The eastern portion of the site is developed as part of a hotel property, the central and western portion is a grassy vacant lot, and residential properties are adjacent to the site. Remedial activities included demolition of existing above grade structures including a two-foot retaining wall and concrete pad; removal of subsurface structures; installation of 622 linear feet of steel sheet pile around the MGP perimeter to a depth of 30-feet for excavation support and ISS; excavation and loadout of 6,240 cubic yards of impacted soils to a depth of 1 foot (near gas regulator), 4-feet (portion of gas regulator parcel and residential properties), and 8-14 feet (MGP site); shallow soft digs outside of the project limits on the adjacent hotel property and around a gas main; on-site management and off-site transportation and disposal 11,160 tons of excavated material and debris; ISS of approximately 8,000 in place cubic yards of MGP impacted soil to depths ranging from 21-feet to 34-feet below existing grade (15 feet to 30-feet below excavation grade) utilizing a Delmag Vertical Auger Mixing Rig equipped with either a 5FT or 10FT diameter auger; performance of core sampling and quality control procedures during ISS activities; dewatering and water management; placement and compaction of approximately 5,000 cubic yards of backfill in excavated/ISS areas with on-site re-use material and imported clean fill to within 6-inches of final grade; cut and/or removal of steel sheet pile to 4-feet below final grade; and restoration of disturbed areas with sod placement, planting and placement of landscaping boulders around the property. Sheet pile was installed using ENTACT's ABI Mobilram along an active gas line, within 65 feet the hotel, and along the 4 residential properties that were remediated.

MGP SITE SERVICE STATION REDEVELOPMENT

MIDWEST

ENTACT was engaged sole-source to assist in design finalization and perform implementation of remedial measures at an operating service facility after successful completion of a nearby former MGP Site regulated by the state's voluntary cleanup program. The site consists of a gas service building and asphalt parking lot. MGP impacted materials resultant from historical operations were located beneath the site. ENTACT's scope of work included abandonment of select utilities; abandonment of monitoring wells, removal of universal wastes, asbestos abatement, and demolition of a warehouse and gashouse building; verification of underground gas holders and soil sampling for waste profiling; removal and rerouting of existing storm sewer and sanitary sewer lines; assistance with relocation of gas lines through the site; UST removal; excavation and off-site disposal of 6,800 cubic yards of impacted soils up to 4 feet deep; demolition of gas holders; installation of multiple cement-bentonite slurry walls to 40 feet bgs; in-situ solidification/stabilization (ISS) of 17,700 cubic yards of subsurface soils utilizing both vertical auger and bucket mixing techniques up to depths of 40 feet; management and off-site disposal of 2,000 tons of excess swell; dewatering; and restoration of the site through installation of clean utility corridors and a demarcation layer, and placement of 6,300 tons of clean fill and 3,800 tons of aggregate base. Remediation was also performed on the adjacent residential property which included excavation of impacted soils to 8 feet deep, and restoration with clean fill, aggregate base, and topsoil.

FORMER MGP SITE SERVICE CENTER REMEDIATION

WEST COAST

ENTACT was engaged to perform remediation of historical MGP impacted soils present at this operating service center. Scope of work included securing work permits; finalizing the design for a soil-cement gravity wall shoring system for excavation support along the high pressure gas regulator pad; demolition of the former Operations Building concrete slab, asphalt pavement and historic below grade MGP structures such as gas holders, pots, chutes, chases, foundations, and old piping; asbestos abatement of transite piping; removal of disconnected utilities; installation of a 125 linear foot perimeter soil-cement with steel beam lagging gravity wall using an ABI TM-22 drill rig equipped with a 3-foot diameter auger triple auger head setup, up to 30 feet bgs and reinforced with steam beams every other column; excavation of 6,500 cubic yards of unsaturated impacted materials up to 15 feet deep; in-situ solidification/stabilization (ISS) of 4,050 cubic yards of impacted soils using a Delmag RH-34 vertical auger mixing rig equipped with a 6-foot diameter auger up to 50 feet below bottom of excavation surface; backfilling affected areas with 6,500 cubic yards of clean fill and aggregate; management and loading of 11,600 tons of excavated soil and contaminated debris; installation of permanent perimeter fencing; and site restoration.

OTHER ISS & SOIL MIXING EXPERIENCE

The following are select project examples representing our other ISS and Soil Mixing experience.

LNG EXPORT FACILITY SITE PREPARATION AND SOIL IMPROVEMENT PROJECT

GULF COAST

ENTACT has been engaged to perform soil stabilization in order to facilitate construction of an LNG export facility on the Gulf Coast. Approximately 3,050,000 cubic yards of soil will require stabilization using excavator bucket mixing and vertical auger mixing to achieve a minimum unconfined compressive strength (UCS) of 35 psi or 50 psi (depending on location) in 28 days. Scope of work includes performance of site clearing and grubbing; installation of (4) construction entrances; performance of four field soil improvement pilot test sections in order to establish the required cement dosages for achieving the specified target UCS; filling low areas with approximately 36,160 cubic yards of soils to raise the surface 1-foot above the water level to provide dry and stable platforms for the soil improvement work; soil improvement of 2,500,000 cubic yards to depths of 6.0, 9.0 and 10.0 feet bgs via excavator bucket mixing and 550,000 cubic yards to depths of 9.0, 11.0, 12.0, and 16.0 feet bgs via vertical auger mixing; and placement of geotextile, geogrid and crushed stone over the stabilized laydown area.

FORMER MGP SITE REMEDIAL ACTION

(AUGER MIXING)

MIDWEST

ENTACT performed remediation of this former MGP Site where historical releases of MGP residuals resulted in impacts to soil, groundwater, and an isolated area of sediment along the shoreline of the shallow river adjacent to the site. Scope of work included clearing and grubbing; demolition of concrete footings and slabs; removal of a gas holder; excavation and off-site disposal of approximately 10,500 tons of impacted soil; temporary bypass of a storm sewer line; installation of 180 linear feet of 36-inch reinforced concrete pipe, manhole, and headwall; ISS through vertical auger mixing of 29,762 cubic yards of impacted materials across the site, adjacent to and beneath the existing BNSF rail line, down the steep terrain towards the river, and 10 to 20 feet from the bank in the river bed; restoration of the site to natural grade with topsoil, native grasses and trees; and stabilization of the river bank through rip rap placement.

DISPOSAL SERVICES NPL SITE

(BUCKET MIXING)

SOUTHWEST

ENTACT completed remedial action activities at this petrochemical and industrial waste site. Activities included design and operation of a water treatment plant to pump and treat over 11 million gallons of impacted water from a 12-acre former process/storage lagoon; in-situ solidification/stabilization of 87,000 cubic yards of hydrocarbon and PCB impacted sludges up to 12 feet deep; management of stored liquids and demolition of tanks, piping, an incinerator, and sheds; excavation, hauling, placement, compaction and grading of over 500,000 cubic yards of material to construct a vault to contain the stabilized sludge, impacted soils, demolition debris, drums and barrels; construction of a 33-acre RCRA compliant Subtitle C equivalent capping system over the lagoon and dike footprint; regrading the evaporation cell; creation of a 12-acre waterfowl habitat lake from the on-site borrow area; installation of monitoring wells; and site restoration.

FORMER ASPHALT TERMINAL REMEDIATION
(BUCKET MIXING)
SOUTHEAST

ENTACT performed in-situ solidification/stabilization of approximately 23,000 cubic yards of LNAPL impacted native and fill soils to depths ranging from 4 to 10 feet in a 99,000 square foot area in the former tank basin. ISS was accomplished utilizing a reagent program consisting of Portland cement and dry bentonite and bucket mixing to meet a permeability range of 1 x 10^{-6} cm/s to 1 x 10^{-7} cm/s and strength improvements. Additional scope included grading, installation of a warning fabric, and construction of a 2-foot soil cover over an approximate 2-acre arsenic impacted area to serve as an institutional control to preclude future excavation in this area. ENTACT performed a treatability study at our in-house laboratory to develop specific mixtures that was the basis of the approved RAWP.

SILICA FACILITY LAGOON CLOSURE AND STORMWATER TREATMENT PROJECT
(BUCKET MIXING)
SOUTHEAST

ENTACT performed closure of five sludge lagoons and one sludge drying bed at this active facility. Scope of work included access road construction; clearing and grubbing; lagoon dewatering and in-situ solidification/stabilization (ISS) of approximately 43,200 cubic yards of impacted sludge from 6 to 16 feet bgs; regrading the stabilized subbase and reconfiguration of lagoon areas in preparation for construction of a Vertical Flow Cell (VFC); construction of the VFC that included installation of a geosynthetic clay liner (GCL), 10oz non-woven geotextile, 6 inches of non-carbonate gravel, 24 inches of compost, 6 inches of non-carbonate gravel, and 18 inches of compost; re-routing the stormwater conveyance system from an existing outfall to the newly constructed VCF; and site restoration, seeding and fertilizing. ISS accomplished via bucket mixing utilizing a mix design that included a combination of Type II Portland Cement, Grade 120 Slag Cement, and Bentonite to meet TCLP requirements for Cadmium, Arsenic, Lead, and Chromium; SPLP for Zinc; and a minimum UCS of 4.5 psi.

ACTIVE CHEMICAL FACILITY ISS PROJECT
(AUGER MIXING AND BUCKET MIXING)
SOUTHEAST

ENTACT performed in-situ stabilization/solidification (ISS) at an active chemical facility to address benzene and chlorobenzene impacted soil. Site preparation activities included establishment of vibration and optical monitoring points, removal of existing dense-graded aggregate (DGA) cover, test pitting to identify historical pile cap locations, and demolition of remaining pile caps/debris for offsite disposal. Remedial activities included ISS excavator bucket mixing and ISS auger mixing using a Vertical Auger Mixing Rig equipped with 3 foot and 6-foot diameter augers. Approximately 2,900 in place cubic yards of impacted soil to 10 feet (below ground surface (bgs) were mixed via excavator mixing and approximately 7,000 cubic yards of impacted soil to depths ranging from 22 to 30 feet bgs were mixed via auger mixing. Site restoration activities including grading swell throughout mixing activities, placement of a demarcation geotextile and 600 cubic yards of previously excavated DGA cover and imported DGA on completed and graded ISS swell subbase surface.

Logistical challenges included site access constraints including height restrictions and site access bridge weight restrictions for equipment, ISS around pile cap locations to maximize the amount of impacted soil remediated via ISS, ISS nearby overhead utilities including pipe racks, and sequencing of ISS to support drill rig stability during mixing.

LNG LIQUEFACTION SOIL STABILIZATION PROJECT TRAINS 1-3

(BUCKET MIXING)

GULF COAST

ENTACT performed mass stabilization of over 2,273,719 cubic yards of soft dredged sediment and fill soils in preparation for an LNG terminal expansion. Upon completion of ground improvement activities, three LNG Trains (Trains 1 through 3), a Common Gas Pre-Treatment Unit, and a Loading Dock was constructed and connected to the existing facility to complete its turn-key natural gas liquefaction facility. In-situ stabilization was accomplished with (16) excavators working atop timber mats and delivery of Portland cement via custom-fabricated pneumatic cement conveyance boxes; and was performed to 8.0 feet bgs under future foundation structure areas and 5.0 feet bgs from finish grade in other remaining areas. All cement-improved soils and sediment was required to achieve a minimum unconfined compressive strength (UCS) of 25 psi.

Additional scope included site wide clearing and grubbing; construction of board access roads to facilitate cement conveyance to proposed stabilization areas; performance of three field stabilization pilot tests to confirm reagent dosages met a minimum UCS of 25 psi in 28 days; excavation and hauling 836,710 cubic yards of soils and/or pre-stabilized material from 26 distinct cut areas using (10) 40-ton articulated trucks, including removal of 167,969 cubic yards of pre-stabilized material in 8 areas in order to achieve bathtub grades; backfill placement and compaction of over 747,129 cubic yards of soil and/or pre-stabilized material within 31 distinct fill areas; stockpiling 89,581 cubic yards of excess pre-stabilized material; construction of temporary shoring system consisting of a series of soil-cement gravity retaining structures installed using vertical auger mixing followed by excavation and construction of a 70-foot by 70-foot sump and 2,660 linear foot trench; installation of reinforced concrete drainage culverts, 36-inch HDPE outflow structure with catch basins and rock filter dam, liquefaction flap-gated outflow structure with headwall and wing walls, and the Facility drainage outflow structure including headwall and wing walls; demolition of 1,117 cubic yards of concrete foundations associated with an old plant/washout pit, existing outfall structure, and concrete supports; removal of 7,000 lineal feet of chain link fence, a 9-foot wide, 61-foot long and 4-foot wide, 26-foot long walkway grating with handrails, and miscellaneous timber and steel beams; and downsizing of 28 piles (HP 10x27) to 2.0 feet below existing grade.

SECTION 2

Health & Safety Metrics & Certificate of Insurance

HEALTH AND SAFETY

ENTACT's Behavior Based Health and Safety Program focuses on preventing losses through behavior modification within an integrated safety management system. This system identifies and eliminates risk before it occurs and is a proven, effective tool that has been integrated into ENTACT's business philosophy.

No injuries. No incidents. No fatalities. No excuses.

Our aggressive attitude towards health and safety does not tolerate unsafe behavior and rewards safe behavior. We expect each ENTACT associate to act in a responsible and safe manner at all times. Communication between Field Crew, Project Management, and Health and Safety representatives is essential to the execution of a safe project. ENTACT conducts task observations, near loss investigations, daily safety meetings at all project sites, staffs projects with qualified on-site health and safety personnel, and conducts safety inspections and audits on a frequent basis to continuously provide methods of communication and improvement.

Our commitment to the Behavior Based Health and Safety System and the dedication of each and every ENTACT associate has enabled our organization to achieve an industry leading health and safety record.

ENTACT TRAINING

ENTACT's Behavior Based Health and Safety System is implemented at all ENTACT office locations and project sites and has been embraced as a business philosophy or "way of life" throughout ENTACT. Every ENTACT associate receives documented training and is required to participate in Behavior Based Health and Safety System processes on a daily basis.

SAFETY HISTORY 2018 – 2021

YEAR	EMR * Effective Date 12/1	INCIDENT RATE				ACTUAL INCIDENTS				HOURS
		LOST TIME	JOB TRANSFER/ RESTRICTED DUTY	MEDICAL ONLY	TOTAL	LOST TIME	JOB TRANSFER/ RESTRICTED DUTY	MEDICAL ONLY	TOTAL	
2018	0.64	0.35	0.18	0.00	0.53	2	1	0	3	1,138,286
2019	0.60	0.00	0.26	0.13	0.39	0	2	1	3	1,540,619
2020	0.71	0.00	0.16	0.16	0.32	0	1	1	2	1,249,340
2021	0.73	0.34	0.00	0.17	0.51	2	0	1	3	1,175,086
2022	0.70	0.00	0.00	1.95	1.95	0	0	1	1	102,377

ENTACT sees its safety management initiative as an obligation and views safety performance as critical to maintaining a leadership role in the environmental and geotechnical services industry. ENTACT is a member in good standing with ISNetworld, Avetta, Veriforce, Gold Shovel Standard, TAPPISAFE, Coalition for Construction Safety, and Edison Electric Institute. ENTACT practices Behavioral Based Safety adapted to specific client needs such as integrating Chevron's Human and Organizational Performance, Learning Teams, Managing Safe Work Standards and Operational Excellence (OE) Processes, and ExxonMobil's Loss Prevention System (LPS) and Operations Integrity Management System (OIMS).

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 11/23/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
Arthur J. Gallagher Risk Management Services, Inc. 300 South Riverside Plaza, Suite 1500 Chicago IL 60606	PHONE (A/C, No, Ext):	FAX (A/C, No):
	E-MAIL ADDRESS:	

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Allied World Assurance Co (U.S.) Inc.	19489
INSURER B : Zurich American Insurance Company	16535
INSURER C : Ironshore Specialty Insurance Co	25445
INSURER D : Colony Insurance Company	39993
INSURER E :	
INSURER F :	

INSURED
Entact, LLC
1 East Oak Hill Drive
Suite 102
Westmont IL 60559

COVERAGES **CERTIFICATE NUMBER:** 1347874270 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X **COMMERCIAL GENERAL LIABILITY** [ ] CLAIMS-MADE [X] OCCUR X Contractors PL X CPL Ded:$100,000 GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY [X] PRO-JECT [ ] LOC X OTHER: DED: $100,000	Y	Y	0311-6241	12/1/2021	12/1/2022	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG Contractors PL	$ 1,000,000 $ 500,000 $ 25,000 $ 1,000,000 $ 2,000,000 $ 2,000,000 $ 1,000,000
B	**AUTOMOBILE LIABILITY** X ANY AUTO OWNED AUTOS ONLY [ ] SCHEDULED AUTOS X HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY X Comp: $1,000 X Coll: $1,000	Y	Y	BAP 3061330-04	12/1/2021	12/1/2022	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
A C D	X **UMBRELLA LIAB** [X] OCCUR X **EXCESS LIAB** [ ] CLAIMS-MADE [ ] DED [X] RETENTION $ $10,000	Y	Y	0311-6243 IEELCASB46V1002 EXO4278268	12/1/2021 12/1/2021 12/1/2021	12/1/2022 12/1/2022 12/1/2022	EACH OCCURRENCE AGGREGATE Excess over Excess	$ 15,000,000 $ 15,000,000 $ 35,000,000
B	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	Y	WC 3061329-04	12/1/2021	12/1/2022	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000
A	Professional Liability Contractors Pollution Liability Pollution & Prof. Ded: $100,000			0311-6241	12/1/2021	12/1/2022	Professional Pollution Aggregate	$1,000,000 $1,000,000 $2,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Evidence of Coverage.
Additional Insured where required by written contract, primary/non-contributory.
Waiver of Subrogation where required by written contract.
Excess Liability is follow form.

CERTIFICATE HOLDER

SPECIMEN

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

SECTION 3

Avetta Status

AVETTA STATUS

ENTACT is compliant (green status) in Avetta.

Avetta
Green Flag Status

SECTION 4

Union Labor Response

UNION LABOR RESPONSE

ENTACT is an open-shop contractor, self-performing remedial construction work nationally using our own trained equipment operators, laborers, and management personnel. However, ENTACT can provide union labor for the subject project and frequently executes project-specific agreements with local unions whenever required by a client or specific project.

SECTION 5

Ameren Experience Response

AMEREN EXPERIENCE RESPONSE

While ENTACT is recognized as a premier remedial construction provider to our Utility Industry Clients and has completed over 35+ former MGP remediation project., We do not have an existing contract with Ameren, nor have we completed work for Ameren in the past.

Forgen
Proposal and SOQ

6558 Lonetree Blvd.,
Rocklin, CA 95765

www.forgen.com

March 23, 2022

Dwayne Keagy
ERM
Woodfield Three
8425 Woodfield Crossing Blvd., Suite 560-W
Indianapolis, IN 46240

RE: S/S Treatability Testing - Revised

Dear Mr. Keagy:

Forgen, LLC appreciates the opportunity to provide bench-scale Stabilization/Solidification (S/S) treatability testing services for a former MGP facility in Taylorsville, IL. Forgen understands that the objective of the S/S treatment is to produce treated materials which will:

- Produce an unconfined compressive strength (UCS) of greater than 50 psi; and
- Develop a hydraulic conductivity of less than 1x10-6 cm/s.

The goal of the study will be to produce treated materials which can be safely left on-site without impacting human health or the environment.

TREATABILITY STUDY OBJECTIVES

The primary objective of the S/S bench-scale treatability study is to develop and verify treatment formulations for the MGP-impacted subsurface soils so that the treated material meets the strength (50 psi) and hydraulic conductivity for leaving the treated material on-site.

The optimal formulations would produce treated materials which are appropriate to remain in-place at the lowest anticipated reagent cost.

FIELD SAMPLING

The bench-scale treatability study will be conducted on two representative samples. To obtain representative samples, ERM will containerize excess material from sonic cores used to define the extent of contamination. Based on the MGP impacts seen in the cores, ERM will select 2 cores for treatability testing. The excess material from these cores will be placed into 5-gallon buckets, which will be shipped to the Forgen's treatability laboratory.

SAMPLE CHARACTERIZATION

Upon receipt at the laboratory, the sample material from each representative sample volume will be individually homogenized. The homogenized sample material from each representative sample will be used for the initial characterization testing and will be analyzed for total VOCs, SVOCs, and TAL metals, TOC, pH, grain size, and solids content. The homogenized samples will also be subjected to SPLP and LEAF leachability testing, with all leachates analyzed for VOCs, SVOCs, and TAL metals.

TIER 1 FORMULATION AND DEVELOPMENT TESTING

1,500 g aliquots of the homogenized sample will be treated using the following reagents and reagent combinations (mix ratio = [(weight reagent)/(weight waste)]):

Formulation	Portland Cement	GGBFS
	Mix Ratio	
1	0.015	0.045
2	0.02	0.06
3	0.025	0.075
4	0.03	0.09
5	0.03	0.03
6	0.027	0.053

The reagents will be mixed 1:1 by weight with water to produce a slurry, which will be mixed into 1.5 kg of waste material using a planetary mixer until visibly homogeneous. The treated material produced will be compacted into five 2-inch x 4-inch right cylinder molds and a 4 oz plastic cup.

Each formulation will be tested for pocket penetrometer strength at 1, 3, 5, and 7 days of curing. Formulations with >4.5 tsf penetrometer strength will be tested for UCS (ASTM D1633) at 7, 14 and 28 days of curing. Formulations attaining with >50 psi UCS will be tested for hydraulic conductivity (ASTM D5058) at 14 and 28 days.

Geotechnical testing will be performed by Timely Engineering Soil Tests, LLC (TEST).

TIER 2 FORMULATION DEVELOPMENT AND TESTING

Based on the results for the initial formulations, Tier 2 formulations will be determined for both sample materials. Up to 4 additional formulations will be prepared to either improve performance (with respect to strength, hydraulic conductivity, and/or reagent usage). The reagents will be mixed 1:1 by weight with water to produce a slurry, which will be mixed into 1.5 kg of waste material using a planetary mixer until visibly homogeneous. The treated material produced will be compacted into five 2-inch x 4-inch right cylinder molds and a 4 oz plastic cup. Each formulation will be tested for pocket penetrometer strength at 1, 3, 5, and 7 days of curing; for unconfined compressive strength at 7, 14 and 28 days of curing; and permeability testing at 14 and 28 days.

TIER 3 LEACHABILITY TESTING

Based on the results for the Tier 1 and 2 formulations, 2 formulations will be selected for LEAF (SW-846 Method 1315) semi-dynamic leach testing and SPLP Testing. The extracts for the LEAF and SPLP testing will be analyzed for SVOCS, VOC, and TAL metals.

REPORTING

The results of the treatability study will be presented in a draft Bench-Scale S/S Treatability Report. The report will include the results of the initial waste characterization, Tier 1, 2, and 3 formulation development, results of geotechnical tests from Tier 1 and 2 tests, and results of the LEAF testing. The report will also include a description of the results as to whether the treatment met the performance criteria, the reagent mix design, preliminary reagent costs, how the treatment would be implemented in the field, and any concerns related to full-scale implementation. Tabular summaries and laboratory reports in support of the Bench-Scale Treatability Study will be included as part of the report.

COST

The cost for conducting the treatability testing outlined above on the two representative samples, including the 4 LEAF tests (two characterization and two treated), will be $64,050. The cost is broken down below:

Category	Labor		UCS		Hydraulic Conductivity		Analytical		LEAF Testing	
	Hours	Cost	#	Cost	#	Cost	#	Cost	#	Cost
Characterization	6	$960					2	$4,100	2	$12,000
Tier 1	18	$2,880	24	$4,320	12	$6,480				
Tier 2	12	$1,920	8	$1,440	6	$3,240				
Tier 3	4	$640					4	$3,000	2	$12,000
Reporting	24	$3,840								
Subtotal	$10,240		$5,760		$9,720		$7,100		$24,000	
Contingency, Supplies, Shipping	$7,230									
Total	$64,050									

SCHEDULE

Forgen will submit a Bench-Scale Treatability Report (discussed above) within 22 weeks from the receipt of the representative samples at our laboratory.

ASSUMPTIONS AND CLARIFICATIONS

Forgen assumes that we will be able to come to mutually agreeable terms and conditions for conducting the scope of work discussed above.

Should you have questions or desire additional information, please contact me directly at (916) 462-6437 or by email at glittle@forgen.com.

Respectfully,

George Little, P.E.
Project Director

Forgen

INQUIP ASSOCIATES, INC.

SOIL MIXING

STATEMENT OF QUALIFICATIONS

TABLE OF CONTENTS

Forgen


At Forgen we are Committed to MINIMIZING YOUR RISK & LIABILITY through a CULTURE of SAFETY, INNOVATION & EXCELLENCE.

SECTIONONE
INTRODUCTION

Forgen was founded to provide high-quality environmental remediation and infrastructure technology solutions to public and private sector clients. We are one of the largest environmental construction companies in the United States offering remediation and infrastructure services on a national level. Our people have significant experience delivering safe and successful projects in a variety of settings utilizing innovative technical solutions and implementation strategies that render the best possible value.

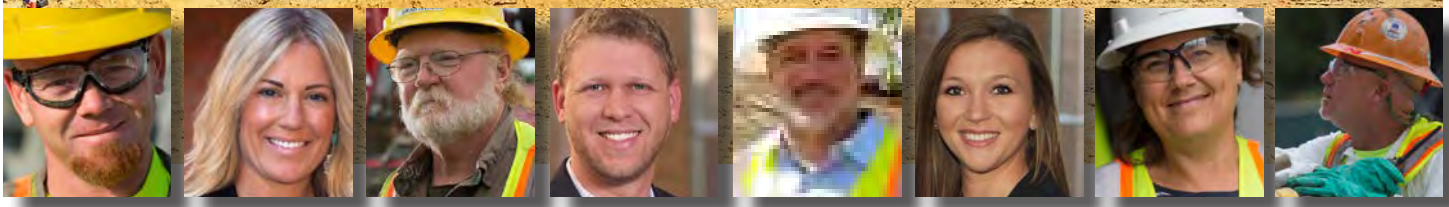
Forgen has built a highly specialized and experienced team with an impressive work history. Many of our completed and current projects includes multi-faceted scopes of work which are subject to stringent health and safety specifications, schedule constraints, and quality control requirements. We are experts at collaborating with clients and other stakeholders to deliver projects on time and within budget, and provide end results that are in the best interest of the overall project.

We recently welcomed Inquip Associates, Inc. (Inquip) into the Forgen family. Inquip is one of the oldest geotechnical companies in the nation with a senior staff of geotechnical engineers and construction superintendents who helped pioneer the slurry trenching method of construction from the 1950s to present.

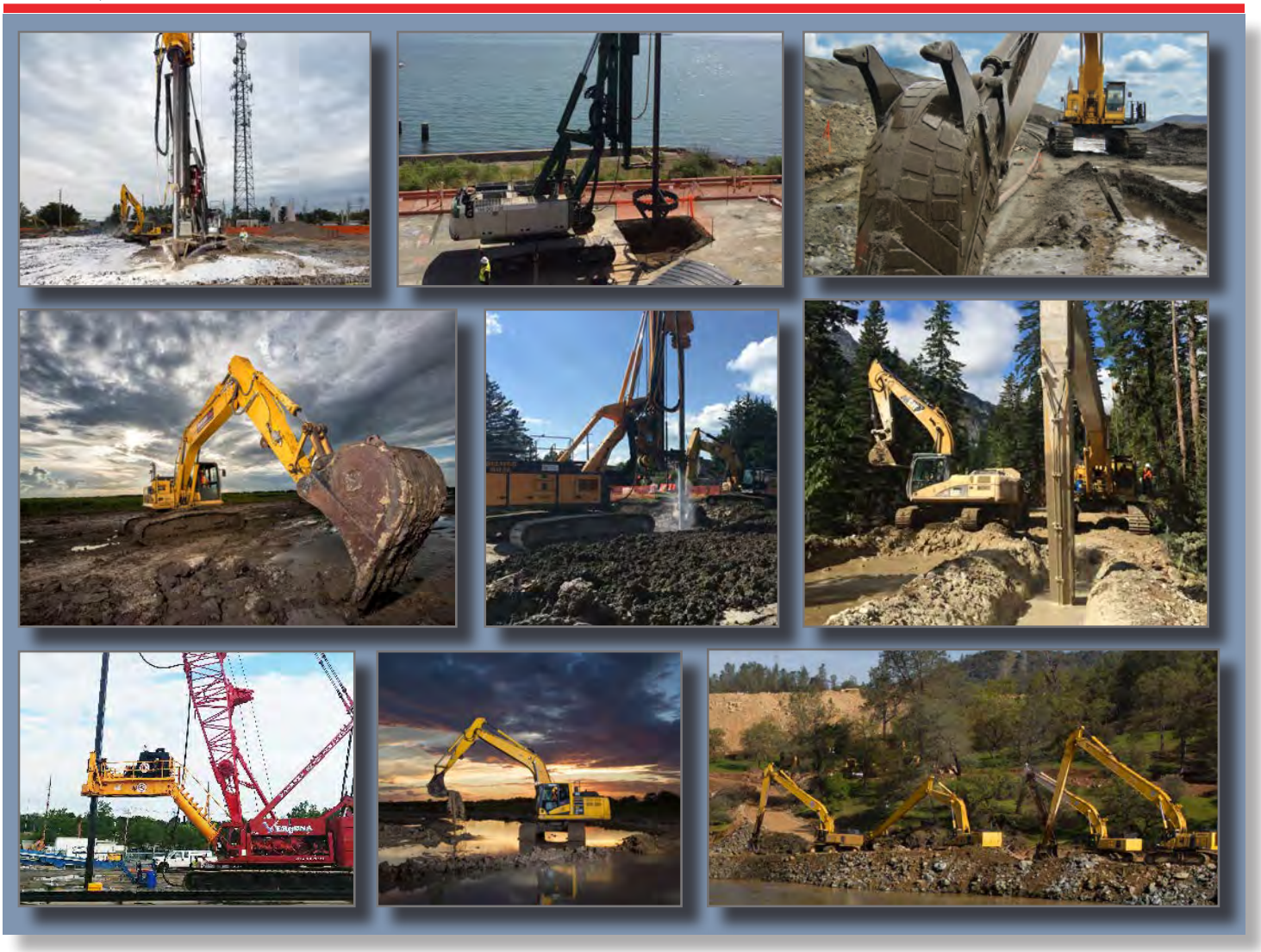
INQUIP ASSOCIATES, INC.

PERSONNEL

Forgen focuses on recruiting the most qualified individuals for positions ranging from technicians and field supervisors to project management and executive leadership. Our staff of professionals includes project directors, project managers, project engineers, construction managers, site superintendents, quality control engineers, safety officers, equipment operators, craft labor, and administrative support. Our leadership team is comprised of accomplished individuals from the environmental and infrastructure industry who share a commitment to successfully completing client projects that are safe, cost effective, and schedule-adherent.



EQUIPMENT



Forgen maintains a powerful and diverse fleet of construction and specialty equipment, supported by in-house mechanics at our three equipment yards. We have the right equipment for the most demanding projects, including a number of Komatsu PC 1250 and PC 800 Excavators. We provide exceptionally qualified operators who will ensure safety and productivity for each piece of equipment. Forgen implements a stringent maintenance program which requires that all equipment be serviced prior to mobilization, as well as undergo thorough periodic inspections to ensure that each piece is functioning properly and meets all safety requirements. Our specialized in-house fleet allows us to complete most projects with minimal support from subcontractors or rental facilities.

EQUIPMENT

Forgen's current equipment inventory includes more than 250 pieces of specialized tools and machinery. We are continually upgrading and servicing our equipment, using only the best tools and methods available.

- DELMAG RH28
- LGP DOZERS
- DRILLING PLATFORM FOR LARGE DIAMETER AUGER MIXING
- LARGE INDUSTRIAL DOZERS
- OFF-ROAD HAUL TRUCKS
- AUTOMATED REAGENT MIX PLANTS
- ULTRA LONG REACH EXCAVATORS & CUSTOM ATTACHMENTS
- OFF-ROAD & ON-ROAD HEAVY TRUCKS & LIGHT VEHICLES
- MARINE EQUIPMENT BARGES
- MULTIPLE DREDGES
- SIGNIFICANT CRANE INVENTORY
- MECHANICAL AND HYDRAULIC CLAMSHELLS
- CHISELS TOOLS
- HIGH CAPACITY DESANDING UNITS
- SINGLE AND MULTIPLE AUGERS

SAFETY&HEALTH

SAFETY & HEALTH PERFORMANCE is a key measure of Forgen's success. Our INCIDENT AND INJURY-FREE (IIF™) culture keeps us focused on injury prevention, responsible actions, and sustained commitment. Lead by senior management and embraced company-wide, IIF™ emphasizes continual improvement in our practices and methods so that we maintain a culture of safety excellence.

Forgen recognizes the importance of safety to the public, our employees, clients, and host communities. Our Incident and Injury-Free™ (IIF™) Commitment creates a culture where safety is personal, relative and important. Becoming IIF™ is a journey of continuous improvement where leadership teams and employees at all levels collaborate to create positive change in people, processes, culture and organizations. Our IIF™ Commitment is demonstrated first by our Executive Leadership and then by our project leadership, setting the example and engaging employees personally. Forgen combines continual improvement in traditional safety processes and practices with IIF™'s personal engagement and demonstrated care for each employee. Employee participation and engagement is a cornerstone of our IIF™ commitment. All new employees complete a 4-hour interactive IIF™ orientation course, typically prior to starting work. The IIF™ orientation opens lines of communication, creates relationships, and gives each employee an opportunity to explore how they think, feel, and relate to safety.

While our safety professionals lead the efforts with traditional safety programs and procedures, the IIF™ orientation is delivered by at least two company operations leaders who are certified IIF™ trainers with active project leadership positions (Project Managers, Superintendents). This conveys to our employees that our safety culture is not just promoted by safety professionals, but by all members of the management team.

SECTIONONE
INTRODUCTION

EMR
2019 **0.48**
2018 **0.68**
2017 **0.58**

IIF™ delivery is our commitment on every project - no injuries, no property damage, and no adverse community or environmental impacts. The safety of our personnel, clients, subcontractors, and the surrounding community is a value, never to be compromised for production, profit, or ancillary project goals. All project personnel, including our subcontractors, have full Stop Work Authority for safety concerns.

Forgen's Senior Leadership, including the CEO, leads our IIF™ journey to drive continual improvement. The IIF™ Leadership Team meets monthly in 2-3 hour intensely honest sessions, where follow-up actions are developed, accountability is assigned, and results are documented and disseminated appropriately through the company. Senior Leadership and management team believes that every incident or accident is preventable. IIF™ delivery is our commitment on every project - no injuries, no property damage, and no adverse community or environmental impacts.

The safety and health of our personnel, clients, subcontractors, and the surrounding community is a value, never to be compromised for production, profit, or ancillary project goals. All project personnel, including our subcontractors, have full Stop Work Authority (Stop- Talk-Accept) for safety concerns. The IIF™ Orientation teaches not only the requirement for Stop Work but also how to perform a Stop Work, with practice sessions and lessons, based on caring for one another, and with full support of senior management.

In conjunction with a site-specific Health and Safety Plan (HASP) and task specific Activity Hazard Analyses (AHA's), all field activities and risk mitigation strategies include our Life Saving Absolutes (LSA's). Our LSA's are the ten most critical safety and health requirements that have the highest severity potential in our line of work. The LSA's are non-negotiable.

Forgen's IIF™ commitment and culture will be fully integrated into all aspects of the project. Our commitment also includes full compliance with the applicable compliance safety requirements of 29 Code of Federal Regulations (CFR) 1910, Occupational Safety and Health Standards for General Industry; and 29 CFR 1926, Occupational Safety and Health Standards for Construction.

Pre-project orientation will be provided for all field personnel (including subcontractors) in coordination with commencing work. Emergency procedures will be detailed in the HASP and reviewed with all personnel participating on the project. Topics to review will include pre-emergency planning, site communications, emergency equipment and supplies, incident response, evacuation procedures, emergency medical treatment, and incident notification and reporting.

FORGEN REQUIRES ITS STAFF & SUBCONTRACTORS TO

- ✓ Promote safe behavior(s) with all coworkers and subcontractors
- ✓ Recognize safe behavior(s) at the management level
- ✓ Communicate that everyone has "Stop-Work-Authority"
- ✓ Report and learn from all incidents, near misses, and stop work situations
- ✓ Report all substandard and hazardous conditions or practices
- ✓ Always observe safety instructions for hazardous substances
- ✓ Wear appropriate personal protective equipment (PPE) for the task being performed

SOIL MIXING EXPERIENCE

Soil Mixing Experience

Forgen has extensive experience performing soil mixing operations and related pilot studies at a variety of industrial properties. Our experience is broad with respect to soil mixing equipment, specialty tools, and various mixing technologies. We have performed soil mixing in many unique settings utilizing drill rigs, large diameter vertical augers, and excavators to treat impacted soils in place and/or for surgical removal and off-site disposal. Forgen has also used large diameter augers, drill rigs, multi-flight augers, and long-reach excavators with specialized attachments on assorted flood control projects.

Supporting our efforts is our fully owned and maintained fleet of mixing equipment including Delmag and Hain platform rigs along with Kelly bars, large diameter augers, automated batch plants, QC monitoring systems, and support equipment. Additionally, we deploy equipment that captures the needed data for quality control such as depth, rpm, grout injection, and durations during stabilization operations.

Successful design and execution of our soil mixing projects requires a comprehensive understanding of the site conditions and the goals to achieve. The Forgen team has the equipment, knowledge, and skills to successfully complete even the most demanding of projects.

SECTIONTWO
SOIL MIXING EXPERIENCE

SOIL MIXING SNAPSHOT

PROJECT	STATS	LOCATION
Soil Mixing of Lead- and Titanium-Impacted Soils	97,000 CY of Soil Mixing	New Jersey
Ogden Chemical Plant Remediation	22,100 CY of Soil Mixing	Utah
Orlando Cutter Soil Mixing	Cutter Soil Mixing	Florida
Soil Mixing Former Wood Treating Facility	Soil Mixing (Multiple Auger)	Washington
Former Technicoat Site Remediation	DSM Sodium Permanganate Treatment	Texas
Feather River West Levee Program (A-D)	500,000 SF DSM (Multiple Auger)	California
West Sacramento Levee Program	372,000 SF DSM (Multiple Auger)	California
Norwich Powerplant Remediation	11,333 SF DSM	New York
NJNG Powerplant Remediation	90,500 CY DSM	New Jersey
Former Powerplant	Soil Mixing	California
First Energy - Lakewood	Soil Mixing	New Jersey
First Energy - Easton	Soil Mixing	Pennsylvania
Exxon Mobil Trenton Terminal	18,300 CY of Soil Mixing	New Jersey
Shallow Soil Mixing - Former Powerplant	80,000 CY of Soil Mixing	Georgia

Lead & Titanium-Contaminated Site Soil Mixing & Site Remediation

SAYREVILLE, NJ

PROJECT HIGHLIGHTS

- Transfer of 15,000,000 gallons of PCB-impacted water
- Ex situ stabilization of 8,500 cy of PCB-impacted titanium dioxide sludge
- In situ stabilization of 97,000 cy of titanium dioxide sludge
- Reservoir berm restoration with 12,000 cy of excavation

This ongoing lead and titanium-contaminated site remediation project involved the in situ stabilization (ISS) of approximately 97,000 cy of titanium sludge from two areas at a former titanium ore processing facility. The scope of work included site dewatering; relocation of 8,500 cy of PCB-impacted sludge; in situ stabilization; reconstruction of stormwater management berms; and site restoration.

Approximately 50 acres of the site was covered with a “white” water that was contaminated with titanium dioxide and PCBs. As a cost-saving measure, Forgen used an on-site reservoir to store the contaminated liquid until it could be properly treated. The reservoir had a capacity of approximately 15,000,000 gallons of water. The clean water in the reservoir was discharged and PCB-impacted liquid was then pumped into the reservoir to dewater the work zone. Personnel installed a series of bridging roads to be able to get out on the sludge and perform removal of the PCB-impacted sludge. Due to wet conditions, excavators had to maneuver on crane mats. On the eastern side of the site, an amphibious excavator was used to prevent crews from becoming landlocked. The removed sludge was processed using ex situ stabilization (ESS).

The ISS work at the site was divided into treatment cells that were 4 ft deep, 20 ft wide, and 200 ft long to complete ISS in a controlled manner. A truckload of Portland cement was pneumatically transferred to the surface of each cell. The in situ treatment process included a two-fold mixing approach, with a rake attachment that was used initially to allow a better distribution of the cement throughout the cell, followed by traditional bucket mixing for complete homogenization of the cement

and sludge. The ISS work was sequenced from the edges of the areas, moving inward toward the center of each area. After 1-2 days of curing, the previously treated material had sufficient strength to allow personnel to mix the next row of cells. Once the stabilization of all sludge was complete, the Forgen team reconstructed the west berm of the reservoir. The work completed by our team at the site was critical for the successful redevelopment of these areas.

Chemical Plant Remediation

OGDEN, UT

PROJECT HIGHLIGHTS

- In situ soil stabilization
- Construction of 10,624 lf of composite slurry wall to a depth of 38 ft
- Excavation of RCRA SWMUs
- Recycling of unused HDPE sheet piles
- Access road construction
- Site grading and SWPP BMPs
- On-site crushing operations
- Quarry and borrow area development

This multi-faceted remediation project was performed by Forgen, formerly Great Lakes Environmental & Infrastructure, at an active chemical plant in Ogden, Utah. The scope of work included development and reactivation of an on-site quarry to produce rock needed for berm and barrier wall platform construction; in situ soil stabilization to support barrier wall platform construction and improve seismic stability; barrier wall work pad construction; soil-sepiolite slurry wall construction; HDPE sheet pile installation; and final dike construction and rock slope protection. The project also included remediation of two RCRA Solid Waste Management Units (SWMUs) and placement of excavated material in an on-site consolidation area.

Performed as an RCRA corrective action under the regulatory authority of Utah's Department of Environmental Quality, the barrier wall was constructed around a series of evaporation ponds to prevent process residuals and waste by-products stored in the ponds from migrating off site. Since the project was situated in the former dry lake bed of the Great Salt Lake, due to soft underlying soils and groundwater at or near the existing grade, a 5 ft working platform had to be constructed in order to provide a stable working surface for barrier wall construction. Working platform construction consisted of placing 1.5 ft of material, produced at the on-site quarry, and stabilizing the lower 3.5 ft of subgrade with in situ soil stabilization.

Orlando Cutter Soil Mixing

ORLANDO, FL

PROJECT HIGHLIGHTS

- Cutter Soil Mixing (CSM) technology to construct a slurry wall up to 62 ft below existing grade
- Demolition of various structures to facilitate construction of the barrier wall
- Jack and bore under an active railroad to install ground water treatment system piping
- Groundwater treatment system consisted of 81 individual wells of varying types

The Orlando project included multiple tasks and specialty construction technologies. Forgen assisted in the design and implementation of a barrier wall constructed with Cutter Soil Mixing (CSM) technology. This technology was chosen due to the confining nature of the site which was bound by an active rail road on the north side and a city street on the south side as well as operating business on other boundaries. The construction of the barrier wall was the first major task where site demolition, site controls, pre-excavation and utility protection had to be implemented. Forgen utilized a specialized double-wheel rotary cutter developed by Bauer to install the barrier wall on the confined site to limit disturbance to the street, rail road and adjacent structures. This barrier wall was installed to a depth ranging from 55 to 62 ft below existing grade in order to tie into the underlying Hawthorn clay formation. The barrier wall met the required performance criteria of both strength and permeability 24 psi and 1 x 10^{-7} cm/sec, respectively.

The top two feet of soil was then excavated and replaced with clean imported fill material prior to the start of the groundwater remediation system. A number of legacy process pipes were found during excavation activities as well as during the barrier wall installation. The subject pipes were traced back to the street or its termination point so that they could be removed during the street closure or plugged and abandoned in place. This work included the tapping of numerous unknown abandoned utilities to identify their past use. Work also encountered wooden trough type pipes that were found which were believed to date back to the original plant construction circa 1880's. A specialized vacuum excavator to "pothole" down was utilized in order to locate all marked utilities and known process lines.

Over 20,000 ft of HDPE pipe was installed and tested to connect to 81 wells which fed a prefabricated groundwater treatment system. A portion of this piping network was installed under an active railroad via jack and bore to access wells located on the north side of the railroad right of way. The system had three methods of discharge including an infiltration gallery, injection wells and a connection to the POTW.

Restoration of the site included the replacement of sidewalk, concrete paving on various properties, asphalt milling and paving as well as extensive landscaping to establish grass cover, shrubberies and trees. Water service was reestablished to two of the properties.

The soil stabilization effort required stabilizing 30 percent of the lower 3.5 ft of the working pad to meet the seismic requirements of the design and help strengthen the subgrade below the upper 1.5 ft of the work pad. Chemical constituents in the existing soils and groundwater elevations, relative to the finish grade of the working pad, varied throughout the site. To meet the unconfined compressive strength requirements for in situ stabilized soils, the team had to continually monitor the grout mix to account for variable subsurface soil conditions and the presence of destabilizing constituents such as sodium chloride, ammonium chloride, sodium hypochlorite, and raffinate.

Forgen successfully completed in situ soil stabilization by making consistent adjustments to the amount of grout added and water-to-cement ratio of the grout mix while monitoring preliminary unconfined compressive strength testing throughout the project. The in situ soil stabilization was performed during the winter and required additional effort to prevent the grout from freezing in the batch plant, hoses, and mixing equipment. This was accomplished by working 24 hours per day and using specialized heating units. Upon completion of the in situ soil stabilization, the site was shut down for the remainder of the winter.

Construction of the composite HDPE/soil-sepiolite slurry wall commenced in May of 2013. In total, 11,000 lf of slurry wall was constructed around the ponds to a maximum depth of 38 ft. Construction progress was accelerated utilizing a two-shifts-per-day schedule and the wall was completed in less than one month. The performance specification for the slurry wall backfill permeability was 1 x 10-7 cm/sec. Actual permeability measured post installation was 5 x 10-8 cm/sec. A total of 275,000 sf of HDPE sheeting were installed in the center of the soil-sepiolite slurry wall using a custom made mandrel to ensure the structural integrity of each panel. A hydraulic sealant was applied to each joint of the HDPE sheet pile prior to installation in the trench. An in-house, custom designed and fabricated slurry batch plant was utilized for mixing the soil stabilization grout and slurry trench backfill.

Additional work included grading to improve site drainage, installation of various drainage pipelines and outfalls, construction of a perimeter site access road, and placement of riprap for dike slope armoring around the outer perimeter of the new dike construction.

Soil Mixing
Former Wood Treating Facility

RENTON, WA

PROJECT HIGHLIGHTS

- In Situ Stabilization via auger mixing
- Excavation, transportation and offsite disposal of impacted material
- Soil mixing performed by mixing soil in a vertical column to the required depth
- Successful remediation and resulting redevelopment

Forgen performed remedial activities at this former wood treating site in Renton, Washington using In Situ Stabilization (ISS) soil mixing technology. The project site was a 20 ac property located on the southwestern shore of Lake Washington where wood treating operations took place from 1955 until the site closed in 1982. A site assessment conducted in 1983 identified polycyclic aromatic hydrocarbon (PAHs) and pentachlorophenol (PCP) in the soil and groundwater.

Site remediation was undertaken to satisfy portions of a Consent Decree with the Washington State Department of Ecology. The In Situ Stabilization (ISS) of contaminated soil using auger mixing was selected over the conventional “dig and haul” approach due to its lower cost, elimination of the need for dewatering and water treatment, and elimination of high volume truck traffic through adjacent residential areas.

The scope of work required demolition of remaining surface and subsurface structures; excavation, stockpiling and loading of hazardous and non-hazardous soil and debris; and final site restoration. ISS work included the drilling and mixing of 375 columns to a maximum depth of 25 ft using a Delmag rig equipped with an 8.5 ft diameter auger. Soil mixing was performed by mixing the soil in a vertical column to the required depth. The mixing location was determined by offsets established by the project surveyor. The operator positioned the auger over the column marker stake with the assistance of a ground laborer. Once in position, the operator began the flow of the reagent, and rotated the auger while lowering it into the soil.

The mixing auger had two ports on each of its two flights to deliver cement and bentonite. The mixture was delivered from a batch plant using a positive displacement pump. It was carried through a high-pressure pneumatic hose which ran up the boom of the rig and into the hollow Kelly bar at

a swivel and out through the auger ports. As the mixing auger penetrated into the soil, slurry was pumped from the mixing plant to the mixing rig through the hollow Kelly bar exiting through ports at the tip of the mixing auger. The mixing auger was custom designed to lift and loosen the soil, blending it with slurry in “pugmill” fashion. The operator continued mixing to the bottom of the column design depth. The entire column was stroked up and down while using the remainder of the reagent, completing two mixing strokes per column.

In order to ensure that the material was thoroughly mixed into a homogenous monolith, an overlapping drilling pattern was designed, consisting of drilling a series of primary and secondary overlapping shafts. The end product characteristics of the treated waste were those of a homogenous soil-cement.

Following successful remediation, this site was developed into the training facility for the Seattle Seahawks.

Former Technicoat Site Remediation

FORT WORTH, TX

PROJECT HIGHLIGHTS

- In situ mixing of impacted clay soils 28 ft below land surface with sodium permanganate
- Installation of engineered excavation support structure
- Installation and operation of dewatering and treatment system
- Scope of work included asphalt removal/haul-off and resurfacing
- excavation/haul-off and backfill of cadmium-impacted areas and chlorinated hydrocarbon PCLE

Forgen was contracted to treat soils within a chlorinated hydrocarbon protective concentration level exceedance (PCLE) zone to the top of bedrock (approximate depth of 28 ft below land surface) using in situ soil mixing with sodium permanganate injection to oxidize the contaminants with the underlying ground water plume. The treatment was completed with a RH-20 Delmag rig turning a 6 ft auger attachment to inject and mix the sodium permanganate into impacted soils. The treated soils were excavated and disposed of at a Class II disposal facility. Following the excavation of treated soils, the area was backfilled. Additional features of work included asphalt removal/haul-off and resurfacing; installation of an excavation support structure and dewatering and treatment system with the ability to support excavation 28 ft below land surface; and excavation/haul-off and backfill of cadmium-impacted areas and chlorinated hydrocarbon PCLE area.

Feather River West Levee Project
Areas A-D

SUTTER COUNTY, CA

PROJECT HIGHLIGHTS

- Completion of 4.6M+ sf of soil-bentonite open trench cutoff wall
- Construction of 500,000 sf soil-bentonite cutoff wall to depths of approximately 100 ft using Deep Soil Mixing (DSM)
- Construction of 450,000 sf soil-cement-bentonite cutoff wall to depths of ≈ 120 ft using DSM
- Coordination of 90 utility crossings (sewer force mains, overhead power lines, and pressurized irrigation pipes)

Forgen and joint venture partners constructed a soil-bentonite cutoff wall for Area A along 7,500 lf of the Feather River Levee in Yuba City, California. The cutoff wall consisted of 500,000 sf using single pass Deep Soil Mixing (DSM) technology and 150,000 sf of conventional open trench. Preparatory work included demolition; clearing and grubbing; top soil stripping; utility removal/relocation; and levee degrade to facilitate cutoff wall construction. Once the wall was installed, the levee embankment was rebuilt from suitable levee fill. Additional work included a cement-bentonite slurry wall constructed to close a gap around a PG&E utility.

Scope of work for Area B and Area D included the construction of a soil-bentonite cutoff wall along 16.5 miles of the Feather River Levee in Sutter and Butte County, California. The cutoff wall consisted of 4.5M sf using conventional open trench method and 450,000 sf using single pass DSM. Preparatory work included demolition; clearing and grubbing; topsoil stripping; utility removal/relocation; and levee degrade to facilitate cutoff wall construction. Once the wall was installed, the levee embankment was rebuilt from suitable levee fill.

West Sacramento Levee Improvement Program
The Rivers Phase 1

SACRAMENTO, CA

PROJECT HIGHLIGHTS

- Construction of a 2,950 lf soil-cement-bentonite cutoff wall to depths between 90 and 135 ft using the Deep Soil Mixing (DSM) method
- Implementation of Single Pass Method for DSM
- Degrading of existing levee (66,868 cy)
- Placement of 50,399 cy of embankment material to reconstruct levee

This project involved construction of a soil-cement-bentonite cutoff wall along 2,950 lf of Sacramento River levee in West Sacramento. The wall had a surface area of approximately 372,000 sf and was installed to depths between 90 and 135 ft using a multi-flight auger system to perform the Deep Soil Mixing (DSM) method. It was the deepest wall yet constructed in the Sacramento levee system. The Rivers Phase 1 project was the first of several Early Implementation Projects conducted by the West Sacramento Area Flood Control Agency (WSAFCA) Levee Improvement Program. The Program's goals were to achieve levee improvements sufficient to withstand a 200-year flood event on 50 miles of levees surrounding the City of Sacramento; begin levee improvements as soon as possible to reduce flood risk; and incorporate recreational and ecosystem restoration elements into the levee improvements.

The levee segment selected for the inaugural project was approximately 2,950 ft long and located on the right bank of the Sacramento River in West Sacramento, California. Specific issues at the Rivers site included unstable slopes caused by improper levee geometry, seepage (under and through the levee), erosion damage, and non-compliant vegetation.

Corrective measures addressed by the design included the installation of an impermeable cutoff wall along the entire length of the project, as well as levee grading and slope flattening to correct the stability issues. Encroachments and vegetation within the project footprint were removed and reconfigured to comply with current U.S. Army Corps of Engineers (USACE) and Central Valley Flood Protection Board policy.

Forgen's role was to provide overall construction management and quality control for the prime contractor constructing the DSM cutoff wall and to provide subcontracted earthwork services necessary to complete the levee degrade and reconstruction. Other features of work included the flattening of the landside and the waterside slopes, construction of a paved levee patrol road and river overlook, a paved pedestrian/bicycle path, an aggregate maintenance road, and several ramps to provide access onto the levee.

The project site was adjacent to a residential neighborhood, local park, and elementary school. Weekly coordination meetings were conducted to ensure the project accommodated the daily bus schedule and school traffic. The project was also on a time critical completion schedule. Forgen recognized that utilizing a single pass method to mix the cement and bentonite in a single step would save time and money compared with dual phased approach originally specified. This modification to the approach proved valuable, allowing the project to complete on time and under budget.

Norwich Power Plant Remediation

NORWICH, NY

PROJECT HIGHLIGHTS

- In situ solidification of 12,000 cy of MGP-impacted soils
- Close proximity to residential homes
- Transportation and disposal of 4,500 tons of MGP-impacted soils
- PIIAN perimeter odor control misting system
- Completed within the NY Susquehanna & Western (NYSW) railroad right-of-way (ROW)

The New York State Electric & Gas (NYSEG) Norwich Former MGP site was located at 24 Birdsall Street in the City of Norwich, Chenango County, New York. In 2010 NYSEG completed in situ solidification (ISS) remediation of the on-site area. The off-site area located across the street from the former facility contained product-impacted soils that also needed remediation.

The off-site target area remedial activities included precut excavation of approximately 3,000 cy of soil to accommodate the volume expansion of soils during ISS. ISS of approximately 12,000 cy of MGP-impacted soil extending an average depth of 26 ft and 2 ft to 4 ft into the underlying confining layer. The project was completed within the NY Susquehanna & Western (NYSW) railroad right-of-way (ROW) and in close proximity to residential homes with extensive odor control systems in place, including PIIAN misting system, BioSolve Pink Water, and Rusmar Odor Control Foam. Additional scopes of work included demolition of a NYSW signal control building, vibration monitoring, transportation and disposal of ISS swell material, site restoration, temporary fencing, seeding, and installation of new signal controls/control building.

The project was completed under budget and with minimal impact on the surrounding residents. All remedial targets for this contract were achieved or exceeded for this project.


CAT

Confidential MGP ISS & Excavation Project

NEW JERSEY

PROJECT HIGHLIGHTS

- Demolition of existing building and abandoned utility services
- Asbestos, universal waste, and potentially hazardous waste removal
- Excavation, removal, and final disposition of approximately 70,000 tons of impacted soil
- In situ stabilization via auger mixing of 86,000 cy of impacted soils to depths ranging from 18 to 48 ft

Forgen provided services for this former MGP facility. Site preparation included the demolition and removal of an existing building and its contents (including asbestos-containing material, universal waste, and hazardous waste); the abandonment of water, sewer, electric, and gas utility services; the installation of erosion controls and temporary fence with privacy screen around the site perimeter; setting up a support zone and contamination reduction zone; and establishing a remote stockpiling area.

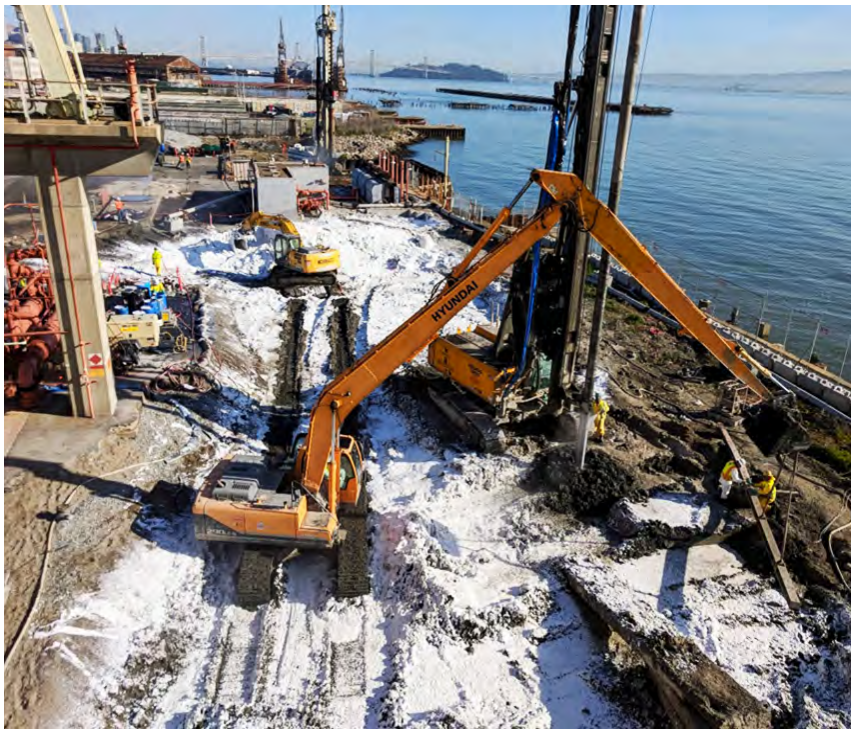
The site was pre-excavated to a depth of 10 feet in preparation for ISS work. This included the removal of asphalt pavement and concrete slabs and the excavation, transport, and off-site thermal treatment of 47,000 cubic yards of MGP-impacted soil. Obstruction (e.g., footers, foundations, pilings, etc.) encountered during the pre-excavation were size-reduced and disposed of off-site with the contaminated soils. Extensive dewatering was conducted to maintain a dry platform at the bottom of the excavation. The collected water was treated in an on-site water treatment facility prior to discharge.

ISS was performed using both a crane-mounted Hain platform and a Delmag RH28 drill rig. The crane/platform assembly was supplemented with a swivel-mounted, top-feeding Kelly Bar capable of reaching a depth of 55 feet bgs and used to turn augers ranging from 6 to 10 feet in diameter. The Delmag rig used a 40 foot Kelly bar to turn augers ranging from 4 to 6 feet in diameter. A grout plant was set up and the required reagent admixture was produced on-site then conveyed to the auger rig, where it was added on a per weight basis using a pre-determined mix design of 9% by weight for Portland cement and 3% by weight for ground granulated blast furnace slag. ISS was first performed at a 10-foot-wide perimeter that was keyed 4 feet into the clay layer, followed by the interior ISS keyed 2 feet into the clay layer. The ISS-treated material met the project performance requirements >50 psi unconfined compressive strength and <1x10-6 cm/s hydraulic conductivity.

Once ISS was completed, the site was backfilled to the required elevations, using imported clean fill soil. Backfill material was installed in controlled lifts and compacted. Once the required grades were established a demarcation layer was installed atop the backfill material then the site restoration was completed by installing paving subbase stone and pavement in a majority of the site and topsoil and seeding in other specified areas.

Soil Mixing
Former Power Plant Site

SAN FRANCISCO, CA



PROJECT HIGHLIGHTS

- Installation of over 750 ISS columns from depths of 20 to 50 ft below grade
- Utilization of augers ranging from 4 to 8 ft in diameter
- Utilization of two ISS drill rigs and batch plants to perform simultaneous ISS operation
- ISS through debris including timber piles
- Extensive odor management
- High visibility and environmentally sensitive site along the San Francisco Bay

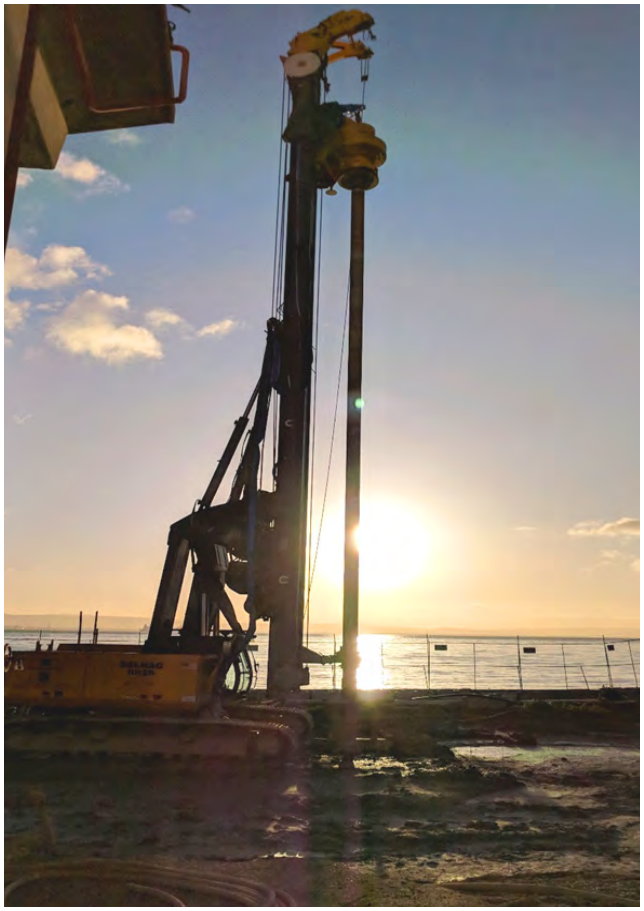
This project involved performing in situ stabilization (ISS) to address coal tar-impacted soil containing continuous dense non-aqueous phase liquid (DNAPL) associated with former manufactured gas plant (MGP) operations at the site. Remedial action objectives for the project included mitigating migration of continuous DNAPL to bay sediments, mitigating exposure to soil and soil gas, and mitigating potential for chemical of potential concern (COPC) in soil to leach into groundwater. ISS involved treatment of two distinct areas within the site to address the DNAPL.

Forgen was contracted to perform ISS activities, as well as odor control during implementation of the treatment remedy for impacted soils. The scope of work included drilling ISS columns in two distinct treatment areas encompassing approximately 20,000 sf of the site. More than 26,000 cy of ISS was completed using mixing augers ranging from 4 to 8 ft in diameter in order to treat 100 percent of the DNAPL-impacted soils. Work was performed over a six month period utilizing two ISS drill rigs and batch plants to complete treatment on time, and to prevent any impacts and delays of subsequent phases of this remediation.

ISS was completed in the northern and southern continuous DNAPL areas to depths ranging from 20 to 50 ft bgs, and included penetration of approximately 3 ft into the underlying bay mud. The primary performance criteria for the treatment zones was a minimum unconfined compressive strength of 30 psi, maximum hydraulic conductivity of 1 x 10^{-6} cm/sec, and visual observation of soil cores to ensure there was no unmixed soil or observed DNAPL. Additionally, ISS within the bulkhead area of the

northern zone was completed through the fill zone and approximately 15 to 20 ft of the underlying bay mud, with a minimum unconfined compressive strength of 100 psi, in order to stabilize the soil mass behind the bulkhead.

The scope of work also included handling of the ISS swell material within the treatment zones and management of obstructions encountered during drilling. Throughout the project, a number of obstructions such as brick, rocks, concrete, miscellaneous debris, as well as historic timber piles were encountered. For timber piles and wood debris, an auger configuration with aggressive cutting teeth was utilized to allow advancement of the auger to full treatment depths through the debris while incorporating the material within the mixed column. All other obstructions were managed by utilizing an excavator to remove the material up to 20 ft bgs.



FirstEnergy Former MGP Site

LAKEWOOD, NJ

PROJECT HIGHLIGHTS

- Removal of 9,100 tons of impacted material
- Expansive excavation support and dewatering systems
- Excavations ranging from 10-20 ft bgs
- In situ soil blending to meet disposal criteria/minimize costs
- Stabilization of impacted material using Calciment to pass PFT
- Coordinated with local agencies to minimize impact to traffic

Forgen was contracted by FirstEnergy to perform excavation of MGP-impacted soil and removal of an existing wooden culvert as part of a remedial action at the Lakewood former MGP site. Arcadis US, Inc., served as oversight engineer.

Contaminants present at the site included benzene, toluene, ethylbenzene, and xylenes and polyaromatic hydrocarbons (PAHs). Remedial activities were broken up into two areas, northern and southern excavations. The northern excavation required the installation of a steel sheet pile excavation support system inclusive of supportive wales and tie backs. Due to the shallow groundwater elevation, a well point dewatering system with over 115 well points was designed and installed to lower the groundwater levels to allow for the efficient removal of impacted material in a dry state. The extracted water was conveyed via a vacuum extraction system to a multiple tieron-site ground water treatment system designed to treat the water to acceptable permit levels prior to discharge to a local sanitary sewer. Forgen also stabilized 5,300 cy of petroleum-impacted/wet material utilizing ISS bucket mixing methods to pass PFT and meet the criteria for over the road transportation. Calciment was added at an approximate 5% by weight and mixed into the material using a CAT 326 long reach excavator. Material was treated in pre-sized cells and ultimately removed for off-site disposal.

The performance of the remedial excavation required the positive location and protection of both overhead and underground utilities as well as the preservation of pedestrian walkways and existing fencing. Excavation depths ranged from 10 ft to 20 ft below ground surface that required ex situ

blending and stabilization to meet disposal facility requirements and over the road transportation criteria. The impacted material was transported to a licensed thermal treatment facility for treatment and subsequent disposal. Due to the presence of main roads and residential homes surrounding the site and the requirement to minimize the impact to residents and daily traffic, clearly defined trucking routes had to be established that required close coordination with the local government agencies.

The excavated impacted material was transported to an on-site temporary structure fitted with an adequately sized air handling/carbon filtration system designed to eliminate VOC and odor emissions. Remediation also required the removal of impacted material around an existing storm sewer system and existing wood culvert in the southern portion of the site. Following backfill and compaction, the entire site was capped with a 1 ft layer of clean fill and extensive restoration seeding/planting.

FirstEnergy
Former MGP Site Remediation

EASTON, PA

PROJECT HIGHLIGHTS

- Removal of 12,200 tons of impacted material from multiple excavations
- Excavations ranging from 6 ft to 23 ft in depth
- Stabilization of impacted material using Calciment to pass PFT
- Demolition of multi-story buildings adjacent to an active roadway
- Demolition of over 2,900 tons of surface/subsurface concrete structures

Forgen was contracted by FirstEnergy to perform remedial activities at this former MGP site that contained both above and below-ground gas holders. Contaminants included DNAPL, NAPL, TPH, benzene, coal tar, and ash. The remediation included the removal of impacted material to a depth of 6 ft for the majority of the site and removal of all impacted material from a below-ground gas holder to a depth of 23 ft. The former coal bin walls were demolished using an innovative non-intrusive technology to ensure the preservation of the underlying dry sack stone wall. Remedial activities included demolition, excavation, and disposal of gas holder slabs, walls, and foundations, as well as removal of all underground piping, valves, and pits once associated with active plant operations.

Forgen stabilized MGP-impacted material in multiple underground gas holders using bucket mixing ISS techniques. Approximately 10% Calciment was added to the material to render it a free flowing product and in preparation for thermal treatment. Approximately 2,500 cy of impacted material was stabilized in this manner. Additional scopes included removal of three underground storage tanks, asbestos abatement, demolition of two abandoned multi-story buildings, active utility relocation/re-installation, dust/odor control, and backfilling/compacting followed by asphalt cap installation. First Energy was pleased with Forgen's performance and this project was finished on time and under budget.

Exxon Mobil Trenton Terminal

TRENTON, NJ

PROJECT HIGHLIGHTS

- Petroleum hydrocarbon impacts extend to 17 ft below ground surface
- Bucket Soil Mixing using Portland cement and ground granulated blast furnace slag
- Soil Mixing treatment completed on-time and within budget
- Zero safety incidents

The Site was situated on Duck Island, located along the southwestern border of the Hamilton Township in Mercer County, New Jersey, which contains several active petroleum terminals, a former landfill, and a power plant. It is bounded by the Delaware River to the southwest and an artificial wetland to the southeast. The Site was used for industrial purposes beginning in 1931 and later became a part of ExxonMobil. On January 3, 1974, there was a documented release of approximately 600,000 gallons of Number 2 Fuel Oil at the Site. Approximately 276,000 gallons of fuel oil were reportedly recovered and an unknown quantity of fuel oil was discharged into the Delaware River. The remedial action at the Site was to address residual free product in saturated soils to minimize contributions to the downgradient groundwater plume. This residual free product was addressed by solidification through Soil Mixing.

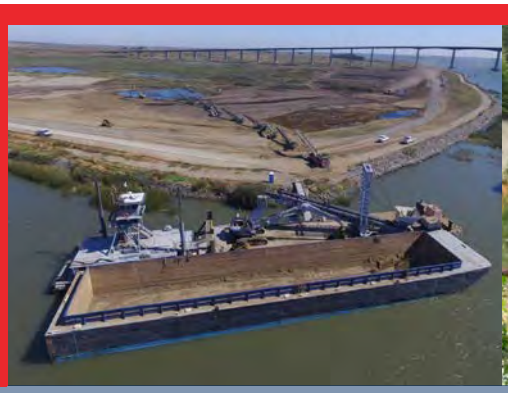
The scope of work provided by Forgen included:

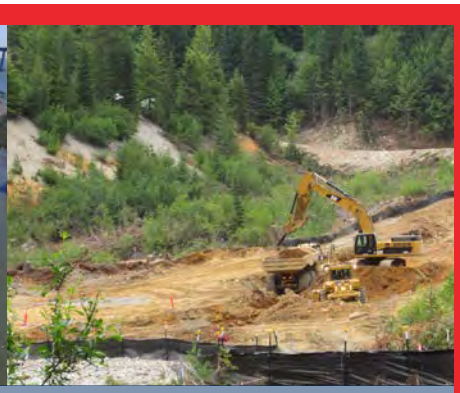
- Mobilization of all personnel and equipment required for the performance of Soil Mixing
- Installation and set-up of grout plant and all associated equipment
- Supply and manage the importation of Portland cement and granulated ground blast furnace slag (GGBFS) for the generation of grout required for Soil Mixing implementation
- Performance of Soil Mixing in a targeted area to an approximate maximum depth of 15 ft below pre-excavated elevation
- Management of swell generated during Soil Mixing operations, limited to the removal of material in support of Soil Mixing advancement

- Survey for Soil Mixing work
- Performance of Quality Control (i.e performance criteria sample collection and analysis) and the preparation of progress reports, submittals, and Contract Records Documents after determination of completion
- Site housekeeping and demobilization

The Soil Mixing was generally performed in cell sizes of 525 sf (typically 15 ft wide by 35 ft). Due to varying depths, the daily production rate varied with an approximate average of 890 cy/day. The mix design used for Soil Mixing will consist of 6% blast furnace slag cement (slag) and 4% Portland cement (cement) by dry soil weight. The weights of slag and cement was calculated using the provided dry soil weight of 105 lbs/cf. Soil Mixing grout batching will be performed using a Forgen owned Scheltzke MS 700 fully automated grout mixing plant. The operator programmed the plant to deliver correct amount of water, cement and slag in accordance with the prescribed mix design. The appropriate amount of water will then be metered into the colloidal mixing tank and dry reagent will be metered into the batch tank using two separate screw conveyors to deliver the specified weight of slag and cement.

Once the grout is initially mixed it will be transferred to the agitator storage tank with a capacity of approximately 750 gallons. Grout from the agitator storage tank was pumped through piping to the active Soil Mixing work area using the batch plant pumping system which could be operated by the batch plant operator or from a remote control box by the Soil Mixing operator. An excavator was used to homogenize the grout and soil over the entire depth of the treatment cell. The soil and grout were mixed until the material appears adequately homogenized. Once a cell has been considered visually homogeneous, the measurement of the Soil Mixing treatment depth will be determined by survey. At a rate of 1 sample per 500 cy, Soil Mixing field samples were collected from the treated soil within 1 Hr of mixing completion while still wet and pliable. Each wet grab sample was obtained at the location and depth requested by the client, using the excavator bucket. All samples met the performance criteria of greater than 50 psi unconfined compressive strength (UCS) and less than $1x10^{-6}$ cm/s hydraulic conductivity. Swell material exceeding the maximum elevation of Soil Mixing treated material (6 ft below original grade) was excavated and stockpile for load-out and off-site disposal by others.





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INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X **COMMERCIAL GENERAL LIABILITY** X CLAIMS-MADE X OCCUR X Contractors Pollution Liability X Errors & Omissions GEN'L AGGREGATE LIMIT APPLIES PER: POLICY X PRO-JECT LOC OTHER:			GPL775552402	06/29/2021	06/29/2022	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 2,000,000 $ 300,000 $ 10,000 $ 2,000,000 $ 4,000,000 $ 4,000,000
B	**AUTOMOBILE LIABILITY** ANY AUTO X OWNED AUTOS ONLY X HIRED AUTOS ONLY X Hired Phys Dam SCHEDULED AUTOS NON-OWNED AUTOS ONLY			BAP764546802	06/29/2021	06/29/2022	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) Comp/Coll Ded.	$ 1,000,000 $ $ $ $ 2,500
A	**UMBRELLA LIAB** X OCCUR X **EXCESS LIAB** CLAIMS-MADE DED RETENTION $			SXS760813800	06/29/2021	06/29/2022	EACH OCCURRENCE AGGREGATE	$ 5,000,000 $ 5,000,000
B	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		WC764546602	06/29/2021	06/29/2022	X PER STATUTE OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000
								$ $ $ $ $

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Certificate Holder is included as an Additional Insured, where required by written contract on the General Liability, Automobile, and Excess Liability policies. Waiver of Subrogation, where required by written contract, in favor of the Certificate Holder is included on General Liability, Automobile, Workers Compensation and Excess Liability policies. Coverage is primary and non-contributory as respects to the General Liability, Automobile Liability and Umbrella Liability policies as required by written contract. Additional Insured, Waiver of Subrogation and Primary and non-contributory wording is limited to the extent of the policy terms, conditions and exclusions. Excess Liability coverages follow form. In the event of cancellation by the insurance companies, the policies have been endorsed to provide (30) days' Notice of Cancellation (except for non-payment) to the certificate holder shown below.

CERTIFICATE HOLDER

Forgen, LLC
6025 S. Quebec St., Suite 300
Centennial, CO 80111

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

AGENCY CUSTOMER ID: _____

LOC #: _____

ADDITIONAL REMARKS SCHEDULE

PRODUCER McGriff Insurance Services, Inc.	**INSURED** Forgen, LLC
POLICY NUMBER	
CARRIER / **NAIC CODE**	**ISSUE DATE:** 06/29/2021

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: _____ **FORM TITLE:** _____

Excess Liability
Effective: 06/30/2021 - 06/30/2022
Carrier: Allied World National Assurance Company, NAIC #10690
Policy Number: 03124065
$10,000,000 Per Incident Limit
$10,000,000 Policy Aggregate

Excess Liability
Effective: 06/30/2021 - 06/30/2022
Carrier: Aspen Specialty Insurance Company, NAIC #10717
Policy Number: EX00H6621
$10,000,000 Each Claim
$10,000,000 Policy Aggregate

CERTIFICATE NUMBER: GVNHLWKP

Geo-Solutions
Proposal and SOQ

Geo-Solutions
Soil and Groundwater Problems Solved

Bench-Scale Treatability Study Cost Breakdown
Former Ameren MGP Site
Central, IL

22-037

3/23/2022

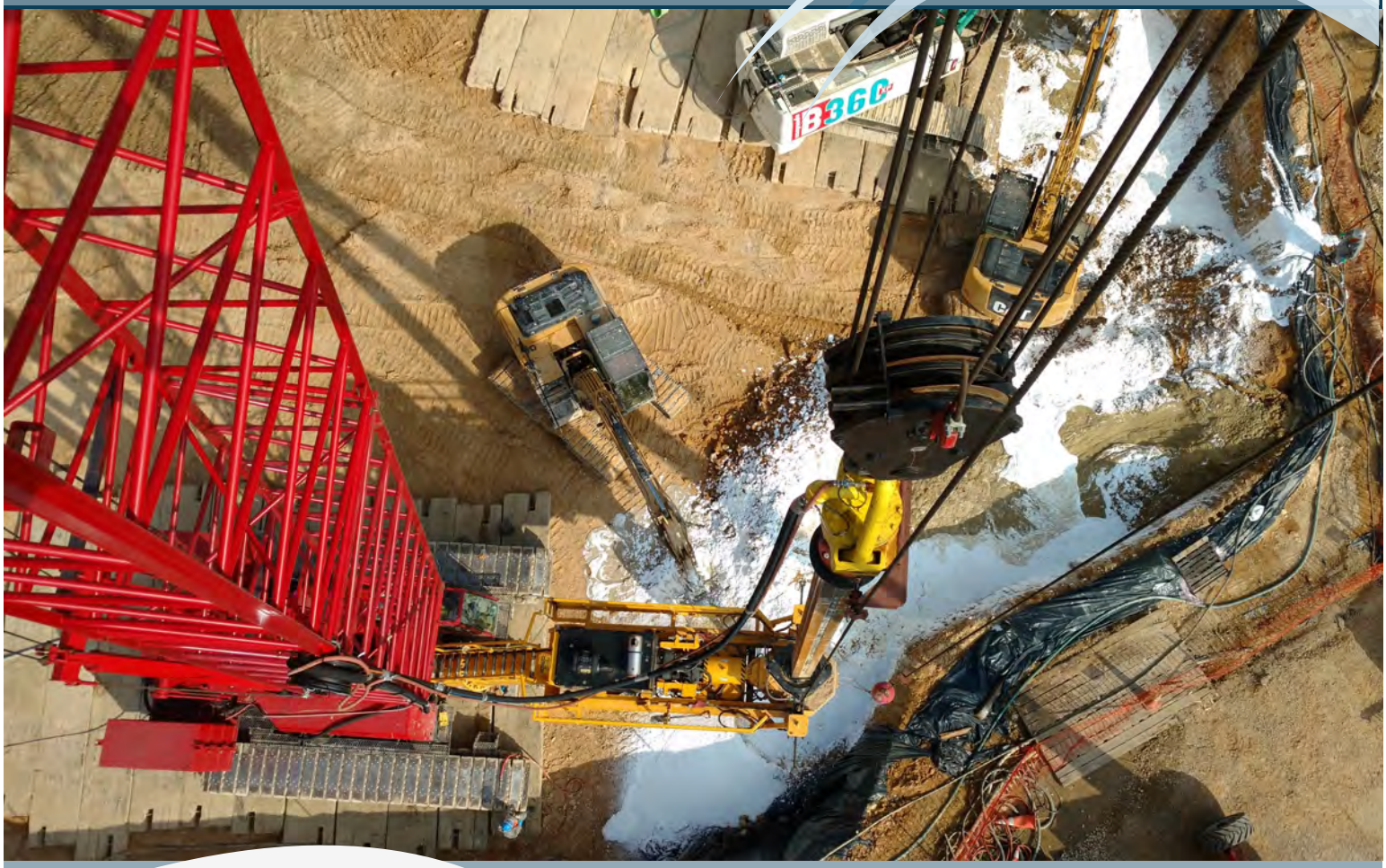
Unit Price Schedule

Item	Description	Test Method	Units	Est. No.	Unit Price	Extended Price
1	**Initial Sediment Physical Characterization**					**$ 22,720.00**
	Material Preparation & Holding	NA	UP	4	$ 100.00	$ 400.00
	Water Testing (pH, Hardness, & TDS)	EPA 600 / Hach	UP	0	$ 75.00	$ -
	Soil pH	EPA 600 / Hach	UP	4	$ 50.00	$ 200.00
	Particle Size Sieve Analysis	ASTM D6913 / D422	UP	4	$ 90.00	$ 360.00
	Organic Content (Loss on Ignition)	ASTM D2974	UP	4	$ 75.00	$ 300.00
	Moisture Content	ASTM D2216	UP	4	$ 15.00	$ 60.00
	SPLP (Method 8260 on leachate)	EPA 1312 mod.	UP	4	$ 350.00	$ 1,400.00
	LEAF (Method 1316, 8260 on leachate)	EPA Method 1316 mod.	UP	4	$ 5,000.00	$ 20,000.00
2	**Initial Mixture Development**					**$ 8,720.00**
	Sample Preparation, Supplies, & Holding	NA	UP	8	$ 100.00	$ 800.00
	Viscosity & Density (grout)[1]	API 13B	UP	0	$ 100.00	$ -
	pH & Temperature (grout)[1]	API 13B	UP	0	$ 50.00	$ -
	UCS (pocket penetrometer) - 1, 3, 5, 7 days incl in UP	ASTM D403/C953 mod.	UP	8	$ 75.00	$ 600.00
	UCS - after 7, 14 and 28 days	ASTM D2166/ D1633	UP	24	$ 80.00	$ 1,920.00
	Hydraulic Conductivity - after 28 days	ASTM D5084	UP	8	$ 325.00	$ 2,600.00
	SPLP (Method 8260 on leachate) - after 28 days[2]	EPA 1312 mod.	UP	8	$ 350.00	$ 2,800.00
	LEAF (Method 1315, 8260 on leachate) - after 28 days[2]	EPA Method 1315 mod.	UP	0	$ 5,000.00	$ -
3	**Final Mixture Development / Confirmation**					**$ 24,360.00**
	Sample Preparation, Supplies, & Holding	NA	UP	4	$ 100.00	$ 400.00
	Viscosity & Density (grout)[1]	API 13B	UP	0	$ 100.00	$ -
	pH & Temperature (grout)[1]	API 13B	UP	0	$ 50.00	$ -
	UCS (pocket penetrometer) - 1, 3, 5, 7 days incl in UP	ASTM D403/C953 mod.	UP	4	$ 75.00	$ 300.00
	UCS - after 7, 14 and 28 days	ASTM D2166/ D1633	UP	12	$ 80.00	$ 960.00
	Hydraulic Conductivity - after 7 and 28 days	ASTM D5084	UP	4	$ 325.00	$ 1,300.00
	SPLP (Method 8260 on leachate) - after 28 days[2]	EPA 1312 mod.	UP	4	$ 350.00	$ 1,400.00
	LEAF (Method 1315, 8260 on leachate) - after 28 days[2]	EPA Method 1315 mod.	UP	4	$ 5,000.00	$ 20,000.00
4	**Subtotal Testing**					**$ 55,800.00**
5	**Labor - Project Management, Reporting, Technical Consulting**					**$ 6,564.00**
	Principal	Principal	UP	2	$ 187.00	$ 374.00
	Project Manager	Project Manager	UP	30	$ 131.00	$ 3,930.00
	Support Engineer	Project Engineer	UP	20	$ 113.00	$ 2,260.00
6	**Support Personnel**					**$ 1,000.00**
	Lab Technician	(if required)	/HR	0	$ 75.00	$ -
	Supplies , shipping, etc.	(estimated)	COST+	1	$ 1,000.00	$ 1,000.00
7					**TOTAL**	**$63,364.00**

[1] Viscosity, density, pH, and temperature will be performed for comparison to parameters measured during construction.

[2] Analytical costs displayed are for budgetary purposes.

Geo-Solutions



Statement of Qualifications

Geotechnical Construction and Environmental Remediation

www.geo-solutions.com

- Slurry Walls
  - Soil-Bentonite
  - Cement-Bentonite
  - Soil-Cement-Bentonite
  - Combination/Composite Systems
- Soil Mixing
  - Barrier Walls
  - Excavation/Structural Support
  - Zero Valent Iron
  - Excavator Mixing
  - In Situ Soil Stabilization/Solidification
- Bio-Polymer Trenches
  - Collection Trenches
  - HDPE Vertical Barriers
  - Pump and Treat
- Permeable Reactive Barriers
  - Funnel & Gate
  - Absorptive Barriers
  - Zero Valent Iron
- Grouting
  - Dam Grouting
  - Pipe Grouting
  - Jet Grouting
- MGP Sites
  - In Situ Soil Stabilization/Solidification
  - Containment
  - Collection
- Levee/Dam Reinforcement & Repair
  - Liquefaction Mitigation
  - Foundation Reinforcement
  - Rehabilitation
  - Seepage Barriers
- Wetlands
  - Remediation/Mitigation

General Corporate Information

Company Background

Geo-Solutions, Inc. (Geo-Solutions) was formed in 1996. In late 2012, Geo-Solutions acquired Geo-Con which reunited many employees who worked together in the 1980s and 1990s. This acquisition formed one of the top specialty geotechnical/geoenvironmental contracting companies in the business. Geo-Solutions has experienced much success and has been involved with some extraordinary projects over more than four decades since the founding of Geo-Con in 1979.

Introduction

Geo-Solutions is a national leader in the specialty construction industry providing full service geotechnical and environmental contracting services. Geo-Solutions offers innovative, cost effective, and practical solutions to problems with soil and groundwater working across the US and internationally in the areas of subsurface stabilization/solidification, site remediation, groundwater control, and subsurface improvement. Geo-Solutions has completed projects in nearly all 50 states, most of the Canadian provinces, and dozens of other international markets.

Health, Safety and Environment

Every Geo-Solutions' employee is empowered with the authority to take all necessary actions to work safely and to provide for a safe work environment. Geo-Solutions develops its own site specific Health, Safety and Environmental Plan(s) or provides task specific addendums to existing plans for all of its projects. At the jobsite level, Geo-Solutions participates in any site specific training and performs daily jobsite safety meetings with the Owner/Engineer/Client and follows any protocols required with respect to any existing Substance Abuse Policy or site specific Health, Safety and Environmental Plan(s).

Quality Control (QC)

Geo-Solutions is committed to providing quality work products to its clients. Geo-Solutions has a QC representative on all of its jobsites who provides technical input to line management in matters regarding quality. All employees are trained on how their role and job functions affect the quality of the GSI work product and are trained to perform any testing that their jobs require. Our Superintendents have significant experience and training in our specialty construction techniques and are responsible for overall safety and quality on their projects.

Sustainability

At Geo-Solutions, sustainability is centered on promoting practices that improve the well-being of its employees, its clients, the general public, and the environment. Ultimately, it's the right thing to do and Geo-Solutions is therefore committed to promoting sustainable practices with the goal of improving sustainability performance over time. Geo-Solutions also understands that there is often a tangible financial benefit associated with sustainable practices which makes Geo-Solutions' commitment to sustainability a "win-win".

Employee Training

All of Geo-Solutions' project staff have completed, at a minimum, the 40-hour OSHA HAZWOPER training with current 8-hour updates and are enrolled in a medical monitoring program including yearly physicals. Many of our staff members have additional training, e.g. OSHA HAZWOPER supervisory training, general OSHA 30 and 10-hour courses, confined space, excavation safety, lifts and rigging, first aid, and radiological hazard training.

In addition to OSHA safety related training, Geo-Solutions performs in-house training for equipment operation, technical aspects related to its technologies, quality control, general safety, estimating, and project management. New hires are put through an informal new-employee orientation that defines their role(s) in the company and provides an overview of policies.

Bonding and Insurance

Geo-Solutions has been a valued client of Westchester Fire Insurance Company, an A++ rated insurance company, since 2012. Geo-Solutions' ability to obtain bonding with a treasury-listed surety puts it in a strong position in the environmental and geotechnical construction fields. For example, Geo-Solutions has bonded individual projects over $75M.

Geo-Solutions also has an all-inclusive insurance agreement that covers its entire operations with coverage and limits that exceed most industry requirements.

Experience

Geo-Solutions has one of the strongest teams in the industry today which makes successful implementation of its projects possible. Geo-Solutions' team is ever-changing and increasing, but generally includes the following key resources: 5+ Executives with over 150 years of combined experience, 8 to 10 Project Managers with over 125 years of combined experience, and 10 to 12 Site Supervisors with over 300 years of combined experience. Geo-Solutions' team consists of a unique blend of exceptionally qualified managerial, technical, and field personnel with significant experience in specialty construction services. Many of the management and field staff have over 25 years of construction experience, specifically in the fields of geoenvironmental or geotechnical design and construction. Drawing from this deep experience pool, Geo-Solutions has the qualifications and expertise to handle even the most difficult project challenges. A significant amount of Geo-Solutions collective experience is the application of slurry trenching and soil mixing to solve geotechnical and environmental problems (see below), but Geo-Solutions also has experience in steam enhanced soil mixing, jet grouting, permeation grouting, chemical grouting, pipe / void grouting, trenching (chain mixing), wetland restoration, and dynamic compaction.

Slurry Trenching (incl. Cutoff Walls and PRBs). The staff at Geo-Solutions have been involved in the construction of slurry trenches since the late 70s. Throughout more than four decades, members of Geo-Solutions' staff have been involved with the installation of over a 1,000 slurry trenches and have authored or co-authored dozens of publications on various topics related to this construction approach. Geo-Solutions has been involved in the development of the reactive barrier wall technology since the late 1980's having pioneered the application of soil mixing and BP trenching to reactive media barrier installations. Geo-Solutions remains active in the advancement of reactive barrier technologies maintaining close working relationships with the inventors, scientists, and engineers who study and design these barriers.

Soil Mixing. The principals of Geo-Solutions were instrumental in the development and expanded use of the soil mixing technology in both the US geotechnical and environmental markets. Geo-Solutions' current and former principals reintroduced the soil mixing technology into the US market on the Jackson Hole Lake Dam project in the late 1980's and oversaw the construction of the first U.S. manufactured deep soil mixing (DSM) multi-auger drill rig. Geo-Solutions' staff were also involved in the earliest applications of soil mixing for the purpose of hazardous waste remediation and for much of the equipment modification and development that has made soil mixing the preferred

choice for many remediation projects. More recently, Geo-Solutions has been actively involved in the widening application of soil mixing for the delivery of oxidizing and reducing agents for the in-situ treatment of difficult contaminants in lithologies that would be impossible to treat otherwise. Finally, most recently, Geo-Solutions has been a leader in the development and application of soil mixing for thermal treatment and stripping of contaminants from soils. Geo-Solutions has an impressive soil mixing resume that spans both the environmental and geotechnical construction markets.

Project Team

Project Team members are selected specifically for each project to provide the client with the highest quality service available in three main areas: 1) technical capability; 2) knowledge and experience of the scope of work and client requirements; and 3) cost-benefit value. Each member of the Project Team brings specialized skills and/or knowledge proven by direct application at similar sites, within the applicable regulatory environment, and relevant to the scope of the project. A typical project team consists of:

Project Manager - responsible for remotely overseeing and managing all aspects of the work by establishing project procedures, lines of communication, reporting requirements, etc.

***Site Manager*/Superintendent** - responsible for overseeing and managing all aspects of the day-to-day work at the jobsite, including on-site subcontractor coordination, direction of the site workforce (e.g. laborers, operators, etc.), completion of required paperwork, maintenance of a safe and healthy work environment, and maintenance of the QC program.

Site Engineer/Technician - responsible for the implementation of the QC components of the work, including performing inspections, testing, surveying, and reporting. In addition to leading GSI's QC efforts, the Engineer / Technician often assists the Project Manager with onsite management and administrative responsibilities.

Site Health and Safety Specialist - assists the Superintendent in the implementation of the Safety components of the work, including adherence to site-specific H&S Plan(s), GSI's Corporate Safety Procedures, and reporting.

Technologies

Slurry Trenches (a.k.a Slurry Walls)

Strictly speaking, the terms Slurry Wall, Slurry Trench, or Slurry Cutoff Wall refer to slightly different construction techniques, but many in the industry use these terms synonymously. For the purposes of this text, these terms refer to non-structural vertical cutoff walls constructed using the slurry trench installation method. For those in the industry, the term “Slurry Wall” (aka Diaphragm Wall) is generally reserved for structural element installations that are installed in discrete elements. The terms Slurry Trench and Slurry Cutoff Wall are widely recognized to refer to the installation of non-structural walls using long, continuous slurry supported excavations. The slurry trench installation method refers to construction practices that utilize an engineered fluid (normally consisting of some mixture of clay and water) to hold open the sidewalls of an excavation, thereby permitting the excavation of deep and narrow trenches without the need for other conventional excavation support systems. These cutoff structures are mainly constructed to slow the flow of groundwater or to slow the migration of subsurface contaminants, namely by slowing the flow of the groundwater carrying the contaminants. Slurry trench cutoff walls have been employed at thousands of sites across the United States and internationally in a variety of applications, including at waste sites to contain contaminated groundwater, at "clean" sites to dewater excavations, and at dams, levees, and similar structures. There are various types of slurry trenches:

- Soil-Bentonite Slurry Trench Cutoff Walls (SB)
- Soil-Cement-Bentonite Slurry Trench Cutoff Walls (SCB)
- Cement-Bentonite Slurry Trench Cutoff Walls (CB)
- Composite and Combination Systems

Most slurry trenches are excavated with hydraulic excavators which can be modified to dig up to 90 feet deep and deeper depths are possible with clamshell excavators. When the excavation is complete, the trench is filled with a low permeability mixture (normally less than 1×10^{-6} or 1×10^{-7} cm/sec) called backfill. Conventionally, the backfill

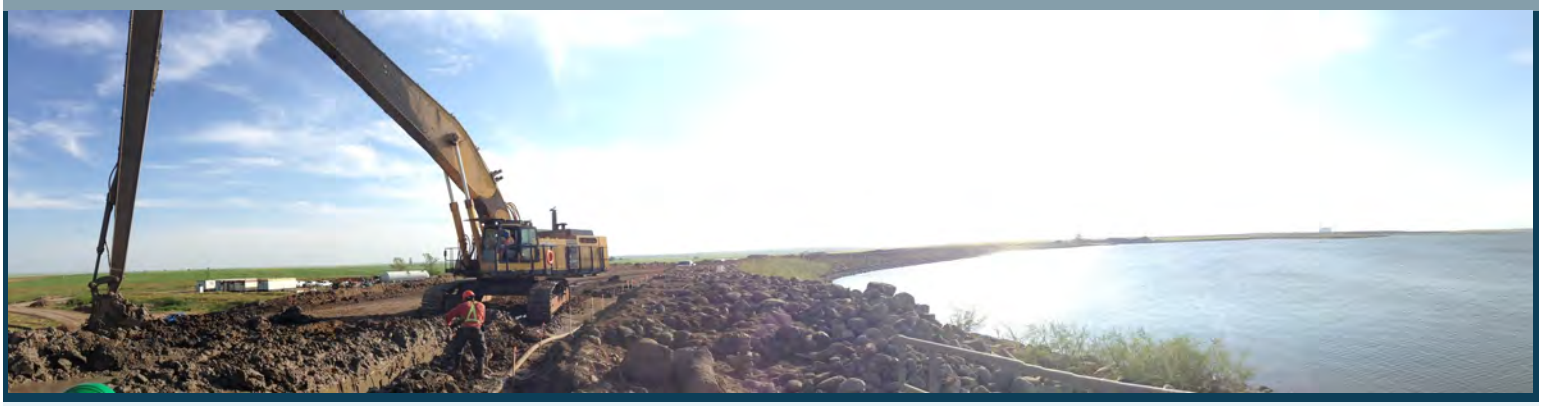
consists of a blend of soil and bentonite; soil, cement, and bentonite; or cement and bentonite, but barriers with synthetic materials (such as HDPE liners) or composite trench systems are also possible. Geo-Solutions has installed some of the longest (up to 11 miles long) and deepest (up to 185 feet deep) slurry trench cutoff walls in North America.

Soil-Bentonite Slurry Trenches

In the installation of soil-bentonite (SB) slurry trench cutoff walls, the trench is excavated under slurry followed by a distinct backfilling step wherein the slurry is displaced by a prepared backfill mixture consisting of soil, slurry to achieve slump, and at times, bentonite. This is sometimes referred to as a two-step or two-stage slurry trench installation. SB cutoff walls are the most common type of non-structural slurry trench, due mostly to their low installation cost. These walls were sporadically used in the United States between the 1940's and 1970's after which their use became commonplace. Since then thousands of these walls have been constructed for a number of purposes.

SB backfill may be blended using a variety of equipment, but the most common and convenient method is to mix batches of backfill alongside the slurry trench using small excavators and/or dozers. The resultant mix looks like wet concrete (i.e. low to moderate slump) and is normally placed in the trench with an excavator. The mixture is placed in a semi-fluid state which allows it to flow into the trench and displace the trench slurry. Once the backfill operation is complete, the SB backfill consolidates slightly ultimately behaving like a soft clayey soil. The most important property of the SB backfill is low permeability. Typically SB backfill has a permeability in the range of 10^{-6} to 10^{-8} cm/sec. Environmental projects often require a permeability less than $1x10^{-7}$ cm/sec, but a levee or dewatering project may require a permeability less than $1x10^{-6}$ cm/sec. Either value is achievable with the right mix of materials. SB backfill has low strength and will remain soft (in the range of 0 to 300 psf (0 to 15 kPa)) for the design life, but this is nearly always sufficient to maintain a vertical cut through the wall for subsequent installation of utilities and other light structures. The most important variables in a SB mix design are bentonite content and grain size distribution.

Surface loadings that span across SB walls, like roads and structural foundations, require the removal and replacement of the top few feet of the wall. Sometimes geogrids are used to distribute the loads above the wall to the soils adjacent.



In general, SB backfill performs well when exposed to pure phase contaminants or impacted groundwater due mostly to the fact that most of the matrix is composed of inert soil particles.

Advantages of Soil-Bentonite Slurry Trenches

Compared to other barrier wall types, SB slurry trenches offer the following advantages:

- Low cost
- High productivity
- Very low permeability
- Verifiable continuity and depth
- Resistance to contaminated groundwater
- Ability to easily flex with ground movements, even small earthquakes
- The slurry remains fluid, allowing time for penetrating difficult layers or obstacles
- Re-use of most of the excavated materials

Soil-Cement-Bentonite Slurry Trenches

Soil-Cement-Bentonite (SCB) slurry trenches are a variation of the more common SB slurry trench. In this method, the soils excavated from the trench are generally blended with bentonite via slurry as well as Portland cement to provide additional strength to the final backfill mixture. SCB walls are excavated using the same general methods as a SB wall installation except that SCB backfilling requires some additional equipment for handling the cement and for making cement grout which is added to the backfill. Cement is added to the backfill most often in a water based grout, but it can be added in dry powder form. Because the grout must be added in small yet fairly precise ratios, mixing is often done in a mixing box rather than on the ground. Mixing is usually accomplished using an excavator, much the same as for an SB wall. Backfill can also be placed with the excavator.

Adding the cement grout to the backfill generally means a higher (less desirable) permeability than could be obtained with the same material without the cement. This is because the Portland cement interferes with the bentonite and prevents it from achieving its full swelling potential. Typical permeability values for SCB backfill are in

the range of 10^{-7} cm/sec. Typical unconfined strengths are in the range of 30-150 psi (0.2 to 1 MPa). SCB permeability remains relatively unchanged over long time intervals, but SCB strength continues to improve over time.

SCB, as a material, has also been used to provide a protective encasement for critical foundations and a replacement for compacted clay when construction must take place in wet and cold conditions. SCB has similar properties to roller compacted concrete and soil cement.

Advantages of Soil-Cement-Bentonite Slurry Walls

- Most of the advantages of SB slurry walls apply to SCB walls
- Higher strength than SB or CB walls
- Greater trench stability is possible because the SCB backfill creates a shorter backfill slope, resulting in less open slurry-filled trench at a given time, especially with deeper walls.
- More resistant to erosion and burrowing animals - extremely important in levee applications

Cement-Bentonite Slurry Trenches

Cement-Bentonite (CB) slurry trenches, aka self-hardening slurry trenches, represent a smaller and more specialized type of the slurry trench installation method market in the US and have been in use here since the early 1970s. Alternatively, in Europe and other international locales, CB walls are the more common barrier wall choice. In this method, the wall is excavated through a slurry that typically consists of water, bentonite, cement, and occasionally other additives such as blast furnace slag cement or attapulgite clay. The trench slurry hardens in place, normally overnight or over a period of a few days. The hardened CB slurry serves as the final barrier wall. CB installations do not require a separate backfilling operation and for this reason this technique is sometimes referred to as one-step or single stage slurry trench construction.

CB walls are excavated using hydraulic excavators and/or clamshell excavation equipment, the same equipment used for other slurry trench installations. At the slurry plant, cement, or some other setting agent, is added to the bentonite slurry. The slurry is then pumped from the mix plant to the excavation. Once the excavation is completed to full depth, the bottom is cleaned and the process moves on. The viscosity of the mixed

slurry is designed to be in the fluid range during the excavation process. The slurry stays in the trench and is allowed to set. Typical CB slurry will attain a butter-like consistency overnight and a clay-like consistency after fully hardening (generally 28 to 56 days).

The properties of interest for most CB slurry walls are strength and permeability. CB slurry has a relatively high water content and because of this there are more water-filled voids than in a SB or SCB backfill. This higher void ratio results in typical permeability values that are higher than SB or SCB backfill, generally in the 10^{-6} cm/sec range although lower permeability values are feasible if the mix is evaluated over a long period of time. CB can take months to fully harden, and long term tests have shown CB permeability gradually decreases (improves) over long timescales (years). CB material generally attains 75% of its ultimate strength after 28 - 56 days of curing and close to 100% after 90 days of curing. The addition of blast furnace slag typically results in a higher strength, lower permeability material, but it takes much longer to achieve the final properties with properties shown to improve beyond 180 days. Chemical compatibility is also an important parameter when designing containment systems for impacted groundwater. CB has a pore size that is particularly well-suited to resisting certain oils and petroleum products, and thus, it is often preferred on sites with heavily contaminated groundwater.

Advantages of Cement-Bentonite Slurry Trenches

- Useful on smaller projects with limited access or narrow work zones because of the smaller equipment footprint.
- No excavated soils are used in the final barrier wall, which is beneficial in areas with undesirable backfill soils.
- Since CB slurry is heavier than bentonite slurry and self-hardens, this method can provide improved trench stability and more easily overcome weaker ground conditions.
- Since the slurry sets after ~1 day, overlapping segments can be constructed in any direction or order to form a continuous barrier.
- Segments can be used to traverse up or down moderate slopes with minimal earthwork construction.
- Construction of walls through porous ground conditions is possible.
- Can be used to remove unsuitable materials below the groundwater without shoring or dewatering.
- CB backfill, once set, has a higher strength than SB backfill.

Geo-Trencher

Although technically more a form of soil mixing, the Geo-Trencher can also be used for the efficient installation of cutoff walls in applications where a slurry wall would be less efficient or impossible. More information about the Geo-Trencher is included below in the soil mixing section.

Bio-Polymer Slurry Trenching

Bio-polymer (BP) slurry trenching is a method used to install high conductivity vertical conduits. These trenches are installed with a bio-degradable slurry and can be backfilled with a variety of permeable materials (e.g. gravel or sand). The goal on these projects is to form permeable zones in the earth to serve as toe drains in dams; recovery trenches for contaminated groundwater; French drains; permeable reactive barriers (see separate PRB references); permeable adsorptive or absorptive barriers (PABs); leachate collection trenches; and other types of active groundwater control structures. BP trenching is similar to slurry trenching with bentonite, but a degradable polymer slurry is used instead of a bentonite slurry. The polymer slurry serves to eliminate dewatering, shoring, unhealthy odors, and it stabilizes the trench walls as the excavation and backfill are completed below the groundwater surface. In some cases, i.e. bio-treatment schemes, the bio-polymer slurry can actually increase the reactivity of the media. Depending on project goals, BP slurry trench drains (or BP Drains) may be equipped with wells, filter fabrics (although not recommended), liners (e.g. HDPE), sumps, horizontal pipes, and any of a variety of other features. When construction is complete and the trench is backfilled with gravel, sand, or other permeable material, the slurry is degraded to water, and minute amounts of environmentally-friendly precipitate material thereby becoming an active drain. Installation of a BP Drain may require the use of long stick attachments, tremie pipes, end stops, special weights, and other tools that GSI possesses.

Soil Mixing

The term Soil Mixing loosely refers to any construction approach used to mix soils with or without a reagent additive. In the fields of geotechnical and environmental contracting, the term often refers to methods of soil mixing performed in-situ for the addition of a cementitious reagent, most commonly Portland cement. The concept for soil mixing originated in the US, but much of the early technological development took place in Europe and Japan until

the technology was reintroduced into the US market (by GSI's current and former principals) in the late 1980's on the Jackson Hole Lake Dam project. Other terms used to describe this process include, in-situ soil mixing (ISSM), auger mixing, deep soil mixing (DSM), shallow soil mixing (SSM), deep mixing method (DMM), soil cement columns / piles, cement soil mixing (CSM), large diameter auger (LDA), and rotary mixing. The most common use of soil mixing in the environmental market is for the in-situ stabilization / solidification (ISS) of wastes, but the method can also be used to deliver treatment reagents to the subsurface or to perform thermal / air stripping of contaminants. Soil mixing is used in the geotechnical market for the installation of rigid elements for bearing capacity and slope stability improvement, for installation of low hydraulic conductivity cutoff walls, and for excavation support systems.

There are many equipment configurations and processes that can be used for the successful completion of soil mixing, but the goal is almost always the efficient creation of a soil-reagent mixture with improved properties relative to the soils alone. The most common type of soil mixing used on environmental sites is large diameter single auger soil mixing in which a large diameter (typically 3 to 12 foot diameter) tool with cutting edges, mixing paddles, and grout ports is drilled into the ground as a fluid grout is pumped through the hollow shaft and out the grout ports. The fluid (which usually contains additives) acts as an aid to drilling and is mixed into the soil column, creating the soil-reagent mixture.

Large diameter mixing can also be used to install geotechnical elements. The term deep soil mixing (DSM) often refers to the use of multi-auger soil mixing rigs that are most commonly used to install linear elements, such as cutoff walls or shear panels. DSM auger configurations are specific to each contractor, but typically include 3 or 4 relatively small (3' to 4') diameter augers spaced evenly apart.

Very shallow soil mixing, typically less than 15' or 20' can be performed using excavator buckets with or without rotary blending tools (think: large rototiller). These methods are more primitive than some of the other approaches, but can be performed at a significantly reduced cost.

As discussed, soil mixing may be used for a variety of purposes: creating structural elements for foundations and earth retention, soil improvement, groundwater cutoff walls, and in-situ treatment of buried contaminants. It is also used with specialized cementing and chemical reagents for hazardous waste treatment, sludge stabilization /

solidification, lagoon stabilization, in-situ chemical oxidation (ISCO), and in-situ chemical reduction (ISCR). Geo-Solutions has more soil mixing experience than any other firm and is the oldest soil mixing contractor in North America.

Advantages of Soil Mixing

- Limited handling of contaminated soils (some handling of mixing spoils which are typically 15-20% of the mixed volume)
- High strengths, 50-200 psi
- Low hydraulic conductivity, ~5x10-7 cm/s
- Mixing is performed in-situ
- Advantageous in weak soils / adjacent to large structures because there is no open trench and columns can be alternated
- Advantageous on sloped sites with difficult access because the drill can be angled to achieve a vertical wall
- Can be performed safely and effectively below groundwater table without dewatering or excavation support

Steam Enhanced Soil Mixing

Geo-Solutions' steam enhanced soil mixing can be used to perform thermal remediation by injection of hot air and steam. This technique can be cost effectively used to remove volatile organic compounds (VOCs) and semi volatile organic compounds (SVOCs) and has been used successfully on a number of project sites in the last 15 or so years. The process is completed using standard soil mixing auger(s) fitted for delivery of air and/or steam to the soil. The steam and hot air raise the temperature in the subsurface to approximately 65° to 95° C causing thermal desorption and volatilization of the contaminants from soil particles and pores. Once in the vapor form, the compounds are carried to the surface with the hot air, collected under a shroud, and then handled using ex-situ vapor phase treatment equipment. The in-situ thermal technology using steam and hot air can have removal efficiencies of up to 99% for VOCs and up to approximately 90% for SVOCs. Compared to other methods of thermal

remediation, soil mixing offers numerous advantages including 100 percent exposure of the contaminants to the hot air and steam. In addition to mass contaminant removal via thermal treatment, a polishing step can and is often performed to extend the treatment. For example, a reducing agent like zero valent iron (ZVI) is often mixed into the soils post steam enhanced soil mixing treatment on sites with chlorinated solvents.

Geo-Trencher

The Geo-Trencher, ideally suited for deep and narrow cutoff walls where a slurry trench is infeasible or inefficient, is essentially a large mixing chain mounted on a tracked chassis. This machine can be used to efficiently mix soil in place (soil mixing) with wet or dry reagents for creation of low permeability cutoff walls or it can be used to excavate and replace the in-situ materials with permeable materials for building collection trenches or permeable reactive barriers (PRBs).

Advantages of the Geo-Trencher

- Can be used to install cutoff walls, collection trenches and permeable reactive barriers without an “open” (slurry filled) trench. This reduces the risk of trench cave-ins and other hazards
- Less equipment is needed as the trencher completes the work which improves overall site safety
- The vertical mixing chain blends all strata within the lithology into a well-blended uniform mix
- Simpler process (less steps) improves quality control
- Lower cost
- Faster installation speed
- Reduced spoils management, less handling of contaminated materials
- Can safely operate in tight spaces which can eliminate a need for remote ex-situ mixing
- Once in the ground the rig can operate in low headroom conditions (<20 ft.)

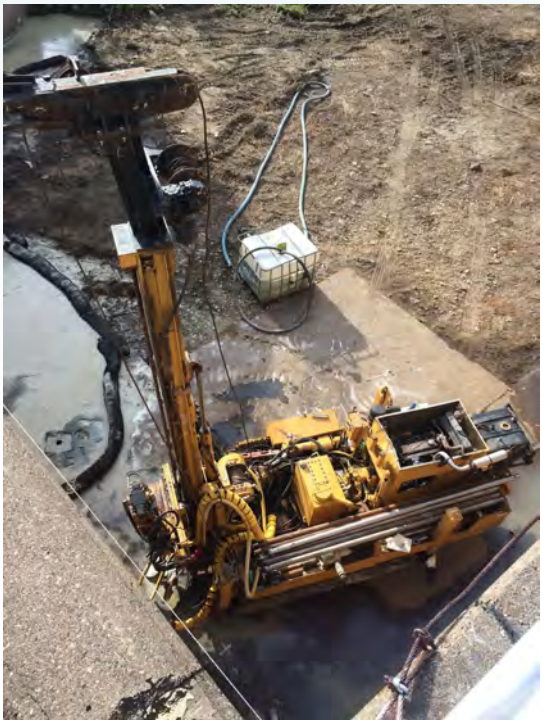
Grouting

Grouting is a means by which subsurface voids, such as open cavities, soil pores, and open fractures in rock are filled with mixtures in order to accomplish site specific objectives (typically reduced permeability or increased strength). Typical grouting involves the installation of a hollow casing to the depth of interest. A grout is then injected into the subsurface through the casing as the casing is simultaneously pulled out of the ground. Grout is

typically injected until a noticeable increase in pressure is observed at the surface which indicates that all of the voids have been filled. Grouting can also be done under high pressure which is commonly referred to as jet grouting.

Jet Grouting

Jet grouting is a technique in which an ultra-high pressure (up to ~6,000 psi) fluid stream is used to erode, mix, and replace soils. This technique is actually a combination of soil mixing and grouting. Generally jet grouting is performed by injecting a cement-water grout and can be performed with jets of grout alone (a.k.a. jet mixing or single fluid), with jets of grout and air (a.k.a. double fluid); or jets of air, water, and grout (triple fluid). Jet grout construction uses a rotating and rising drill rod with small nozzles that direct the grout horizontally to form columns of soilcrete or soil-cement. Jet Grout columns are typically formed from the bottom up providing a column of fully mixed soil. Typical column diameters are 2 to 6 feet (0.6 to 2 m). Jet grouting is the only type of grouting that is capable of treating all types of soils from clays to gravel, but is most effective in highly erodible soils. Jet grouting is also useful for mixing isolated zones of soil and for mixing around and below buried structures and utilities. Jet Grouting is commonly used in conjunction with other techniques, e.g. slurry trenching or soil mixing, to complete sections of barrier or a monolith in areas with difficult or limited surface access, subsurface obstructions, or sensitive utility locations. Jet Grouting is also particularly effective in structural underpinning and foundation rehabilitation. Members of Geo-Solutions' staff have been performing jet grouting since the mid-1980's when this technique was first introduced into the US.



Pressure Grouting

Pressure grouting is a proven methodology for installing seepage barriers or curtains to eliminate, or minimize, problematic water flow through karstic, fractured, or otherwise pervious bedrock. This technique is commonly applied for reducing seepage beneath dam foundations through the installation of "grout curtains". Grout Curtains are typically installed by injecting cement-based grout into the underlying bedrock, under pressure, through grout-pipe and borehole packers. Geo-Solutions has performed extensive laboratory testing to develop a comprehensive suite of state-of-the-art balanced, stable grouts that can meet today's stringent specifications. Geo-Solutions can also employ real-time computerized monitoring systems for continuously measuring and recording grout injection parameters during construction.

Pipe or Void Grouting

Pipe or void grouting is an application of pressure grouting that can be used to fill underground pipes, abandoned utilities, or voids to prevent future collapse. This application involves the use of grout that is capable of flowing the length of the pipe or void and that will meet the specific strength and permeability requirements. This application is highly specialized and typically requires a bench scale study to determine an appropriate grout mixture. Geo-Solutions' resume includes some of the longest pipe grouting projects (over 10 miles of pipeline) and the largest void grouting projects (11,000 cubic yards) in the United States.

Permeable Reactive Barrier (PRB) Walls

Permeable reactive barrier walls, sometimes called passive reactive barriers or PRBs, are vertical elements used to passively remediate contaminated soil and groundwater. This technology does not require any mass excavation, disposal or conventional "pump and treat" methods. Generally, a treatment media or reactive barrier, is buried in a narrow trench beneath the ground surface so that contaminated groundwater can pass through the media passively. After the contaminated groundwater passes through and reacts with the media, the groundwater exits the other side of the wall "clean". Typical treatment media used in PRBs includes granular iron, activated carbon, engineered bacteria, chemicals, and special clays. PRBs can be installed using the BP slurry excavation method, soil mixing, or a chain mixing tool (e.g. the Geo-Trencher). Zero-valent iron is the most common reactive material used in PRBs and was initially developed in the 1990's by the University of Waterloo. Geo-Solutions was instrumental in working with the University in developing this technology back then and remains the preferred installer of deep PRBs in the industry. Similar installation methods can be used to install permeable barriers for ad- or absorption referred to as PABs.

Combination Systems

Many of Geo-Solutions' construction techniques are complimentary, i.e. multiple are routinely used on the same construction site. For instance, slurry trench cutoff walls are occasionally used to funnel groundwater toward a PRB. This type of installation is often called a "funnel and gate" system. Another example of a combination system is the use of jet grouting to supplement soil mixing or slurry trenching in difficult areas of a site. Geo-Solutions is one of the few contractors that has the in-house capabilities to install such combination systems.

Services

Geo-Solutions can provide a range of services from method evaluations to treatability studies to design/construction.

Traditional Contracting

Geo-Solutions has the ability to bring all of the labor, equipment, materials, and experience to work directly for the Owner or General Contractor in the execution of a project. This is Geo-Solutions' primary service model.

Technical Assistance

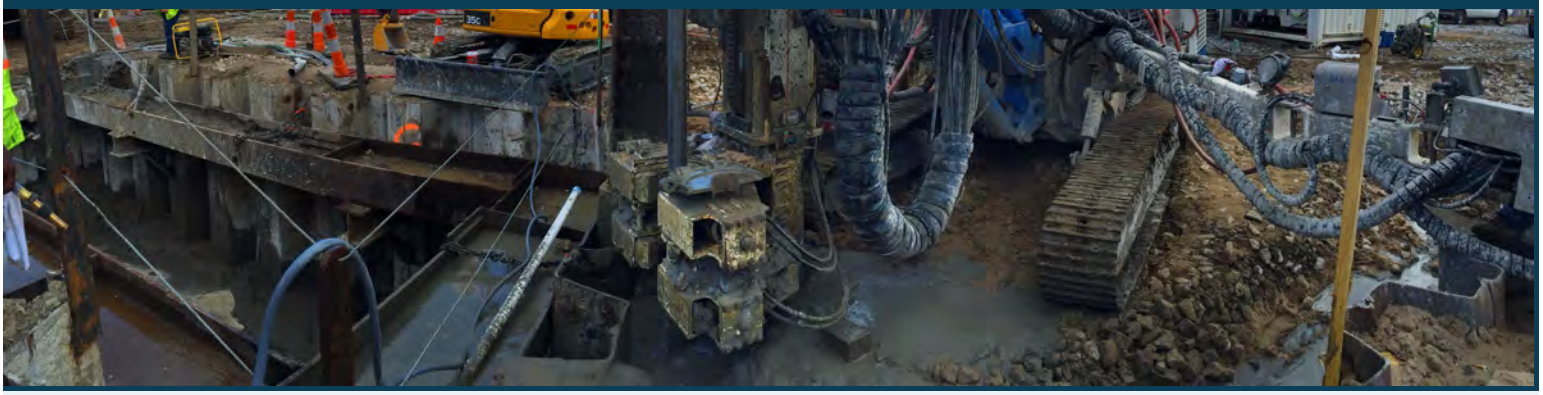
In select markets or for select clients, Geo-Solutions may be willing to bring skilled supervisors, specialized materials, and specialty equipment to the job site to assist another contractor in the execution of its specialized work.

Joint Ventures and Teaming

When it makes sense for both parties, Geo-Solutions has and will team with a company or companies that might otherwise be a competitor. This is a particularly good option in challenging markets or for large projects that might not be feasible or efficient for a single contractor. These ventures range from "silent" teaming arrangements to formal joint ventures (JVs).

Consulting

Geo-Solutions is routinely engaged by Owners, Engineers, and Contractors to assist in the design or development phase of a project. As consultants, Geo-Solutions' staff can draw upon their construction experience to guide projects successfully through the design phase. Geo-Solutions' consulting includes feasibility studies, project cost estimating, method evaluation, and design mix studies. Geo-Solutions' consulting arrangements often center on a bench scale design mix study. Given the subtleties of slurry trenching and soil mixing, design mix studies are frequently required to determine if a selected methodology can successfully and cost effectively meet the project objectives. Geo-Solutions has a detailed understanding of grouting, slurry trenching, and soil mixing which allows it to develop its bench scale studies in a way that makes the results valuable for the full scale implementations. Geo-Solutions has completed hundreds of such studies.



Equipment

Geo-Solutions maintains an impressive equipment fleet that is specifically tailored to meet the needs of its specialty geotechnical and geoenvironmental projects. In order to keep mobilizations costs at a minimum, Geo-Solutions rents as much standard equipment (i.e. forklifts, generators, backhoes, etc.) as possible from local vendors and supplements with its specialized equipment. Much of Geo-Solutions' equipment fleet was custom designed and built or modified for its specialized work.

Geo-Solutions' Owned Equipment Includes:

- Large excavators (including 40, 80, and 125 MT machines) suited for Geo-Solutions' long stick / booms
- Track mounted (e.g. hydraulic drills) soil mixing drill rigs capable of mixing with 8' to 12' augers down to a depth of 70'
- Crane mounted soil mixing drill rigs capable of mixing with 8' to 12' augers to depths greater than 70'
- Jet grout drill rigs
- The Geo-Trencher, a chain trencher capable of mixing down to a depth of 45'
- Custom long sticks and booms for excavators which allow for the excavation of slurry trenches down to depths of 90'
- Rotary mixing tools for the cost effective implementation of soil mixing down to depths of 20'
- Low/high flow and/or low/high pressure automated, continuous, and batch type slurry and grout mixing plants, including bulk pneumatic tanks and various size silos for the storage of bulk cement, bentonite and other reagents
- Jet pumps for jet grouting
- Clamshells for deep excavations
- System components for steam enhanced soil mixing, including real-time gas chromatographs, shrouds, flame ionization devices (FIDs), boilers, vapor conditioning and treatment equipment, and custom data acquisition software
- Automated data acquisition systems, flowmeters, GPS devices, and other QC equipment
- Specialty soil mixing attachments, including augers, Kelly bars, centralizers, rotary heads, etc.
- An assortment of smaller support equipment and tools including forklifts, manlifts, pumps, excavators, dozers, loaders, VFDs, storage boxes, tools, etc.

Contact Us

Our strong, highly experienced team of professionals is available to help you with questions concerning environmental remediation or geotechnical construction. Contact us through our website, via email or directly at any of our offices located throughout North America.

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Geo-Solutions
Soil and Groundwater Problems Solved

GEO-SOLUTIONS KEY ISS PROJECTS				TECHNOLOGY																			TYPE									DIMENSIONS
Project Name & Location	Year Completed	Value	General Contractor	Slurry Wall, SB, SCB	Self-Hardening Slurry Wall, CB	Bio-Polymer - Interceptor Trench, PRB	Trencher	ISCO / ISCR	Thermal Remediation	In-Situ Soil Stabilization	Soil Mixing	Bucket Mixing	Auger Mixing	Rotary	Pressure/Compaction Grouting	Jet Grouting	Pipe Grouting	Site Remediation	Waste Management	Cap, Liners	Wetlands	Site Development	Contamination, (ie Hydrocarbons, PCBs, Heavy Metals, Coal Tar)	EPA, Superfund	DOD/DOE	USACE	MGP	DAM/LEVEE	USACOE	RCRA/CERCLA	CONFIDENTIAL	
SEDIMENT STABILIZATION GOWANUS, NY	2022	$7M TO $8M								✓			✓																			34 FT DEEP 15,200 CY
MGP REMEDIATION WEST BABYLON, NY	2021	$1M TO $2M	✓							✓			✓					✓										✓					
SITE REMEDIATION WESTERN US **CONFIDENTIAL**	2021	$3M TO $4M	✓							✓								✓										✓				✓	600 CY
SITE REMEDIATION EASTERN US **CONFIDENTIAL**	2021	$2M TO $3M						✓		✓													✓									✓	12,844 CY
SOIL MIXING SARANAC LAKE, NY	2021	$2M TO $3M								✓	✓		✓																			26 FT DEEP 36,940 CY
FORMER MGP SITE MIDWESTERN US **CONFIDENTIAL**	2021	$1M TO 1.5M	✓							✓	✓		✓					✓					✓					✓				✓	49 FT DEEP 5,000 CY
FORMER GAS PLANT SITE CAMDEN, NJ	2020	$2M TO $3M								✓	✓	✓	✓										✓										32 FT DEEP 34,000 CY
FORMER MGP SITE MIDWESTERN US **CONFIDENTIAL**	2020	$1M TO 1.5M	✓							✓	✓	✓											✓					✓				✓	1,000 CY
FORMER LYNN LANDFILL LYNN, MA	2020	$1.5M TO $2M								✓		✓		✓																			13 FT DEEP 19,550 CY
FORMER MGP SITE MIDWESTERN US **CONFIDENTIAL**	2020	$2M TO $3M	✓							✓	✓	✓						✓					✓					✓				✓	3,090 CY
FORMER MGP SITE WESTERN US **CONFIDENTIAL**	2020	$3M TO $4M								✓		✓																✓					30 FT DEEP 10,879 CY
SITE REMEDIATION BUFFALO, NY	2019	$11M TO $12M	✓							✓	✓	✓							✓														16 FT DEEP 240,000 CY
MGP SITE REMEDIATION SOUTHERN US **CONFIDENTIAL**	2019	$12M TO $13M	✓							✓	✓		✓															✓				✓	30 FT DEEP 108,500 CY
CONFIDENTIAL MGP REMEDIATION MIDWESTERN US **CONFIDENTIAL**	2019	$20M TO $30M	✓							✓	✓		✓					✓					✓					✓				✓	60 FT DEEP 110,000 CY
FORMER MGP SITE TOMS RIVER, NJ	2019	$1M TO 1.5M								✓	✓	✓		✓				✓					✓					✓					16 FT DEEP 13,516 CY
GRANVILLE FORMER MGP GRANVILLE, NY	2019	$4M TO $5M								✓	✓		✓															✓					15 FT DEEP 43,400 CY
FORMER PLAINFIELD GAS WORKS PLAINFIELD, NJ	2019	$7M TO $8M								✓	✓		✓					✓					✓					✓					40 FT DEEP 68,000 CY

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FORMER MGP SITE NORTHWESTERN NEW JERSEY	2018	$2M TO $3M	✓							✓	✓	✓						✓									✓					25 FT DEEP 9,200 CY
FLORIDA AVENUE FORMER MGP ATLANTIC CITY, NJ	2018	$7M TO $8M								✓	✓		✓					✓					✓				✓					64 FT DEEP 95,000 CY
REMEDIAL ACTION MIDWESTERN US **CONFIDENTIAL**	2018	$1.5M TO $2M								✓	✓		✓					✓					✓	✓							✓	22 FT DEEP 33,000 CY
SOIL/GROUNDWATER REMEDIATION YONKERS, NY	2018	$1M TO 1.5M								✓	✓	✓																				38 FT DEEP 10,890 CY
FORMER MGP FACILITY RED BLUFF, CA	2017	$1M TO 1.5M								✓	✓		✓					✓					✓				✓					33 FT DEEP 9,706 CY
FORMER MGP SITE NEW JERSEY	2017	$8M TO $9M								✓	✓		✓					✓					✓				✓					28 FT DEEP 100,000 CY
MACASSA TAILING SHEAR KEY KIRKLAND LAKE, ON	2017	$2M TO $3M								✓	✓		✓																			42 FT DEEP 340,761
REMEDIAL ACTIONS EASTERN US **CONFIDENTIAL**	2016	$4M TO $5M			✓					✓	✓	✓						✓													✓	22 FT DEEP 14,000 CY ISS
FORMER MGP REMEDIAL ACTION HAMMONTON, NJ	2016	$5M TO $6M								✓	✓		✓					✓					✓				✓					66 FT DEEP 43,500 CY
FORMER MGP SITE SUFFERN, NY	2016	$3.5M TO $4M								✓	✓	✓	✓										✓				✓					35 FT DEEP 16,000 CY
GOWANUS CANAL BROOKLYN, NY	2015	$2M TO $3M	✓							✓	✓		✓											✓								22 FT DEEP 1,1850 CY
CONFIDENTIAL SITE WYOMING	2015	$2M TO $3M								✓	✓	✓		✓				✓														17 FT DEEP 13,476 CY
ROADWAY AND BRIDGE RECONSTRUCTION	2015	$1M TO 1.5M								✓		✓		✓																		20FT DEEP 14,450 CY
FORMER MGP SITE REMEDIATION TWO RIVERS, WI	2014	$5M TO $6M	✓							✓	✓		✓										✓				✓					33 FT DEEP 74,000 CY
NORTH PLANT MGP SITE WAUKEGAN, IL	2014	$12.5M TO $15M	✓							✓	✓		✓					✓	✓	✓							✓					27 FT DEEP 299,590 CY
MARKET STREET GAS WORKS MGP SITE NEWARK, NJ	2014	$1M TO 1.5M								✓	✓	✓											✓				✓					16 FT DEEP 17,700 CY
SITE REMEDIATION LOUISVILLE, MS	2013	$3M TO $4M		✓						✓	✓	✓											✓	✓		✓						60 FT DEEP 190,000 VSF SB

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DNAPL STABILIZATION - AWI PORTSMOUTH, VA	2013	$8M TO $9M	✓							✓	✓							✓		✓			✓	✓		✓			✓			28 FT DEEP 47,400 CY
SENECA MEADOWS LANDFILL WATERLOO, NY	2013	$1M TO 1.5M								✓	✓		✓																			25 FT DEEP 11,230 CY
MGP WASTE STABILIZATION WEST COAST	2012	$2M TO $3M								✓	✓		✓			✓							✓				✓					50 FT DEEP 500 VSF
SITE REMEDIATION OHIO	2012	$5M TO $6M								✓			✓			✓							✓				✓					41 FT DEEP 61,300 CY
MGP SITE REMEDIATION HOMER, NY	2012	$7M TO $8M	✓							✓	✓		✓					✓	✓	✓			✓				✓					47 FT DEEP 54,300 CY
FORMER MGP SITE MIDDLE GEORGIA	2012	$4M TO $5M	✓							✓			✓																			30 FT DEEP 47,000CY
IN SITU SOIL STABILIZATION SACRAMENTO, CA	2012	$3M TO $4M								✓	✓	✓	✓														✓					33 FT DEEP 42,500 CY
SOIL MIXED BARRIER WALL GREENFIELD, MA	2012	$1M TO 1.5M								✓	✓		✓										✓				✓					32 FT DEEP 14,995 VSF
EQUALIZATION BASIN REMEDIATION NORWICH, NY	2012	$2M TO $3M						✓		✓	✓		✓										✓									27 FT DEEP 17,144 CY
TEXARKANA WOOD PRESERVING COMPANY	2012	$7M TO $8M						✓		✓	✓		✓					✓		✓			✓	✓						✓		42,000 CY
WOOD PRESERVER'S REMEDIATION WARSAW, VA	2012	$2M TO $3M								✓	✓	✓	✓										✓									31 FT DEEP 58,454 CY
IN SITU REMEDIATION WITH ZVI WHITEFISH LAKE, ALBERTA	2012	$1M TO 1.5M						✓		✓	✓		✓										✓									26 FT DEEP 9,500
SAR LEVEE REPAIR NEWPORT BEACH, CA	2011	$1M TO 1.5M								✓	✓		✓			✓												✓	✓			54 FT DEEP 6,100 CY
F-AREA BARRIER WALL EXTENSION SAVANNAH RIVER SITE	2011	$1.5M TO $2M								✓	✓		✓										✓		✓							70 FT DEEP 1,400 LF
OMC PLANT 2 SITE REMEDIATION WAUKEGAN, IL	2011	$1M TO 1.5M								✓	✓		✓										✓	✓								25 FT DEEP 8,900 CY
RICHARD P. KANE WETLAND MOONACHIE, NJ	2010	$10M TO $15M	✓							✓								✓			✓											260 ACRES
MW-520 SITE REMEDIATION EAST RUTHERFORD, NJ	2010	$1.5M TO $2M						✓		✓	✓		✓										✓									19 FT DEEP 7,600 CY

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AGL FORMER MGP SITE MACON, GA	2009	$1M TO 1.5M	✓							✓	✓		✓					✓		✓			✓				✓					25 FT DEEP 16,290 CY
FORMER MGP SITE REMEDIATION CAMBRIDGE, MA	2008	$2M TO $3M								✓	✓					✓			✓				✓				✓					18 FT DEEP 1,200 CY
ISS PERIMETER WALL SAG HARBOR MGP, NY	2008	$1M TO 1.5M								✓	✓		✓										✓				✓					23 FT DEEP 7,200 CY
FUNNEL & GATE MUSKEGON, MI	2008	$1M TO 1.5M								✓	✓		✓							✓			✓									55 FT DEEP 9,921 VSF
CKD GROUNDWATER REMEDIATION METALINE FALLS, WA	2007	$1M TO 1.5M	✓	✓		✓				✓								✓	✓	✓	✓		✓									15-20 FT DEEP 31,400 VSF
STABILIZED SOIL BARRIER PLATTSBURGH, NY	2007	$1M TO 1.5M								✓	✓		✓			✓							✓				✓					22,000 CY 45,750 VSF
MGP - IN-SITU SOLIDIFICATION NYACK, NY	2007	$1.5M TO $2M								✓	✓		✓			✓							✓				✓					21 FT DEEP 11,400 CY
IN-SITU SOIL TREATMENT SHOREHAM, NY	2006	$1M TO 1.5M						✓		✓	✓		✓			✓			✓				✓									100 FT DEEP 177 COL
FLYASH LAGOON CLOSURE YARMOUTH, ME	2002	$1M TO 1.5M								✓	✓	✓																				28,000 CY
FLUSHING CSO FACILITY FLUSHING, NY	2002	$1M TO 1.5M								✓	✓		✓																			68,000 SF

07/26/21

Avetta

Geo-Solutions Inc.

Became a member of the Avetta Consortium on:

06/14/19

This document certifies that the company above is a Member of the Avetta Consortium. Being an Avetta Consortium Member significates that you are part of a global effort to advance company and worker safety, sustainability, and operational excellence. Consortium Members represent a pursuit of excellence in delivery, safety and sustainability.

Arshad Matin

Arshad Matin, President and CEO

Taylor Allis

Taylor Allis, Chief Product Officer

Geo-Solutions

1250 Fifth Avenue, New Kensington, PA 15068
T 724-335-7273 **F** 724-335-7271
www.geo-solutions.com

Safety

Geo-Solutions (GSI) is committed to maintaining a safe work environment for all workers, site visitors, and the general public. This commitment is reinforced by our upper management's leadership of our core safety values, safety program implementation, and risk-based hazard identification. A zero-incident safety culture is a continuous improvement process that involves every employee with-in Geo-Solutions and is validated by upper management. We are devoted to the safety of our employees and exceeding compliance with applicable statutes, regulations, and ordinances throughout our operations.

GSI's safety department is managed by multiple Board-Certified Safety Professional (CSP) and is structured to assist line management with regulatory compliance and optimize safety performance. The safety department oversees safety program development, management, training, auditing (at all levels of the organization), and case management. Our safety staff is available to all employees and customers 24 hours a day, 365 days a year.

Our Commitment to Safety

Our commitment to safety begins with surpassing compliance with all applicable statutes, regulations, and ordinances. One of the core components of our safety program is risk-based hazard identification, including:

- Development of Site-Specific Safety Plans
- Project Specific Task Hazard Analysis Development and Review
- Job Specific Safety Analysis
- Job Site Safety Audits / Inspections
- Employee Training
- Stop Work Authority

Using Web-Based Tools to Improve Safety Performance

Geo-Solutions uses a web-based application (SiteDocs™) to document and collect worksite safety data to improve safety performance. Jobsite safety documentation begins each day with the submittal of jobsite safety meeting summaries from all of Geo-Solutions' active jobsites which are digitally signed by all crew members. These can be reviewed remotely by corporate safety personnel which provides an opportunity to confirm that safety is the first thing discussed every day and maintains critical documentation for audits or inspections. The system also allows the user to create, complete and document safety audits, safety observations, incident and near miss reports. To improve ease of use, each jobsite is assigned a tablet computer devoted to SiteDocs™ and the application can also be installed on smart phones.

As a means of tracking leading indicators to make informed decisions, one of the most important features is the ability to conduct and document safety observations. This enables Geo-Solutions to be proactive in our safety efforts by improving the identification of deficiencies in employee behavior or site conditions. Each observation is logged in the system and safety personnel can quickly generate reports to monitor trends to determine if training and support can be provided to prevent incidents. Heinrich's theories show

that 88% of incidents are a result of human behavior, or unsafe acts, and safety observations related to behavior can be used to reduce the probability of incidents.

We are dedicated to achieving safe production. We believe in protecting the safety and health of our own employees and that of other personnel who may be impacted by our work. We also believe that we can and must take the time to do our work safely and strongly believe that safety, production, and quality can all work harmoniously to achieve our ultimate goal of zero losses. Geo-Solutions anticipates use and participation in this application to improve with time, demonstrating tangible improvements to our solid safety record.

Gold Shovel Certification

Geo-Solutions has been approved for the Gold Shovel Standard Certification.

It is a first of its kind effort to create a North American scale program, driven by industry and underpinned by data technology, to unify excavation safety under a single broadly meaningful professional brand. The mission of Gold Shovel Standard is to both certify that excavators and locators have adopted standard safety management elements into their excavating processes and create and deploy the infrastructure to quantitatively measure and communicate their success in doing so, such that best-in-class performance can be rewarded.

Safety Certifications

Geo-Solutions is proud of its certified safety program and has earned accreditation with ISNetworld, Avetta, and PEC Safety assuring our clients of standards in worker and process safety.

Training

Our site superintendents have overall responsibility for managing site safety on projects. Our superintendents are matched to each job site / assignment according to their level of training, experience, and past performance for completing assignments in a safe, professional, and efficient manner. GSI's supervisors conduct tailgate safety meetings at the beginning of the workday to discuss site safety issues from previous workdays as well as potential areas of concern for the work ahead. All GSI employees are empowered with no repercussions "stop work" authority to ensure a safe work environment.

All GSI employees working on HAZWOPER 1910.120 regulated sites are properly trained and have their initial 40-hour HAZWOPER training and 3-day on-the-job training followed by their annual 8-hour HAZWOPER refresher training to stay current.

Our Superintendents have successfully completed the OSHA 10 and/or 30 Hr. Construction Outreach Training Course, the 8-hour HAZWOPER Supervisor Course, and 1st Aid/CPR/AED.

All skilled employees have a combination of some of the following training depending on their position.

- New-Hire Safety Orientation
- Gold Shovel Standard Training
- 40 Hour HAZWOPER
- 3 Days OTJ Training
- 8 Hour Annual HAZWOPER Refresher
- Confined Space (Batch Plant Operator)
- Forklift
- Aerial Lift
- OSHA 10 Hr. Construction Industry Outreach

Safety Statistics

YEAR	2021	2020	2019	2018	2017
EMR	0.82	0.746	0.559	0.704	0.669
TOTAL HOURS WORKED	235,853	154,060	248,407	264,264	236,863
AVERAGE NO OF EMPLOYEES	111	85	120	124	119
INCIDENT RATE (TRIR)	1.69	0.00	1.61	0.76	1.69
FREQUENCY RATE (DART)	1.69	0.00	0.81	0.00	0.84
LOST WORKDAYS (LWD)	126	0	23	0	100
DAYS AWAY FROM WORK (DAW)	81	0	23	0	6
FIRST AID ONLY CASES	0	0	2	4	8
MEDICAL TREATMENT CASES	2	0	2	1	2
FATALITIES	0	0	0	0	0
OSHA VIOLATIONS	0	0	0	0	0

Geo-Solutions NAICS code: 562910

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 2021

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	2	0	0
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
81	45
(K)	(L)

Injury and Illness Types

Total number of... (M)			
(1) Injury	2	(4) Poisoning	0
(2) Skin Disorder	0	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	0

Establishment information

Your establishment name Geo-Solutions, Inc.

Street 1250 Fifth Avenue

City New Kensington State PA Zip 15068

Industry description (e.g., Manufacture of motor truck trailers)
Environmental Remediation Services

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
5 6 2 9 1 0

Employment information

Annual average number of employees 111

Total hours worked by all employees last year 235,853

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Rob Winters
Company executive

VP Risk Management
Title

724-335-7273
Phone

01/18/22
Date

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health

Year 2021

U.S. Department of Labor
Occupational Safety and Health Administration

You must record information about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Form approved OMB no. 1218-0176

Establishment name: Geo-Solutions, Inc.

City: New Kensington State: PA

Identify the person				Describe the case		Classify the case											
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
(A) Case No.	(B) Employee's Name	(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death	Days away from work	Remained at work		Away From Work (days)	On job transfer or restriction (days)	(M) Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
								Job transfer or restriction	Other record-able cases								
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
21-01		Batch Plant Operator	4/16/2021	Infront of the PC 800	Struck by hoist cylinder caused neck, shoulder and head injuries		X			16	45	X					
21-02		Laborer	6/8/2021	EZ infront of the Allu tool	Struck by clump of material falling from Allu tool		X			65		X					
					Page totals	***0***	***2***	***0***	***0***	***81***	***45***	***2***	***0***	***0***	***0***	***0***	***0***

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 2020

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	0	0	0
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
0	0
(K)	(L)

Injury and Illness Types

Total number of... (M)			
(1) Injury	0	(4) Poisoning	0
(2) Skin Disorder	0	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	0

Establishment information

Your establishment name Geo-Solutions, Inc.

Street 1250 Fifth Avenue

City New Kensington State PA Zip 15068

Industry description (e.g., Manufacture of motor truck trailers)
Environmental Remediation Services

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)
____ ____ ____ ____

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
5 6 2 9 1 0

Employment information

Annual average number of employees 85

Total hours worked by all employees last year 154,060

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Rob Winters
Company executive

VP Risk Management
Title

724-335-7273
Phone

01/07/21
Date

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 2019

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	1	0	1
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
23	0
(K)	(L)

Injury and Illness Types

Total number of...	(M)		
(1) Injury	2	(4) Poisoning	0
(2) Skin Disorder	0	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	0

Establishment information

Your establishment name: Geo-Solutions, Inc.

Street: 1250 Fifth Avenue

City: New Kensington State: PA Zip: 15068

Industry description (e.g., Manufacture of motor truck trailers)
Environmental Remediation Services

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
5 6 2 9 1 0

Employment information

Annual average number of employees: 120

Total hours worked by all employees last year: 248,407

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Rob Winters
Company executive

VP Risk Management
Title

724-335-7273
Phone

01/01/20
Date

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health

Year 2019

U.S. Department of Labor
Occupational Safety and Health Administration

You must record information about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Form approved OMB no. 1218-0176

Establishment name: Geo-Solutions, Inc.

City: New Kensington State: PA

Identify the person				Describe the case		Classify the case											
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
(A) Case No.	(B) Employee's Name	(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death	Days away from work	Remained at work		Away From Work (days)	On job transfer or restriction (days)	(M) Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
								Job transfer or restriction	Other record-able cases								
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
19-01		Superintendent	6/27/20019	North Plainfield, NJ Gas Works	Fell from drill rig platform, Fractured ribs (Left side)		X			23		X					
19-02		Welder	10/22/2019	New Kensignton, PA Shop	While using compressed air, foreign body entered left eye.				X			X					
					Page totals	***0***	***1***	***0***	***1***	***23***	***0***	***2***	***0***	***0***	***0***	***0***	***0***

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

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Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

Willis Towers Watson

April 8, 2021

Mr. Robert Winters, VP - Risk Management
Geo-Solutions, Inc.
1250 Fifth Avenue
New Kensington, PA 15068

RE: **PA Experience Rating Modification**

Dear Rob:

Based on your company's payroll and loss experience in the Commonwealth of Pennsylvania, we calculated the conceptual Experience Modifications below:

Effective Date: 4/01/2021	.82
Effective Date: 4/01/2020	.746
Effective Date: 4/01/2019	.597
Effective Date: 4/01/2018	.704

Sincerely,

Lisa Scheffler

Lisa Scheffler, CPCU, ARM
Account Executive
Willis Towers Watson Northeast, Inc.
Lisa.Scheffler@willistowerswatson.com
610-260-4336

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 04/02/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Willis Towers Watson Certificate Center	
Willis Towers Watson Northeast, Inc. c/o 26 Century Blvd P.O. Box 305191 Nashville, TN 372305191 USA	PHONE (A/C, No, Ext): 1-877-945-7378	FAX (A/C, No): 1-888-467-2378
	E-MAIL ADDRESS: certificates@willis.com	

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
Geo-Solutions, Inc. 1250 Fifth Avenue; New Kensington, PA 15068	INSURER A : Admiral Insurance Company	24856
	INSURER B : Travelers Property Casualty Company of Ame	25674
	INSURER C : Great American E & S Insurance Company	37532
	INSURER D : Travelers Indemnity Company	25658
	INSURER E : Scottsdale Insurance Company	41297
	INSURER F : Gray Surplus Lines Insurance	15889

COVERAGES **CERTIFICATE NUMBER:** W20625673 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	[X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC [ ] OTHER:			FEI-ECC-11909-08	04/01/2021	04/01/2022	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ $ 5,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
B	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS [X] HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY			TJ-CAP-2H529844-TIL-21	04/01/2021	04/01/2022	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
C	[X] UMBRELLA LIAB [X] OCCUR EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [X] RETENTION $ 10,000			XS E694659	04/01/2021	04/01/2022	EACH OCCURRENCE AGGREGATE	$ 3,000,000 $ 3,000,000
D	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y / N: No If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		UB-2N610045-21-51K	04/01/2021	04/01/2022	[X] PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 1,000,000 $ 1,000,000 $ 1,000,000
E	Business Auto Buffer			XLS0119163	04/01/2021	04/01/2022	Each Occurrence Limit	$4,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Umbrella Policy #XS E694659 is Excess the Employer's Liability coverage.

SEE ATTACHED

CERTIFICATE HOLDER

Evidence of Coverages

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

AGENCY CUSTOMER ID: _____

LOC #: _____

ADDITIONAL REMARKS SCHEDULE

AGENCY		NAMED INSURED
Willis Towers Watson Northeast, Inc.		Geo-Solutions, Inc. 1250 Fifth Avenue; New Kensington, PA 15068
POLICY NUMBER See Page 1		
CARRIER See Page 1	NAIC CODE See Page 1	EFFECTIVE DATE: See Page 1

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance

INSURER AFFORDING COVERAGE: Gray Surplus Lines Insurance NAIC#: 15889
POLICY NUMBER: GSL 100098 EFF DATE: 04/01/2021 EXP DATE: 04/01/2022

TYPE OF INSURANCE:	LIMIT DESCRIPTION:	LIMIT AMOUNT:
Excess Umbrella Liability	Each Occurrence	$5,000,000
	Aggregate	$5,000,000

INSURER AFFORDING COVERAGE: Admiral Insurance Company NAIC#: 24856
POLICY NUMBER: FEI-EXS-11910-08 EFF DATE: 04/01/2021 EXP DATE: 04/01/2022

TYPE OF INSURANCE:	LIMIT DESCRIPTION:	LIMIT AMOUNT:
Excess Liability	Each Occurrence:	$15,000,000
	Aggregate:	$15,000,000
	Retained Limit:	$0

ADDITIONAL REMARKS:
Excess Liability Coverage follows over General Liability, Professional Liability and Pollution Liability Coverage.

INSURER AFFORDING COVERAGE: Admiral Insurance Company NAIC#: 24856
POLICY NUMBER: FEI-ECC-11909-08 EFF DATE: 04/01/2021 EXP DATE: 04/01/2022

TYPE OF INSURANCE:	LIMIT DESCRIPTION:	LIMIT AMOUNT:
Contractors Pollution Liability	Each Claim	$1,000,000
& Professional Liability	Aggregate	$2,000,000

ADDITIONAL REMARKS:
Contractor's Pollution Liability and Professional Liability are included in the General Liability coverage.

INSURER AFFORDING COVERAGE: Travelers Property Casualty Company of America NAIC#: 25674
POLICY NUMBER: QT-660-8P345203 EFF DATE: 04/01/2021 EXP DATE: 04/01/2022

TYPE OF INSURANCE:	LIMIT DESCRIPTION:	LIMIT AMOUNT:
Contractors Equipment	Owned	$14,823,594
	Leased	$2,000,000

ADDITIONAL REMARKS:
All risk coverage including Flood.

SR ID: 20928015 BATCH: 2043806 CERT: W20625673

NorthStar
Proposal and SOQ

NorthStar

2760 South Falkenburg Road
Riverview, Florida 33578
770-335-1101 Phone

March 25, 2022

Mr. Dwayne Keagy, MS, LPG
Principal Consultant – Geologist
ERM
Woodfield Three
8425 Woodfield Crossing Blvd., Suite 560-W
Indianapolis, IN 46240

Re: ERM - Ameren Taylorville, IL MGP
Revised Quote for ISS Bench-Scale Study

Dear Mr. Keagy:

NorthStar I&E, Inc. (NorthStar) is pleased to submit our revised quote for the ISS bench-scale study in support of the Ameren Taylorville, IL MGP site. Below you will find the details regarding our revised quote, followed by the additional information requested in your March 11th and March 22nd emails.

Proposed Treatability Study

NorthStar has reviewed the proposed scope of work for MGP remediation, and has identified the following scope of work necessary to perform the required treatability testing to be able to execute the work with the following assumptions:

- Performance requirements for the site are assumed to be:
  - Unconfined Compressive Strength (UCS) > 50 psi
  - Hydraulic Conductivity < 1E-6 cm/sec
  - There will be no leachability performance requirements for the site, however baseline chemical and post–ISS leachability testing is included in this proposal to demonstrate reductions in leachable concentrations for negotiations with the regulator.

Based on the information provided, NorthStar has assumed that two homogenate soil samples would be collected from the site (by others). Each sample would require at least five gallons of soil sample to perform the required testing. One sample would be collected from the GW table to 50-ft, and from 50-ft to bedrock (assumed max depth of 95-ft). Additionally, at least five gallons of potable water to be used during grout preparation during full-scale would be required. NorthStar will perform the following treatability scope of work:

- Geotechnical index testing on each of the homogenates, including grain-size, moisture content, and Atterberg Limits;
- Perform total VOCs and SVOCs along with SPLP and LEAF 1316 tests on each of the untreated homogenates;
- Develop six mix designs for each sample, using a combination of Type I/II or Type IL Portland cement (PC), blast furnace slag cement (BFSC), site potable water and site soils (12 mixes total);
- Perform 7-day and 28-day UCS (ASTM D1633) testing on each developed mix design;
- Perform 28-day permeability testing (ASTM D5084) on each developed mix design;
- Perform SPLP testing on all 12 mixes from Phase 1;

- Based on the results of the geotechnical and SPLP testing, NorthStar has included refinement stage, which will include up to two additional mix designs for each homogenate. These four mix designs will also be tested for UCS and permeability as described above;
- NorthStar will then perform SPLP and LEAF 1315 (modified for organics) on all four final mix designs (two for each of the homogenates);
- NorthStar will provide test results and summary report for the treatability scope above including identifying viable mix designs that meet the project performance requirements.

NorthStar's geotechnical and analytical labs (Timely Engineering Soil Tests, LLC and Eurofins) are both accredited, and their accreditations have been included in **Attachment 1** of this submittal.

NorthStar estimates the above scope of work to have a lump sum cost of **$52,900** and expects the work to take approximately 12 weeks to complete from receipt of soil materials. NorthStar understands that ERM wants to be a part of the process; however, NorthStar also assumes that we will be compensated for any changes made throughout the process.

Statement of Qualifications

NorthStar is a nationwide environmental remediation, demolition, and civil construction contractor, with one of our primary services being in-situ stabilization (ISS) of impacted soil at MGP sites. NorthStar has implemented numerous projects involving ISS including the recent ISS projects performed for Ameren at former MGP sites in Macomb and Jacksonville, Illinois. We also performed recent ISS projects at the West End site in Cincinnati, Ohio and at a site for Consumers Energy in Manistee, Michigan. As requested, NorthStar has included our Statement of Qualifications (SOQ) in **Attachment 2** of this submittal. Within the appendix of the SOQ, you will find complete project descriptions for the aforementioned projects.

Safety Metrics

NorthStar has an exemplary health and safety program. With an Experience Modification Rate (EMR) of 0.78 for 2021, and several safety statistics well below the averages for our industry, our safety performance is an industry leader. This attention to safety should be most beneficial to this project. To facilitate an easy review, NorthStar has included our three year Experience Modification Rate (EMR) and OSHA safety statistics in the table below.

NorthStar I&E, Inc. 3-year OSHA Statistics

Statistics	2021	2020	2019
EMR (NorthStar Group Services, Inc.)	0.78	0.71	0.90
Man-hours Worked	346,315	354,236	353,341
Lost Workday Case Rate (LWCR)	0	0	0
Total Recordable Incident Rate (TRIR)	0.60	0.60	0
Days Away, Restricted & Transfer (DART)	0	0	0

Certificate of Insurance

NorthStar has provided a sample Certificate of Insurance in **Attachment 3** of this submittal.

Union Labor

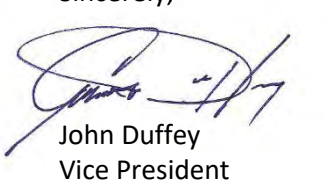
NorthStar has the ability to provide union labor. In fact, both Ameren projects currently under contract (Jacksonville, IL and Macomb, IL) are being performed with union labor.

Avetta

NorthStar I&E, Inc. (ID #134305) is a long time participant of the Avetta program. We've had several clients connect to our Avetta account and award us a "Green" status after reviewing our EMR documentation, Historic OSHA Statistics, Policies and Procedures, Insurance, etc. Therefore, we do not anticipate any issues connecting with ERM and/or Ameren.

NorthStar greatly appreciates the opportunity to submit this proposal, and we look forward to the opportunity to work with you at this site. Should you have any questions, please contact me at jduffey@northstar.com for any and all matters regarding our proposal.

Sincerely,



John Duffey
Vice President

Attachment 1

Geotechnical and Analytical Lab Accreditations

Timely Engineering Soil Tests, LLC (/)

The following is a list of T.E.S.T.'s certifications/accreditations:

- AASHTO (/s/AASHTO_CERTIFICATION_2017.pdf) - T.E.S.T. meets the quality standards of a geotechnical laboratory per ASTM E 329, ASTM D 3740, and AASHTO R18
- Small Disadvantaged Business (SDB) – certified by U.S. SBA
- Licensed Engineering Firm (/s/TEST-Eng-Firm-License.pdf) in Georgia
- GA DOT pre-qualification (/s/GA-DOT-Timely-Engineering-Soil-Test-LLC-08152016-approval-letter-4hw3.pdf) letter for materials testing
- GA DOT approval (/s/GA-DOT-Lab-Material-Testing-Cert.pdf) for class 6.04a Laboratory Materials Testing
- US Army Corp. of Engineers validation (/s/USACE-Validation.pdf)
- Certified Minority Business Enterprise (/s/GA_Minority_Business.pdf) (State of Georgia Department of Administrative Services)

- Georgia State Financing and Investment Commission (Special Inspections, Material Testing, and Geotechnical Services (/s/GSFIC_eligible_firm.pdf))
- USDA Permit (/s/USDA-Permit_P330-15-00197_20150727.pdf) for receiving foreign soil

LOCATION (/LOCATION)

1874 Forge Street
Tucker, GA 30084

CONTACT (/CONTACT)

lev@test-llc.com
+1 678 612 6534

Lancaster Laboratories Environmental

Guide to Certifications

✓ Certification/Accreditation held

● In process

✱ NELAP

† Contact your project manager to confirm matrices offered.

Certifications Offered

- Potable Water (PW)
- Waste Water (WW)
- Solid Waste (SW)
- Dioxins & Furans
- Air & Emissions (A&E)
- Underground Storage Tank (UST)
- Tissue/Biota
- PFAS

Note: Certifications are subject to change

Additional Accreditations

A2LA (0001.01)
American Association for Laboratory Accreditation

DoD ELAP
Department of Defense Environmental Laboratory Accreditation Program

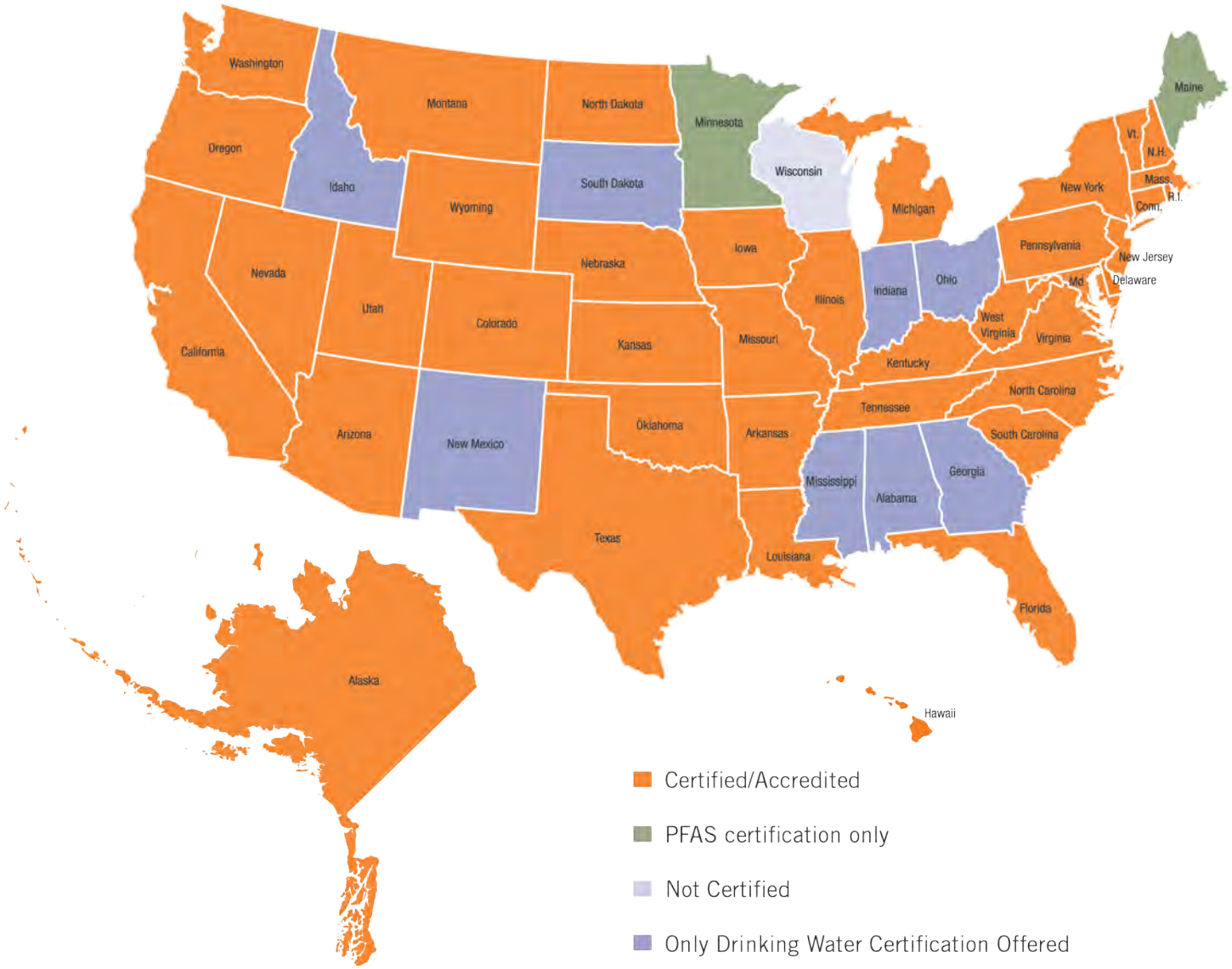
Eurofins Lancaster Laboratories Environmental, LLC

2425 New Holland Pike
Lancaster, PA 17601
717-656-2300

www.EurofinsUS.com/LancLabsEnv

	Potable Water (SDWA)	Waste Water (CWA)	Solid Waste (RCRA)	Dioxins & Furans	Air & Emissions (A&E)	Underground Storage Tank (UST)	Tissue/Biota	PFAS†
Alabama								
Alaska	✓	✓	✓	✓		✓		✓
Arizona				✓				✓
Arkansas		✓	✓	✓				
California	✓	✓	✓	✓				✓
Colorado	✓			✓				
Connecticut	✓	✓	✓	✓				✓
Delaware	Approved							✓
✱ Florida	✓	✓	✓	✓	✓			✓
Georgia								✓
Hawaii	✓			✓				✓
Idaho								
✱ Illinois		✓	✓	✓				
Indiana								
Iowa		✓	✓			✓		
✱ Kansas	✓	✓	✓	✓				✓
Kentucky	✓	✓		✓		✓		
✱ Louisiana		✓	✓	✓	✓		✓	✓
Maine								✓
Maryland	✓			✓				
Massachusetts	✓	✓						✓
Michigan	✓			✓				✓
✱ Minnesota				●				✓
Mississippi								
Missouri	✓							
Montana	✓			✓		✓		✓
Nebraska	✓							✓
Nevada	✓	✓	✓	✓				✓
✱ New Hampshire	✓	✓	✓					✓
✱ New Jersey	✓	✓	✓	✓	✓		✓	✓
New Mexico								
✱ New York	✓	✓	✓	✓	✓			✓
North Carolina	✓	✓	✓					
North Dakota	✓	✓	✓	✓				✓
Ohio								
✱ Oklahoma		✓	✓	✓				
✱ Oregon		✓	✓	✓	✓			✓
✱ Pennsylvania	✓	✓	✓	✓				✓
Rhode Island	✓	✓						✓
South Carolina		✓	✓	✓				
South Dakota								
Tennessee	✓			✓				
✱ Texas	✓	✓	✓	✓	✓		✓	
✱ Utah	✓	✓	✓	✓				✓
Vermont	✓							✓
✱ Virginia	✓	✓	✓	✓	✓			
Washington	✓	✓	✓	✓	✓			✓
West Virginia	✓	✓	✓	✓				✓
Wisconsin								
Wyoming	✓			✓		✓		

9044 1020



Standard Services:

Volatiles
Semivolatiles
Metals
Pesticides/PCBs/Herbicides
Petroleum-Related Analysis
Waste Characterization
Water Quality
Drinking Water
Vapor & Air Analysis
Sediment & Tissue Testing
Method Development
Shale Oil & Gas Analysis

www.EurofinsUS.com/LancLabsEnv

Specialty Services:

Dioxins/Furans
PCB Congeners
Hydrazines/NDMA
Explosives
Perchlorate
Alkyl PAHs, Alkanes, Biomarkers
PFC (PFOA)
Organic Acids
Aldehydes
1,4-Dioxane (low level)
Low-Level Mercury
PMI
Method 25D

Eurofins Lancaster
Laboratories Environmental, LLC
2425 New Holland Pike
Lancaster, PA 17601
717-656-2300

24/7 Emergency Response
717-415-1734

Attachment 2

Statement of Qualifications

STATEMENT OF QUALIFICATIONS

Sanford, Florida MGP Site, 140,000 cy of In-situ Soil Mixing using two Large Diameter Augers

NorthStar

Manufactured Gas Plant/Soil Mixing Sites

www.NorthStar.com

TABLE OF CONTENTS

Manufactured Gas Plant Sites SOQ

NorthStar

1. INTRODUCTION

1.1 General Company Information

Company Information	
Company Name:	NorthStar I&E, Inc.
Corporate Street Address:	2760 South Falkenburg Road
City:	Riverview
State:	Florida, 33578
Telephone:	813-684-4400
Website:	www.northstar.com
Primary Contact Information	
Primary Contact Name:	John H. Duffey
Title/Position	Vice President/Account Manager
Telephone:	770.335.1101
Email:	jduffey@northstar.com
Address:	885 John Ct. Lawrenceville, GA 30046
Business Information	
Nature of Business:	Environmental Remediation
Ownership (LLC, corporation, etc.):	Corporation
Industry Status:	ENR No. 1 for Demolition ENR No. 1 for Asbestos Abatement
Years in Business:	26 years
Personnel:	170 (NorthStar I&E, Inc.) 2,500 (NorthStar Group Services – parent)
Offices:	28
Owned Equipment:	$80,000,000
EMR Rating:	0.78 (2021 – 2022)
Parent Company (if any):	NorthStar Group Services, Inc.
Affiliates (if any):	**NorthStar Contracting Group, Inc.** (ID# 13-3414537) **LVI Environmental Services of New Orleans, Inc.** (ID# 72-1241673) **NorthStar Contracting Group, Inc.** (ID# 13-3466162) **NorthStar Contracting Group, Inc.** (ID# 13-3897850) **NorthStar Demolition and Remediation, Inc.** (ID# 22-2664340) **NorthStar Facility and Site Services, Inc.** (ID# 13-3405168) **NorthStar Contracting Group, Inc.** (ID# 13-3879343) **NorthStar Contracting Group, Inc.** (ID# 26-0153510) **NorthStar Contracting Group, Inc**. (ID# 13/3877881) **LVI Environmental Services Inc.** (ID# 13-3877879) **LVI Facility Services Inc.** (ID# 13-3949918) **NorthStar Demolition and Remediation, Inc.** (ID# 13-3877877) **TEG/LVI Environmental Services Inc.** (ID# 13-3974024) **NorthStar Recovery Services Inc.** (ID# 26-2165151) **NorthStar Federal Services, Inc.** (ID # 91-1310640) **NorthStar Contracting Group GP, LLC** (ID # 20-4890832)

	NorthStar Decommissioning Holdings, LLC (ID # 81-4742531) **NorthStar Nuclear Decommissioning Company, LLC** (ID # 81-4540179) **NorthStar CG, LP** (ID# 20-4890773) **NorthStar Demolition and Remediation GP, LLC** (ID # 26-1265746) **NorthStar Demolition and Remediation, LP** (ID # 26-1400552) **NorthStar Vermont Yankee, LLC** (ID# 58-2507604) **Heneghan Wrecking & Excavating Co, Inc.** (ID# 36-2761603) **Patrick's Equipment Leasing, Inc.** (ID# 36-2605374)	
Subsidiaries (if any):	None	
Corporate Management Information		
List of Company's Controlling Personnel	Timothy Furiate Brent Anderson Gregory G. DiCarlo Jeffrey P. Adix Gary Thibodeaux Kamal Sookram	President Vice President/Operations Vice President/Secretary Vice President/Treasurer Vice President/H&S Vice President/HR

1.2 Why NorthStar?

- #1 Specialty Contractor in the U.S. since 1999 by Engineering News Record (ENR)
- Excellent safety record for over 26 years
- Self-performance of all projects
- National Reach and Local Presence
- Top Industry Rankings in Demolition, Abatement, and ISS
- Various Service Offerings
- Solid Financial Strength, Bonding, and Insurance
- World Class Health & Safety Program
- Corporate Commitment and Involvement
- Largest fleet of equipment in the industry
- Licensed in all 50 states
- Bonding capacity in excess of $300 Million and specialized Environmental Insurance
- No cost, complimentary pre-loss assessments
- Financial strength to support projects large and small
- Experienced management & staff
- Cost-effective, on-schedule performance
- Post-loss management recovery planning
- 28 offices and over 100 response locations nationwide, allowing us to be on the ground within hours
- Account Management Program
- Response logistics in place before a disaster strikes

1.3 Statement of Qualifications

NorthStar Group Services, Inc. (NorthStar) is the result of a 2014 merger between the nation's two largest abatement and demolition companies, LVI Services Inc. (LVI) and NCM Group Holdings, LLC (NCM). Over the last 10 years, LVI has been the Engineering News Record (ENR) #1 rated largest abatement and demolition company, and NCM has been the #2 demolition company. NorthStar's service offerings and capabilities are unparalleled in this market sector, with annual revenues of nearly $775 million and over $300 million in bonding capacity. In October 2014, NorthStar purchased the assets of WRS Infrastructure & Environmental, Inc. The acquisition of WRS expands NorthStar's environmental remediation and civil construction capabilities.

In response to a national need for the remediation, restoration, and reuse of properties for Manufactured Gas Plants (MGPs), NorthStar placed our focus on this industry sector and has provided our services for over 28 years. Because we possess all of the core technologies required to successfully remediate MGP sites, we are in a unique position to offer our clients a complete turn-key restoration of the property and natural resources impacted at these old facilities.

Many MGP sites are located along bodies of water and are now surrounded by residential and urban developments. Our experienced project managers and site superintendents know how to complete all required work safely, while respecting the special needs of the local habitats and communities. We are experts at maintaining environmental controls, including but not limited to noise reduction, noxious odor control, stormwater management, dust migration, traffic safety, security, and public relations.

NorthStar offers a broad range of experience in the remediation and reuse of former MGP sites. NorthStar has experience in the following services and technologies for MGP projects, large or small.

Excavation and Off-Site Disposal

Excavation and/or earthmoving activities are typically performed at MGP sites. NorthStar typically excavates contaminated materials using standard earthmoving equipment, such as trackhoes and front-end loaders. Upon characterization, excavated materials can subsequently be treated on-site or disposed off-site at an appropriate disposal facility. NorthStar has performed excavation activities ranging from several thousand to several hundred thousand tons.

Ex-situ Soil Stabilization

Ex-situ soil stabilization is typically accomplished using a pugmill mixing device, though smaller projects can be completed using hydraulic excavators (i.e., mixing with an excavator bucket). Organic, inorganic, and metal-contaminated soil is excavated and processed through a dual-shaft pugmill to mix the soil completely with the selected stabilization or solidification reagents. Reagents, such as Portland cement, are metered into the pugmill at the desired rate to achieve stabilization of the impacted materials. Production rates using a pugmill often approach 200 tons per hour.

In-situ Soil Stabilization

NorthStar also has the capability to conduct in-situ soil improvements via various techniques, including auger mixing, conventional excavator, patented rake injectors, and high-speed rotating mixing devices. The characteristics of each project are reviewed to determine the most effective method of treatment.

Large-Diameter Single-Auger Mixing

In-situ auger mixing, or deep soil mixing (DSM), utilizes a crane-mounted turntable that rotates a mixing auger system to drill into affected soil and uniformly mix the soil with cement-based grout or other additives. A crane-mounted turntable or truck-mounted drill rotates a 4 to 12-foot-diameter auger to treat soil, sludge, and/or groundwater to 90-foot depths. Liquid reagents, hot air, steam, or other treatment media are injected through the rig's Kelly bar. Upon mixing completion, an in-situ column of treated soil and/or groundwater is created.

Excavator-Mounted Soil Mixing

Conventional excavators can also be used to mix soils, sludge, sediments, and other wastes in-situ. Soil strengthening reagents can be injected while the excavator bucket is used to loosen and mix the material in-place, without removing it. Similar results for stabilization of shallow soil can be achieved through the use of "fork" and "rake" attachments or high-speed rotating mixing devices fitted to conventional excavators and

bulldozers, respectively, to achieve impacted material stabilization. This technology effectively solidifies shallow soft sediment, sludge, or soil.

Low-Temperature Thermal Desorption

NorthStar has provided on-site thermal treatment of hazardous wastes since 1988. During this period of time, NorthStar has successfully remediated over 620,000 tons of contaminated soil and sludge at 19 sites. Contaminants remediated include VOCs, SVOCs, PCBs, pesticides, PAHs, and dioxins.

Achieving In-situ Performance Criteria

On all our soil stabilization projects, NorthStar meets or exceeds the performance criteria. Typical performance criteria for soil stabilization projects include 50 psi unconfined compressive strength (UCS), 1x10-6 cm/s permeability, and leachability.

Quality control samples of the treated material are obtained to verify that the performance criteria are met. These samples, collected from the location and depth specified by the client or their oversight engineer, are placed into appropriate right cylinder molds, cured for up to 28 days, and tested in 3rd party geotechnical and/or analytical laboratories. Should the QC samples indicate that the performance criteria are not met, NorthStar will retreat, at our cost, the material represented by these samples. QC samples from the retreated material will be obtained and retested. Retreatment will continue until NorthStar demonstrates compliance with the performance criteria.

NorthStar has over 3 decades of experience performing remediation at MGP sites. To date, we have completed, or are currently performing, environmental remediation on over 50 MGP sites. The table below shows sites completed within a variety of dollar ranges for 30 of our completed sites.

Project Name/State	Project $ Value
$1 million to $2.5 million	
Delmarva Power, Wilmington Coal Gas MGP site/DE	$1.5 million
Georgia Power, Americus MGP site/GA	$1.7 million
Unitil Former MGP Site, Portland, ME	$1.9 million
New Jersey Natural Gas, Long Branch MGP site/NJ	$2.0 million
Central Maine Power, Waterville Gas Works/ME	$2.1 million
Central Hudson Gas & Electric MGP/NY	$2.4 million
West Side and Racine MGP sites/WI	$2.5 million
$2.5 million to $5 million	
WE Energies, Appleton MGP site/WI	$2.7 million
Harbor Point MGP site/NY	$3.8 million
New York State Electric & Gas, Elmira MGP site/NY	$4.1 million
New York State Electric & Gas, Norwich MGP site/NY	$4.4 million
Macon MGP Site/GA	$4.4 million
Delmarva Power, Wilmington Coal Gas MGP site/DE	$5.0 million
$5 million to $10 million	
Brooklyn Commons BNG site/NY	$5.4 million
Georgia Power Athens Uplands/GA	$5.5 million
New Jersey Natural Gas, Long Branch MGP site/NJ	$5.5 million
Brooklyn Union Gas, Columbus MGP FCRC/	$6 million
Public Service Electric & Gas Paulsboro MGP site/NJ	$6.1 million

Project Name/State	Project $ Value
Georgia Power Athens Riverbank/GA	$7.7 million
Abilene MGP/KS (in progress)	$7.7 million
Cambridge Creek MGP site/MD	$8.1 million
Augusta MGP site, Off-sites/GA	$8.2 million
Former Kinston MGP Site, Kinston, NC	$8.3 million
Augusta MGP site, Northern Parcel/GA	$9.0 million
Consumers Energy Manistee/MI	$9.3 million
Georgia Power, Columbus MGP site/GA	$9.6 million
Public Service Electric & Gas, Camden MGP site/NJ	$9.7 million
>$10 million	
Cascades Park MGP Site/FL	$10 million
Consumers Manistee MGP/MI	$10 million
Ameren, Jacksonville MGP site/IL (in progress)	$11 million
West End Gas Works, Cincinnati, OH	$13 million
Ameren, Macomb MGP site/IL	$13 million
Sanford MGP site/FL	$14 million
Georgia Power, Waycross Canal/GA	$15 million
Saratoga Springs MGP site/NY	$16.3 million
Georgia Power, Network Underground/GA	$16.3 million
Augusta MGP/GA	$45.0 million

2. HEALTH & SAFETY

NorthStar embraces and incorporates the concepts of a behavior-based health and safety program into our corporate program and safety culture. We recognize that excellence in accident prevention requires "beyond compliance" vision and action, and incorporates changing or bettering behaviors. We have utilized and integrated the Loss Prevention System (LPS) and Hazard Recognition Plus System by Decision Point Associates to enhance and continuously improve our program.

NorthStar utilizes a Safety Management System to achieve excellence in workplace safety that incorporates operational and administrative elements with behavior-based and cultural factors. The NorthStar program closely resembles the system advocated by the National Safety Council (NSC). The nine elements of the system include:

- Management leadership and commitment
- Organizational accountability, communications, and system documentation
- Assessments, audits, evaluations, and continuous improvement
- Hazard recognition, evaluation, and control
- Project planning
- Operational safety programs
- Employee involvement
- Motivation, behavior, and attitude
- Training and orientation

2.1 Safety/Health Professionals

NorthStar has a comprehensive health and safety program aimed at providing a safe working environment for our employees, promoting safe work practices, and ensuring appropriate health monitoring for employees engaged in work at all work sites. This plan is administered by our staff Certified Industrial Hygienist who has over 20 years of experience in industrial hygiene.

2.2 NorthStar's Accident Prevention Behavior Based System

We define our culture of excellence in accident prevention as the sum of our behaviors. Many of our accident prevention tools focus on behavior modification. We measure the use of these tools and provide incentives to increase safe behaviors at all levels in the company. Accident prevention tools include the following:

- Employee participation in Daily Safety Meetings
- Job Safety Observation (supervisor-employee, peer-peer)
- Self-auditing for safety
- Reporting near misses
- Accident investigation
- Planned safety contacts
- Job/Task Safety Analysis with employee participation

Design of our tools has been informed by the following:

- Decision Point Hazard Recognition Plus System
- Loss Prevention System (LPS)
- International Loss Control Institute (also known as "Bureau Veritas")

- Operation Zero
- Supervisor Training in Accident Reduction Techniques (S.T.A.R.T.)
- National Safety Council's Accident Prevention Manual

A key component of our health and safety program is support and participation at all staff levels, including corporate management. The success of a project is not just measured by profit/loss statements: it is measured equally by project safety, quality, and productivity.

Our health and safety program is compliant with all OSHA and U.S. EPA regulations; our Health and Safety Manual is the framework for site-specific health and safety plans (SSHASP) for hundreds of construction, demolition, decommissioning, and environmental-remediation projects company-wide.

2.3 Site-Specific Health and Safety Plans

NorthStar develops SSHASPs for each project. All plans incorporate our corporate health and safety policies and procedures combined with our clients' requirements. We also develop a program-level SSHASP, using SSHASP addenda for individual tasks. We utilize the lessons learned and experience obtained from field-proven plans.

2.4 Daily Safety Meetings

We hold daily safety meetings at each project site to assess any physical or chemical hazards, equipment, and necessary personal protection needed during the work day. Our project superintendents conduct the meetings with direct guidance from the health and safety manager. The daily safety meetings ensure that our personnel are in compliance with state and federal regulations as well as NorthStar's safety guidelines.

2.5 Job Safety Audits and Inspections

To ensure that all health and safety procedures and guidelines are followed, NorthStar performs periodic job safety audits and inspections for each project.

The site management team conducts weekly inspections to look for any deficiencies at the project and to make required corrections. The corporate safety department conducts comprehensive project audits and works with the project management team to check for any safety concerns and determine appropriate corrective actions.

2.6 Continuous Training

NorthStar understands that training is essential for our personnel, subcontractors, and vendors to work safely and efficiently on site. We are committed to continuous health and safety training and provide classes for our personnel focusing on workplace hazards, safety practices, regulatory requirements, company policies, and proper use of equipment; the components of a job that ensure tasks are completed safely and efficiently on project sites.

2.7 Outstanding Safety Record

For the last 10 consecutive years, the National Safety Council has recognized NorthStar for having a Lost Time Incident Rate that is less than half the industry average. This demonstrates our commitment to a safe and healthy workplace for our employees, clients, and subcontractors. Please see below for our EMR ratings for the past five years:

Policy Year	EMR	TRIR	DART	LTIR
NorthStar I&E, Inc.				
2021	0.78	0.60	0.00	0.00
2020	0.71	0.60	0.00	0.00
2019	0.90	0.00	0.00	0.00
2018	0.87	0.00	0.00	0.00
2017	0.71	0.60	0.60	0.00
2016	0.69	0.00	0.00	0.00
2015	0.69	0.00	0.00	0.00

TRIR = Total Recordable Incident Rate
DART = Days Away, Restricted, and Transferred Rate
LTIR = Lost Time Incident Rate

3. Cost and Schedule Control

NorthStar has the experienced staff and systems in place to manage all aspects of financial information to maintain the fiscal integrity of every project; control, analyze, reconcile, and estimate costs using established policies and procedures; continuously track and report the integrated project scope, budget, and schedule; and use project management tools to model, develop, and implement corrective actions.

NorthStar key features to track schedules:

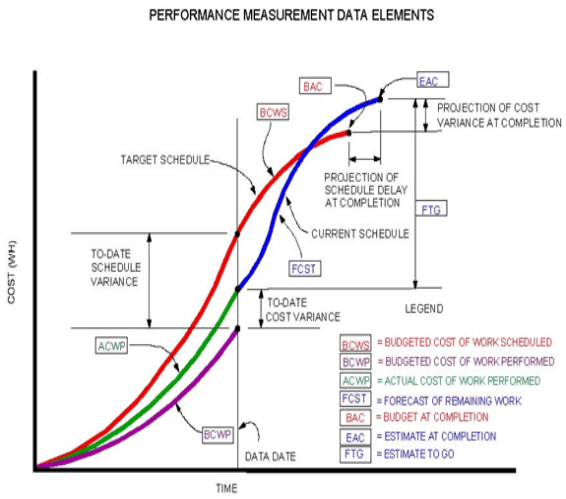
- Project Initiation
- Project Controls
- Project Closeout

Resulting in proven procedures for:

- Planning
- Estimating/Budgeting
- Schedule Tracking
- Communicating
- Controlling

The NorthStar Management Information System (MIS) provides the framework to accumulate project cost and schedule data. We create a detailed Work Breakdown Structure (WBS) commensurate with project size and complexity, closely monitor project performance, manage costs, report progress, and implement and track any necessary corrective actions. We use a variety of software tools to model, evaluate, track, and present cost, schedule, and resource data including Gantt charts, CPM diagrams, logic diagrams, resource/cost curves, and resource leveling.

For each project, NorthStar maintains an up-to-date database of actual costs from the Work Plan/Cost Estimate through project close out. It is a NorthStar corporate policy that all costs are tracked and recorded daily. We use our computerized cost system to accumulate and track costs, and we assure cost data control through a single point of data entry and multiple reviews for accuracy and compliance. On-site Project Accountants may be assigned to track costs directly in the field.



Our Project Managers will take quick action to communicate and correct problems that could lead to cost or schedule overruns. The cost and time to complete each work assignment will be monitored after 30%, 60%, and 80% of the project budget has been used. If the cost to complete is higher than the remaining budget, or if a schedule overrun is predicted, the PM will use the MIS to identify the source(s) of the potential overruns and take corrective actions, such as:

- evaluate individual tasks to determine if multi-tasking can be used to remain on schedule
- assign additional personnel to shorten the duration of remaining tasks
- determine if tasks can be accomplished more efficiently if conducted in a different manner
- change the labor category mix, while not compromising the performance of assignments
- conduct cost and status reporting

The NorthStar MIS will provide the budgeting/accounting reports and performance submittals required by this contract and the internal reports required by NorthStar to effectively manage each project. The MIS enables integration of all project data to produce the following budgeting and accounting reports. These reports are an

invaluable tool for communication of project status to our clients, supplementing regular verbal communications.

- **Daily Reports:** Summary of work in progress/completed, equipment used, waste manifests, etc. used to track productivity
- **Weekly:** Summary of work accomplished during the reporting week and cumulative to date; includes a network diagram of the baseline and current schedule, work to be performed in the following week, QC data, and any other pertinent logs or documents
- **Biweekly:** Cost Performance Report (CPR) comparing cumulative actual to planned performance at the appropriate WBS level, and a project or WBS level graph showing cumulative budget and actual curves. The report includes a discussion of cost and schedule variances, their causes, and corrective actions to mitigate their impact.
- **Monthly:** Performance report includes a discussion of the project and work accomplished during the reporting period, supported by a network diagram of the project schedule. Actuals, budget, and earned value by WBS reporting level with variance calculations are provided.

NorthStar generally proposes to use web-based cost and schedule reporting. Web based reporting of cost and schedule will enable NorthStar Project Managers to update project schedules on a moment's notice, track real-time project costs, and keep our Clients informed with the most up-to-date costs and schedule information for projects worldwide.

4. QUALITY CONTROL

NorthStar is committed to performing all MGP Site Remediation work at the highest levels of quality. Our procedures for meeting this objective are detailed in the NorthStar QAP, which was developed specifically to support the construction and chemical QC requirements of our remediation/construction contracts. After award of a contract, NorthStar will prepare a QPP, based on our corporate QAP, for the Client's review and approval.

QA encompasses every NorthStar employee, team member, and subcontractor throughout all project-related activities. NorthStar will implement a well-organized program and project team to ensure that work is effectively managed and produces consistently high quality results. The NorthStar program management team will ensure that QA/QC activities take place at all levels in the program organization and that all personnel associated with projects and the program have a high level of quality awareness and commitment.

Implementation of the QAP involves two levels of quality management or control over all projects: the site or project level and the program level. At the project level, quality standards, methods, and procedures are dictated by the project-specific Program QAP, Sampling and Analysis Plan (SAP), Health and Safety Plan (HSP), and Construction Quality Plan (CQP). The primary responsibility for on-site or project-level QC rests with the Project Manager. On larger or more complex projects, a QC Coordinator (QCC) may be assigned to support the project team in both chemical QC and construction QC. The PM or QCC has the front-line responsibility for ensuring that all work performed by each individual on the job on a daily basis complies with the WP, schedule, Client specifications and requirements, and the QPP.

The Program QA/QC Manager provides QA oversight at the program level. He oversees the activities of site-specific QCCs and also performs the audit function mandated within NorthStar to review project quality compliance. Any discrepancies or problems with quality management or compliance are immediately brought to the attention of project management and elevated up the chain-of-command as necessary for swift resolution. Quality issues and planned corrections will also be communicated to the Client in a clear and timely manner.

5. PROJECT PLANNING

NorthStar believes that proper planning is critical to successful project execution and is best accomplished through effective partnering with all members of the project team. The project team typically consists of the customer, regulatory authorities (if appropriate), NorthStar, NorthStar Team Partners, selected NorthStar subcontractors, and other customer-designated entities. We are strong advocates of all parties becoming involved early in the planning process. This provides everyone with a clear understanding of the overall project plan and mutually agreed upon objectives prior to implementation. Responsibilities are clearly defined, as well as lines of communication and problem resolution procedures. This planning promotes a cohesive team during project execution.

The NorthStar planning process generally addresses the following:

- project scope and schedule
- resource allocation
- schedule and cost controls
- procurement procedures
- regulatory compliance
- partner responsibilities
- health and safety policies and procedures
- reporting and communication requirements

NorthStar advocates for a formal partnering approach to project execution which, while not altering contractual agreements and obligations, brings together all project stakeholders with the goal of fostering a cooperative "win-win" working environment. This approach ensures that all stakeholders know each other personally and have the opportunity to have their views heard and acted upon. The goals of this approach are to:

- establish teamwork
- identify team goals
- open lines of communication
- allow early identification of issues and expedite cooperative resolution
- foster trust and cooperation

6. COST ESTIMATING

The NorthStar estimating system combines the best qualities of engineering and heavy construction estimating systems. Our system produces cost estimates organized by the standard NorthStar Statement of Work (SOW). We can easily reorganize tasks into any SOW defined by the customer or project specifications.

NorthStar reviews every task and activity of a project for work scope, resource needs, regulatory compliance, and schedule requirements. The NorthStar estimating system provides the following primary outputs for project planning, review, and ongoing tracking:

- total costs, component costs, and unit costs
- project or task schedules of several varieties, including CPM schedules and reports
- material and resource lists, submittal lists, and schedules
- analysis reports for review, comment, and approval

The flexible NorthStar estimating system can generate any format of client-requested reports, such as schedules, schedules of values, submittal reports, and cash flow projections.

FORMER KINSTON MGP SITE

CLIENT CONFIDENTIAL /Silar Services

LOCATION Kinston, NC

VALUE $6 M

SAFETY Zero OSHA Recordables

In-Situ Stabilization

NorthStar was retained by a major southeastern power producer to remediate a former Manufactured Gas Plant Site in Kinston, North Carolina. To facilitate the removal of ~2,400 CY of MGP impacted sediments, NorthStar constructed a 300' by 100' by 100' coffer dam within the Neuse River. NorthStar worked off modular barges using an environmental clamshell bucket to dredge the sediments. The sediments were dewatered on top of the barge. Sediments were then excavated from the transport barge and loaded onto articulating dump trucks for the nearly ½ mile trip to the sediment mixing area.

The upland MGP impacted soils and sediments were then blended with Portland cement and slag reagent add mix and stabilized to an average depth of 18-22 feet BGS at >50 psi unconfined compressive strength and 1x10 to the minus 7 permeability was achieved through the stabilization process. Once all of the 62,000 CY of soils/sediments achieved the desired performance criteria the site was capped with an evapotranspiration cap and vegetative cover was installed.

FORMER PORTLAND GAS WORKS SITE

CLIENT Unitil Service Corporation

LOCATION Portland, ME

VALUE $1.9 M

SAFETY Zero OSHA Recordables

In-Situ Stabilization (ISS) and Sediment Removal

NorthStar performed this remediation project at a former Manufactured Gas Plant (MGP) site (ISS) project located in Portland, Maine. The scope of services consisted primarily of removing over 2,000 cubic yards (cy) of impacted sediment from the Fore River. The work area extended roughly 50 feet from the shore and was required to be performed in the wet, while working from the landside. This necessitated the installation of a heavy section modulus steel sheetpile wall with grouted joints at the shoreline and the use of a long-reach excavator to remove impacted sediment furthest from the shoreline while working from the land side of the sheetpile wall.

Site preparation included removing existing fence and installing temporary fence and gates to secure the site, installing erosion controls, removing an underground storage tank, setting up a support zone and contamination reduction zone, installing temporary access roads, constructing a lined sediment dewatering and stockpiling area, demolishing a wooden pier, abandoning existing monitoring wells and installing new piezometers, pre-trenching along the sheeting alignment to identify and remove any near-surface obstructions, and removing portions of a granite vlock wall along the shoreline. To facilitate the flow of subsequent remediation work, NorthStar performed waste characterization sampling and analysis using a small boat and sampling tools to collect samples of the impacted sediment and obtain disposal approval in advance of the work.

The specified vertical barrier wall was installed along the shore of the Fore Rover. This included a combination of AZ-19-700 and AZ-50 sheets installed to depths up to 55 feet using a vibratory hammer. The interlocks of the AZ-50 sheets were retrofitted by welding a 25-foot long piece of angle iron, with the resulting interlock area filled with grout. Once the sheeting was installed, weep holes were cut at the specified depth and every 25 feet along the shoreline.

Sediment was removed from the Fore River to the specified horizontal and vertical limits using a combination of a long-reach excavator and a standard excavator. The material was excavated and piled near the shoreline during periods of low tides as the portion of the work area nearest to the shoreline was free of standing water during low tide. The material was permitted to gravity drain, then was transferred to the staging area for moisture conditioning by mixing Portland cement with the sediment, then loaded-out for disposal. During periods of high tide, the material was gravity drained in a lined area established by NorthStar on the landside of the sheeting wall.

The sediment removal work area was backfilled with a variety of materials specified in the design. This included creating formwork to install AquaBlok on the water side of the sheetpile wall as well as installation of layers of various size crushed stone and riprap at the prescribed locations.

Site restoration included restoration of a portion of the granite block wall removed during site preparation, removal and disposal of the sediment dewatering and stockpile area construction materials, installation of topsoil and seeding in disturbed upland areas, removal of temporary facilities installed to perform the work, and replacement of the original fence and gates.

SANFORD MGP SITE

CLIENT Progress Energy

LOCATION Sanford, FL

VALUE $14 M

SAFETY Zero OSHA Recordables

In-situ stabilization (ISS)

The manufactured gas plant (MGP) remediation area included the location of the former Sanford Gasification Plant, which was located south of Sixth Street. A number of properties downstream from the site, and immediately adjacent to Cloud Branch Creek, were affected by the pilot test and remediation activities (mixed usage-zoned properties). Cloud Branch Creek, which traversed the remediation work areas, discharged to Lake Monroe past the confluence of Mill Creek located at the northern limit of OU3.

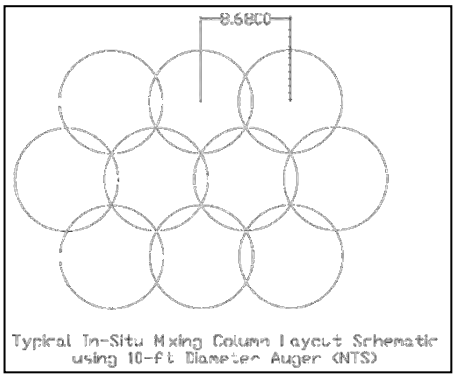
Soil remedial activities completed at the Sanford site included the demolition of three abandoned structures, excavation of the first two feet (20,000 cubic yards) of unsaturated soils, ISS of 125,000 cubic yards of saturated soil, extensive utility relocation and major improvements to Cloud Branch Creek. To improve Cloud Branch Creek, we installed nearly 1,000 feet of 7 feet x 7 feet and 11 feet x 7 feet culverts, realigned the creek, and completed 450 feet of open channel improvements to the creek located in OU3 North and terminating at the confluence of Mill Creek.

The ISS operations within the site were conducted using a 4000-series Manitowoc crane equipped with an attached Hain Platform. The crane/platform assembly was supplemented with a swivel-mounted, top-feeding Kelly Bar capable of reaching a depth of 75 feet below ground surface. Augers were attached to the bottom of the Kelly Bar. This project utilized a 10- and 12-foot auger.

The appropriate amount of water was metered into an initial 5 cubic yard batch tank equipped with a high-speed, high-shear mixer. Reagents (Portland cement and ground granulated blast furnace slag) were transferred from the silos to the batch tank using the internal screw conveyor to deliver the specified volume of reagent. Water was added to the mix tank first and the volume of water was recorded. NorthStar periodically tested each batch being prepared using a mud balance to ensure the proper mix design was met. The batch number, volume of water used, and the weight of each reagent added were recorded on a Grout Log by the batch plant operator. When the correct grout composition was achieved, the blended grout was transferred to the auger.

The batch plant was also equipped with a second storage tank, which offered temporary storage of a blended batch to allow uninterrupted production of batches. A high-speed mixer was used in the second tank to ensure the blended batch did not separate. The pre-determined grout volume was pumped to the treatment area based on the soil density, reagent admixture ratio, and the work area dimensions (i.e. column diameter or panel

dimensions). ISS treatment was performed in a series of overlapping columns as per the schematic to the right. Columns along the perimeter of the ISS area had a 1-foot overlap in the area known as the triple treatment triangle, while the interior columns had a neat-line overlap.



Typical In-Situ Mixing Column Layout Schematic using 10-ft Diameter Auger (NTS)

NorthStar used a TOPCON 3000-Series Total Survey Station during ISS operations. This instrument ensured proper column overlaps, column location, vertical extent of treatment, and the rate of advancement of the tool. Using the pre-determined column locations, NorthStar placed stakes at the center point of each column slated for treatment for the day's production. The crane operator set the auger tip directly over the center stake to ensure the proper location. Prior to the initiation of the drilling operations, ISS personnel verified the key parameters for the column (i.e. total anticipated depth, grout volume needed, etc.). This information was recorded in the ISS Master QA/QC Log.

Grout plant personnel were in constant radio contact with the crane operator and QC personnel to ensure proper grout volumes were dispensed and incorporated into each column. NorthStar's Quality Control Officer (QCO) communicated with the operator to verify that the Kelly bar was plum at the start of each column. The QCO verified vertical depth by surveying the elevation of the top of the Kelly bar (known length) when the auger was at the top of the mixing area and at the bottom of mixing area. When the terminating depth was reached and the overall grout volume for the column injected, the auger was extracted and reintroduced to the same column to complete three mixing passes per column to achieve a homogeneous mixture.

In-situ treated material sampling was performed utilizing NorthStar's in-situ sampler. Upon the completion of the ISS column slated for sampling, the in-situ sampler was lifted by the excavator and advanced to the vertical midpoint of the column. Once the in-situ sampler reached the sampling depth, the sampling chamber was opened using a hydraulic actuator. The sample then entered the sampling chamber. Once the chamber was filled, it was hydraulically closed and the in-situ sampler was retrieved.

NorthStar's ISS Swell Management Plan was to incorporate the swell into the site's final contours and grades. To the extent practical, all ISS swell was managed on-site and within the ISS treatment limits. NorthStar graded the ISS to the site's final contours and grades before the ISS treated material started to set. This allowed for on-going determination as to whether or not all of the ISS swell could be managed on-site and within the ISS treatment limits.

NORWICH FORMER MGP SITE

CLIENT New York State Electric & Gas (NYSEG)

LOCATION Norwich, NY

VALUE $4.4 M

SAFETY Zero OSHA Recordables

In-Situ Stabilization (ISS)

NorthStar performed this in-situ stabilization (ISS) project for NYSEG at the Norwich Former MGP Site located in Norwich, New York. The scope of services consisted primarily of ISS treatment of 52,000 cubic yards (CY) of soils using an auger mixing method, with other activities necessary to prepare for ISS work and to restore the site. The site was adjacent to an active shopping that remained open during remediation, thus the work was highly visible to the public.

Site preparation included abandoning monitoring wells located in the work area, performing a detailed utility location survey, exposing and retiring known gas mains in the work area, installing erosion controls, removing the existing perimeter fence where necessary and installing temporary fence with privacy screen around the site perimeter, setting up a support zone and contamination reduction zone, and establishing a stockpiling area.

The site was pre-excavated in preparation for ISS work such that the treated material would be at least 4 feet below the final grade as required by the NYSDEC. This included the removal of asphalt pavement and concrete slabs, removing of over 6,000 CY of expectedly non-impacted soil, and removal and off-site disposal of known hot spots of impacted soil. The soil that was potentially non-impacted was transported to a stockpiling site several miles from the site and at another property owned by the client, where it was sampled and verified to either be suitable for reuse as backfill material at the site or disposed of off-site.

ISS was performed using a 10-foot diameter auger. A grout plant was set up and the required reagent admixture was produced on-site then conveyed to the auger rig, where it was added on a per weight basis using a pre-determined mix design of 8% by weight for Portland cement and 1% by weight for bentonite. As the work progressed, the reagent admixture was refined to reduce the amount of bentonite required as the bentonite addition rate was hampering the ability to productively complete the work under adverse winter weather conditions. ISS was first performed at a 10-foot-wide perimeter that was keyed 4 feet into the clay layer, followed by the interior ISS keyed 2 feet into the clay layer.

Once ISS was completed, the site was backfilled to the required elevations. Suitable excavated and stockpiled soil was returned from the remote stockpile location and was supplemented by imported clean fill soil. Backfill material was installed in controlled lifts and compacted. Once required grades were established, a demarcation layer was installed atop the backfill material then the site restoration was completed by installing paving subbase stone and pavement in a majority of the site and topsoil and seeding in other specified areas.

All equipment and temporary facilities were decontaminated and removed from the site, support areas were restored, and the temporary fencing was replaced with new fence where required.

The stabilized soil routinely met the treatment criteria of a minimum unconfined compressive strength of 50 psi at 28 days and a minimum hydraulic conductivity of 1 x 10^{-6} cm/sec. Both NYSEG and NYSDEC were very pleased with the performance of NorthStar. The project was performed incident free and on-schedule, which was quite challenging considering the client's desire to perform the work (for public relations purposes) during the winter in upstate New York where winter weather is not conducive to performing work of this nature.

COLUMBUS MGP ISS SITE

CLIENT Georgia Power Co./Barr Engineering

LOCATION Columbus, GA

VALUE $9.6M

SAFETY Zero OSHA Recordables

In-Situ Stabilization (ISS)

This project involved site investigation, design preparation, in-situ stabilization (ISS) of over 80,000 cubic yards of coal-tar-contaminated soil, and placement of an 87,000-square-foot multilayered cap over the disturbed area. Contaminated soil was located primarily in a 15-foot thick zone below the water table under 10 to 20 feet of miscellaneous fill. Excavation and remediation activities were required directly adjacent to the Chattahoochee River, which bordered the site. The downtown urban setting created restrictive space constraints and a high public profile.

NorthStar worked with Georgia Power to engineer, design, and implement the preferred remedial method that consisted of the in-situ stabilization of all impacted soil and the construction of an impermeable cap over the stabilized area.

Upon completion of the in-situ stabilization of the impacted soil, clean on-site fill was utilized to prepare the subgrade prior to the placement of the cap. The cap consisted of a 60-mil HDPE liner with two layers of geotextile and a 2-foot soil cap. Final site restoration consisted of the construction of a new park.

MADISON AVENUE MGP ISS SITE

CLIENT NYSEG

LOCATION Elmira, NY

VALUE $1.75M

SAFETY Zero OSHA Recordables

Excavation and In-Situ Stabilization (ISS)

NorthStar performed this excavation and in-situ stabilization (ISS) project for NYSEG at the Madison Avenue MGP Site located in Elmira, New York. The scope of services consisted of a combination of excavation and off-site disposal in certain areas of concern and ISS treatment of 7,800 cubic yards (CY) of soils using an excavator mixing method. Other activities included site preparation for the excavation and ISS work and site restoration once the work was completed.

Site preparation included pre-work surveying, noise and vibration monitoring, locating and abandoning known utilities in the work areas, installing erosion controls, removing existing perimeter fence where necessary, installing temporary fence around the site perimeter setting up support zone and contamination reduction zones, performing clearing and grubbing, constructing an excavated material staging area, providing frac tanks for temporary water storage prior to off-site disposal, and performing test trenching in four specified locations.

Steel sheeting was installed around the perimeter of three excavation areas. The alignment was pre-drilled along the sheeting alignment to ensure that sheets could be driven to the desired depths. Sheets were installed using sealant at the interlocks to minimize any potential for groundwater intrusion into the excavation area. The sheets were installed and removed around Areas 1, 2 and 6 in a sequence that enabled the reuse of the pre-cut sheets.

Areas 1, 2 and 6 were excavated and the soil was loaded into trucks for off-site disposal by others. Upon the completion of excavation, the areas were backfilled with reusable on-site soil and imported fill materials. The sheeting was removed from the perimeter of the excavation area once backfilling activities were completed.

The ISS work areas were pre-excavated in preparation of a mass balance for ISS work such that the finish treated material would swell up to no higher than 4 feet below the final grade as required by NYSDEC. Performing a mass balance resulted in zero swell material requiring off-site disposal, translating into cost savings for the client.

Excavation activities included the removal of asphalt pavement and concrete slabs and removal of non-impacted soil. The non-impacted soil was directly loaded into off-road trucks and placed as reusable fill in excavation Areas 1, 2 and 6 or as part of the 4-foot cap above ISS treatment areas.

ISS was performed in Areas 3 through 5 and 7 through 12 using an excavator-mixing method. A grout plant was set up and the required reagent admixture was produced on-site then conveyed to the ISS treatment cell, where

it was added on a per weight basis using a pre-determined mix design of 4% by weight for Portland cement and 0.5% by weight for bentonite. ISS was performed on roughly 7,800 cy of soil up to depths of 28 feet below grade (the maximum depth of ISS after pre-excavating to accommodate for swell was 21 feet).

Once ISS was completed, a demarcation layer was installed on top of the monolith and the areas of concern were backfilled to the required final elevations. Suitable excavated material removed from ISS areas was direct-loaded and used as fill on previously treated areas or stockpiled as needed. A final cap of imported fill was placed in lifts using gravel and the required areas were finished with topsoil and seeding. Backfill material was installed in controlled lifts and compacted.

All equipment and temporary facilities were decontaminated and removed from the site, support areas were restored, and the temporary fencing was replaced with new fence where required.

The stabilized soil routinely met the treatment criteria of an unconfined compressive strength between 50 psi and 175 psi at 28 days and a minimum hydraulic conductivity of 1×10^{-6} cm/sec. Both NYSEG and NYSDEC were very pleased with the performance of NorthStar. The project was performed incident free and on-schedule.

ATHENS RIVERBANK MGP SITE

CLIENT Georgia Power Co. PRP Group

LOCATION Athens, GA

VALUE $7.5M

SAFETY Zero OSHA Recordables

Excavation and In-Situ Stabilization (ISS)

The Athens Riverbank MGP site was the location of a former incinerator facility. As a result of previous operations at the site, contamination became concentrated along the riverbanks and in the sediments of the North Oconee River. In order to remediate the site, excavation and off-site disposal of contaminated materials were selected.

Prior to excavation, Willow Street (which transected the remediation area) was closed, and a 30-inch high-pressure water main was relocated. A 12-inch sewer line and a 115-kilovolt (kV) transmission pole were also relocated. Following the street closure and utility relocation, extensive soil and erosion control features, including diversion berms and a retention pond, were installed to protect the North Oconee River from receiving runoff due to the steep slope running from the site to the river.

To facilitate the removal of river sediments and as part of the runoff control features, NorthStar used a 300-foot portable cofferdam structure, or Porta-Dam. The cofferdam was installed in the river and drained of water prior to sediment removal. Four high-capacity dewatering pumps (7,000 gallons-per-minute [gpm] total capacity) continually pumped the river water so that the excavation could proceed “in the dry”. Sediments that exhibited indication of tar-like material and staining were excavated and placed in an area to drain adjacent to the working terrace. Water that drained from the removed sediments was contained, collected, and treated. The sediment was then stockpiled, characterized, and treated (as necessary) prior to disposal at a Subtitle D Landfill.

Absorbent booms and pads were used during sediment removal both inside and outside the cofferdam to mitigate water contamination resulting from sediment disturbance. Water remaining inside the cofferdam after sediment removal was pumped to on-site water storage tanks and was treated prior to disposal. Treated water was discharged to the Athens-Clarke County Publicly Owned Treatment Works (POTW). Prior to discharge to the POTW, treated water was sampled for the constituents of interest, as required by the discharge permit obtained from the POTW. Approximately 70,000 tons of contaminated soils and sediments were removed from the site, with approximately 20% of that material requiring pugmill stabilization to meet Toxicity Characteristic Leaching Procedure (TCLP) lead standards prior to off-site disposal.

In addition to the removal activities on the riverbank and in the river, remediation activities also included perimeter air monitoring around the site, preparation of design and corrective action plans, support of the community relations program, installation of 450 lineal feet of 30-inch-diameter water main, and replacement of an existing sanitary sewer line. Restoration of the site included placement of approximately 50,000 tons of clean imported fill for the construction of a scenic river park overlook.

MACON MGP SITE REMEDIATION

CLIENT CONFIDENTIAL

LOCATION Macon, GA

VALUE $4.4M

SAFETY Zero OSHA Recordables

In-situ stabilization (ISS)

NorthStar completed remediation of this 5-acre site in downtown Macon, Georgia. The remediation strategy included ex-situ and in-situ treatment as well as off-site disposal of approximately 150,000 tons of contaminated soil, concrete, and debris. An on-site water treatment facility was available for collection and treatment of potentially contaminated surface and groundwater throughout the site remediation. The source of the soil and groundwater contamination was coal tar in the subsurface remnants of a former coal gasification plant that supplied gas to homes and businesses from the 1870s to 1940.

The off-site removal/disposal work included demolition, excavation, and off-site transportation of approximately 90,000 tons of coal-tar-contaminated soil, concrete, and debris to a local Subtitle D landfill. Most of these materials were above the existing groundwater table elevation. Several of the structures extended below the water table.

Ex-situ treatment included conditioning of tar and tar-like materials with other soils and quicklime. Approximately 5,000 tons of heavily impacted soils were treated, stockpiled, tested, and transported off-site using 175 tons of quicklime. In-situ stabilization was performed with a 12-foot-diameter mixing/injection tool powered by a high-torque drill transmission attached to a 150-ton crawler crane.

Approximately 55,000 tons of contaminated soils below the groundwater table were mixed in situ with a cement-based grout and solidified into an impermeable monolith. Contaminated soils and groundwater were treated with 1,108 overlapping, circular columns to an average depth of 10 feet. Samples of the mixed material were tested daily for unconfined compressive strength, permeability, and wet-dry durability. All tests met the desired criteria. The in-situ portion of the project eliminated the need for expensive earth-retention systems and addressed all groundwater issues as existing impacted groundwater was locked into the solidified monolith.

During remedial activities, off-site odors were eliminated using a state-of-the-art point-source and perimeter control system. No complaints were filed by nearby residents and businesses. Following stabilization, approximately 30,000 cubic yards of engineered backfill material was placed to return the site back to street grade. Topsoil and seed were added to complete site restoration.

SARATOGA SPRINGS MGP SITE

CLIENT Confidential Client

LOCATION Saratoga Springs, NY

VALUE $16.3M

SAFETY Zero OSHA Recordables

MGP

As a result of former operations at the MGP site in Saratoga Springs, New York, contamination spread to several areas of the site, adjacent properties, and the Spring Run Creek. Overall, the scope of work for the site included activities at three major areas of the site: the Skating Rink Property, NMPC Property, and in Spring Run Creek. Principal activities associated with each of these areas included installation of 61,000 square feet of heavy-duty watertight steel sheeting; installation of groundwater extraction and recovery wells; installation of a permanent water treatment system; rehabilitation of 850 feet of brick storm sewers; relocation of a historic brick roundhouse; excavation and off-site disposal of contaminated soils and debris; building demolition; construction of an asphalt cap; and site restoration.

In addition to those activities, NorthStar was required to remediate a contaminated portion of Spring Run Creek. Upon completion of clearing and grubbing activities near the creek and construction of temporary haul roads to provide access, NorthStar installed approximately 30,000 square feet of temporary sheeting. Subsequently, NorthStar excavated and transported for off-site disposal approximately 5,300 cubic yards of contaminated creek sediments. During excavation activities, it was necessary to divert 1,900 lineal feet of the creek. Following completion of the removal activities in the creek, wetland plantings were implemented to restore the site.

FORMER MANISTEE MGP ISS

CLIENT Consumers Energy

LOCATION Manistee, MI

VALUE $10.0 M

SAFETY Zero OSHA Recordables

In-Situ Stabilization (ISS)

The former manufactured gas plant operated from 1882 to 1955 when it was decommissioned. Impacts to soil and groundwater included both LNAPL and DNAPL. The project included demolition of an existing building, subsurface utilities, and foundations; excavation and re-use of 24,000 cy of non-impacted soil; and ISS treatment of 48,000 cy of impacted soil utilizing auger and excavator mixing technologies.

Auger ISS was performed within 10 feet of an active railroad. Perimeter rows of perimeter ISS columns were installed as part of an engineered excavation support system that facilitated removal of 12 to 19 feet of non-impacted soil. ISS excavation support was utilized to reduce the volume of treatment of clean soil and to facilitate mixing of the impacted soil with excavator ISS at the groundwater table for the interior of the site.

The work included a joint permit with the USACE for ISS auger mixing and restoration activities in the river bank and in-river which necessitated the use of steel sheet pile to keep ISS swell from flowing into the navigable channel. Large marine vessels frequently passed the work area and silt curtain maintenance was critical.

Additional work was requested by the client to treat an adjacent site. The scope included the removal of 8,500 cy of clean overburden, installing shoring to remove a former holder wall, and treatment of an additional 3,500 cy of impacted soil via excavator mixing ISS.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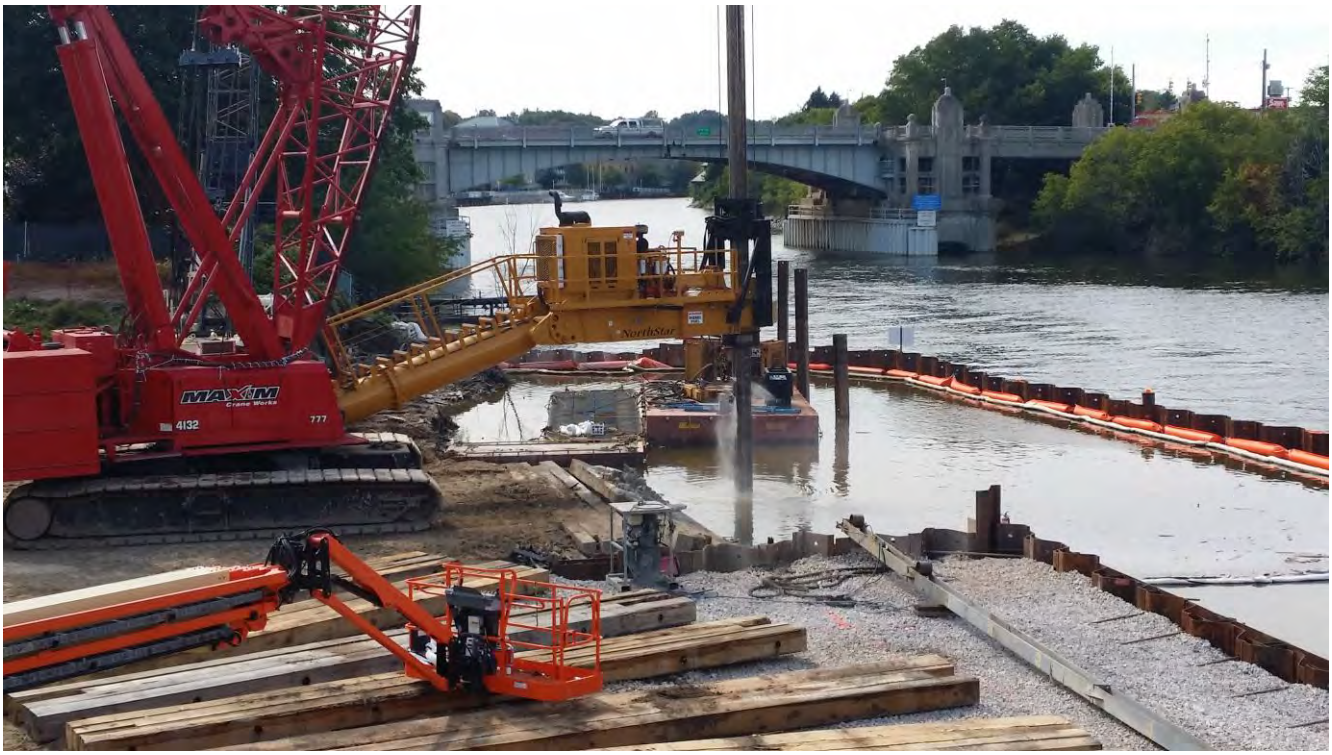
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NorthStar


NorthStar
DIESEL FUEL

WEST END GAS WORKS MPG SITE

CLIENT CONFIDENTIAL Client

LOCATION Cincinnati, Ohio

VALUE $13 M

SAFETY Zero OSHA Recordables

In-Situ Stabilization (ISS)

The primarily scope of the work includes excavation of impacted soil from two areas of concern (Phase 3 Area and Tower Area), transportation of impacted soil to the specified facility (Rumpke Landfill) for disposal, ISS in two locations (Areas A and B) located in the Phase 3 Area and beneath the impacted soil, backfilling the excavated areas and site restoration. The work will be performed in coordination with the installation of excavation support systems by Richard Goettle, Inc. (Goettle), who will be retained separately by the client.

The project work involves excavation of an expected 27,280 tons of material from the Tower Area and an expected 147,060 tons of material from the Phase 3 Area. Considering these depths typically are 20 feet or greater from the existing ground surface, excavation will require the installation of perimeter excavation support systems that will be installed by Goettle.

The excavation support system installation will commence as early as possible in the project schedule. NorthStar will pre-trench the support system alignment as soon as possible after mobilization and the support system will be installed by Goettle lagging behind the pre-trenching. NorthStar install the piles in the Phase 3 Area first from the south to the north, following by piles in the Tower Area. While the piles are being installed around the perimeter of the site by Goettle. NorthStar will perform excavation within the site. Our work will be sequenced to make sure that site crews are available to excavate a working bench along the west side of the Phase 3 Area where Goettle will be installing walers and grouted tie-back anchors. This will involve a single bench a few feet below the waler depth for the portion of the support system that requires single anchors. In the areas where double anchors are required, NorthStar will sequence our excavation work to install a second bench just below the waler depths for the second anchors. The overall goal will be to excavate and load-out impacted soil at the maximum rate it can be accepted by the approved landfill.

Excavation of the Phase 3 Area will also be sequenced to facilitate commencement of ISS work at the earliest date practical as this will also optimize the overall project work schedule. The Phase 3 Area will be supported around the entire perimeter by either cantilevered shoring or shoring with anchors. There are areas with single anchors and areas with double anchors, all located along the western side of the Phase 3 Area. NorthStar will excavate the Phase 3 Area in the sequence generally described above. Based on discussions with the proposed disposal facility (Rumpke Landfill), the daily excavation production rate will be limited to 1,000 to 1,500 tons per day. NorthStar will perform excavation at an average rate of 1,250 tons per work day over the entire excavation duration.

Material will be excavated and loaded into trucks in a controlled to minimize any potential for contamination of the exterior of the trucks. Trucks will exit the site once loaded by travelling across the truck washing area and wheels will be washed to the extent necessary.

The Tower Area excavation area will be supported by cantilevered shoring around the north, east and south sides. Excavation will progress to the full depth up to the shoring system on the east and south sides. When excavating in the Tower Area, NorthStar will slope the west and north sides of the excavation. The material excavated to create an access ramp on the west side will be loaded into trucks for transportation to the approved disposal facility. When excavating the north side of the Tower Area, no equipment will be operated within the specific 20-foot construction surcharge offset zone. The soil wedge in this area will be incrementally excavated by sequencing the excavation in a series of cells excavated perpendicular to the slope and advancing in a manner such that two adjacent cells are not excavated at the same time. NorthStar will advance this work in cells and will backfill each cell before the next cell is excavated.

Backfill will be placed and compacted as required. Specifically, general fill will be placed in maximum 15-inch lifts and will be compacted to 95% standard Proctor if located within 5 feet of the ground surface (90% if greater than 5 feet below grade). Placement will be performed using a bulldozer and compaction will be achieved using an 8-ton roller. Gravel will be placed in maximum 12-inch lifts and will be compacted to 95% standard Proctor.

The main work item for this project is in-situ stabilization (ISS) of 53,300 cy of soil in two areas located within the Phase 3. ISS Area A will include ISS to Elevation 439 and ISS Area B will include ISS to Elevation 457. ISS Area A requires treatment over a 35-foot depth increment and ISS Area B requires treatment over depth increment ranging from 12 to 16 feet. NorthStar proposed to use auger mixing in the deeper Area A and excavator mixing in the shallower Area B. Excavator mixing to depths less than 20 feet has been proven effective and viable at similar sites using an excavator of sufficient size to reach the bottom of the ISS treatment zone. In this case we would propose to use a Caterpillar 349 or equivalent excavator to enable bucket mixing to the required maximum depth of 16 feet in ISS Area B. Excavator mixing offers value for Duke Energy as excavator mixing is a lower unit price method relative to auger mixing. Our unit price for ISS is a blended rate that incorporates the lower unit price for excavator mixing versus our unit price for river bank and in-river ISS.

ISS will be performed using the reagent mix design specified in the bid documents. Reagents will be added on a per weight basis, with conversion of mass to weight based on a soil dry density of 100 pounds per cubic foot (pcf). The addition rates will be 3% by weight for Portland cement (PC) and 3% by weight for ground granulated blast furnace slag (slag).

ISS work will be assisted by an excavator that is capable of removing obstructions. NorthStar proposed to use a Caterpillar 330 (or equal) excavator. This size excavator will reach nearly 20 feet in depth, which will access the maximum required ISS depth in ISS Area B and will also access 40 feet below the original surface e elevation in ISS Area A.

- Crane (Manitowoc 777 or equal)
- Diesel-Hain Drill Platform (400,000 foot-pounds of torque)
- Hain Hollow-Stem Kelly Bar (13½ inches square with oil-field swivel)
- Large-Diameter Auger Mixing/Injection Tools
- Peristaltic Grout Pumps
- Grout Batch Plant
- Reagent Silos for Portland Cement and Slag
- Storage Trailer
- Mission Pumps


CAT
390F

AMEREN ILLINOIS MACOMB ISS

CLIENT Ameren Illinois

LOCATION Macomb, IL

VALUE $12.6 M

SAFETY Zero OSHA Recordables

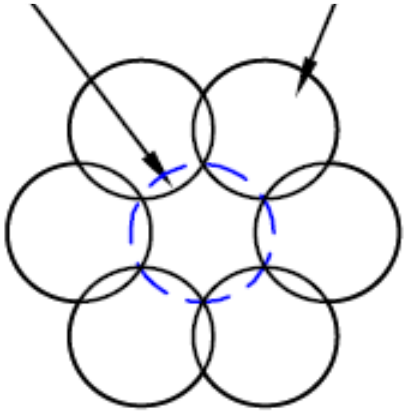
Large Diameter Auger and Excavator ISS/Demolition of Site Structures

NorthStar was retained by Ameren to perform remediation at the former Manufactured Gas Plant Site in Macomb, IL. The scope was unique in that Ameren requested that the awarded contractor collaborate on the final design to be submitted to the State of Illinois. NorthStar worked collaboratively with Ameren and their design engineer to complete the design, taking it from 50% to 100%. One advantage to bringing the contractor in early versus at the 100% design stage is that NorthStar worked on behalf of Ameren to optimize the mix design. The original specification called for a 10% Portland cement mix recipe. However, after reviewing the existing data and performing additional treatability and pilot testing, NorthStar was able to reduce the Portland cement content to 7.5%, resulting in significant cost savings for Ameren. NorthStar also worked with the design engineer to reduce the volume of material treated using Large Diameter Augers (LDA) by suggesting incorporation of excavator bucket mixing in select areas. This change resulted in significant cost and schedule savings to Ameren. Furthermore, by adjusting the project/work sequence and schedule, NorthStar was able to work around and below an active gas regulator station allowing us to fully address all the impacted soils. The development of a Risk Register was used to provide fixed lump sum costs for identified risk items to limit potential scope and cost changes for the project. Because the project was executed during the height of the COVID-19 pandemic, NorthStar established comprehensive procedures and work requirements in conjunction with Ameren and their engineer to continue project operations in a safe and healthy working condition.

Major construction elements of the work included:

- Demolition of aboveground and underground items/structures, including multiple above grade and on-grade structures (a residence, a garage located near the northeast corner of the site, an automotive garage, a portion of an antique shop located south of the excavation and ISS work areas)

- Design and installation of perimeter shoring system using cantilevered steel sheet piling to support 8-foot and deeper pre-excavation required as part of the work
- In-situ solidification (ISS) of ~32,500 cy of impacted soil to depths up to 68 feet using six-foot and eight-foot-diameter augers
- ISS using excavator mixing of 35,000 cy to depths up to 38 feet, with initial benching down to depths up to 10 feet
- Excavation of approximately 24,000 cy of soils to remove surface soils and obstructions prior to ISS mixing
- Backfilling with imported clay and rock
- Site restoration including topsoil and seeding in limited areas and replacing curb and sidewalk in other areas
- Disposal of overburden soils and excess ISS swell and backfilling of clean fill to establish a 10-foot clean cap over the footprint of the site per IEPA requirements

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AMEREN ILLINOIS JACKSONVILLE

CLIENT Ameren Illinois

LOCATION Jacksonville, IL

VALUE $14M

SAFETY Zero OSHA Recordables

Excavation and In-situ stabilization

NorthStar was retained by AMEREN of Illinois to perform a remediation project involving in-situ stabilization (ISS) treatment of impacted soils at this former manufactured gas plan (MGP) site. In order to prosecute the ISS treatment, soil was excavated and removed to a depth of 10' below ground surface. ISS was performed via augering and bucket mixing. An additional scope of work consisted of relocating and re-installing 42", 36", 24", 15", and 12" stormwater and storm sewer piping and 6 manholes with one 20'x20'x20' vault structure. A sewer bypass was installed with a redundant capacity of 10,300 gallons per minute, and was maintained during the project ISS operation and sewer replacements. A total of eight automated pumping systems were installed capable of running with or without electrical power.

In addition to the stormwater relocation, both electrical and high pressure gas main lines were also relocated and re-installed prior to construction completion. During the utility work, the project continued with multiple activities simultaneously including excavation activities, ISS auger mixing, and ISS bucket mixing while utilizing two automated batch plants. The scope of work included:

- Building demolition
- Shoring adjacent to an active creek
- Slide rail shoring of adjacent properties allowing 20' excavations to occur
- Gas Holder stabilization and demolition (90' in diameter, 28' deep with 3' thick walls)
- Excavation below the water table of over 51,600 tons of contaminated soil including off-site transportation and disposal
- Waste Water Treatment and Disposal on-site using a carbon and filtration system treating over 400,000 gallons of ground water and surface contact water
- ISS auger mixing of 1,038 columns over 3 acres (30,126 cubic yards)
- ISS bucket mixing of 24,037 cubic yards
- Installation of a 10' clay capping layer totaling 18,600 cubic yards of imported clays
- Odor controls with foam units including daily posi-shell encapsulation

Odor control systems were a critical part of this MGP remediation due to the fact that a restaurant was located at the property line of the excavation and ISS activities. Residential homes were also located on all four property lines of the remediation requiring constant real time air monitoring and full time personal air monitoring.


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NorthStar

ABILENE FORMER MGP

CLIENT	Burns & McDonnell/OneGas
LOCATION	Abilene, KS
VALUE	$7.7M
SAFETY	Zero OSHA Recordables

In-situ Stabilization/DMM Wall Construction

This is an ongoing project; therefore, a full project description with project close-out metrics has not been fully developed. A unique element of this project is the use of Deep Mix Method (DMM) and In-situ stabilization (ISS). For the excavation and stabilization of the MGP affected wastes, NorthStar is currently constructing a DMM wall for support of excavation at the perimeter of the site. The DMM wall will be used to control hydraulic and geotechnical forces to the interior of the excavation site. The site also includes ISS of 23,000 cy of MGP impacted soil as well as excavation, load out, and transportation of waste.

The scope of work at this site primarily includes demolition of aboveground and underground structures, installation of an excavation support system and DMM wall at the perimeter of the work area, excavation and off-site disposal of impacted soil to a depth of 11 feet, ISS of impacted soil to depths up to 53 feet from the existing ground surface, removal of swell from the ISS operations to a depth of 1 feet, backfilling with imported fill and rock, and site restoration. To facilitate this work, NorthStar will perform various site preparation activities (e.g., utility location and protection, surveying, installation of temporary fence, providing erosion controls), project support activities (e.g., odor/vapor control, water management), and site restoration activities (e.g., removal/installation of fencing).


STEEL

FORMER TIE TREATING FACILITY (CREOSOTE)

CLIENT Union Pacific Railroad

LOCATION Escanaba, MI

VALUE $7 M

SAFETY Zero OSHA Recordables

Sheet Piling | Soil Bentonite Cutoff Wall | Dredging

NorthStar performed this remediation project at a former tie treating facility located in Escanaba, Michigan. The scope of services consisted primarily of removing 10,525 cubic yards (cy) of impacted sediment from Lake Michigan and installation of a combination a 78,740 square foot (sf) Soil Bentonite Cutoff Wall (SBCW) and 17,280 sf Steel Sheet Pile Cutoff Wall (SSP). The dredge area extended up to 170 feet from the shore and was mechanically dredged from constructed riprap finger piers with a hydraulic clam shell bucket. Backfilling occurred from barges and from shore using a 105-foot truck-mounted telescoping conveyor belt (telebelt). SBCW and SSP installation occurred concurrently to complete the project in a short window before the onset of winter. The work performed consisted of the following:

- Site preparation included installing erosion controls, constructing lined dewatering pads, constructing decontamination and fuel storage pads, assembling a Waste Water Treatment Plant (WWTP), setting up support and contamination reduction zones, installing temporary access roads, installing temporary vinyl shoring in the lake, and oil boom/turbidity curtain at the outer limits of the dredge area. NorthStar performed waste characterization sampling and analysis of the sediment using a small boat and sampling tools to collect samples of the impacted sediment and obtain disposal approval in advance of the work.
- Dredging was completed by constructing finger piers from riprap obtained on-site from a previous Interim Remedial Action. The finger piers were spaced so all of the dredge area was within the reach of a 330 long-reach excavator equipped with a 1 cy level cut hydraulic clam shell bucket with RTK GPS positioning. Sediment was transported via articulating dump trucks to a dewatering pad and allowed to gravity drain prior to stockpiling for disposal. Over 190,000 gallons of water was collected, treated and tested in 21,000-gallon frac tank batches, then was used for dust control.
- The SBCW was installed by the One Pass method using a large trencher to mix the slurry wall to depths as specified in the project drawings which ranged from approximately 65 feet to 35 feet. The alignment of the wall was leveled to create a working platform and staked every 25 feet along the alignment. The wall was sampled daily and met the hydraulic conductivity specified for the project. The wall was also cored to confirm it was tied-in to the underlying clay confining layer.

- The SSP barrier wall was installed along the shore of Lake Michigan and tied into the SBCW at three upland locations to complete the groundwater cutoff wall. This included PZC-18 sheet piles driven to depths up to 65 feet using a vibratory hammer and impact hammer where required. The sheets were delivered to the site with Wadit installed in the interlocks to form a sealed sheeting system.
- Capping of the dredged area was completed by using a combination of a 105-foot Telebelt and started with a 3 to 6-inch leveling layer of sand, a 3 to 6-inch layer of Aquablok followed by a 4-foot layer of sand placed in a tiered process. The telebelt was required to work both from the barge and from the shore. A diffuser was installed on the end of the conveyor belt to spread out the capping layers in a wide and even pattern. The telebelt was fed material using excavators to load the hopper. A bag cutter was installed in the hopper when using supersacks of Aquablok to "break" the bags and safely feed the hopper.

- Sediment from dredging and swell from SBCW installation were stabilized with 2% cement kiln dust and/or 2% Portland Cement using excavators prior to transportation and disposal at the local Subtitle D landfill. A total of 30,000 tons of stabilized sediment and swell along with existing rip rap and debris was handled and loaded off site.
- A new 24-inch HDPE water line was installed through a vault on the existing pumphouse out to Lake Michigan to replace an old deteriorated line. The reinforced concrete walls of the vault were cored and a directional drill was used to drill through the vault out to Lake Michigan. The pipe was pulled back to the vault and grouted before removing the inflatable plug in the pipe. A weight fabricated out of two concrete bin blocks and a spreader bar was placed over the HDPE pipe to keep it from floating in the future.
- Site restoration included SBCW trench restoration using bentonite chips, non-woven fabric and geogrid, installation of a road crossing culvert, demolishing dewatering and decontamination pads, removing temporary shoring and turbidity controls, seeding, mulching and installation of 12 recovery wells. The project completed with nearly 21,000 safe working hours.

- The key to the success of this project was the coordination of the activities and completion of the work prior to the onset of winter weather in Escanaba. Subcontracted services, dredging, sediment management and disposal were performed congruently and capping operations were performed as the SSP was completed.

Additionally, crews worked extended hours to expedite the completion of the project. NorthStar mobilized to the site in late August and all site work and equipment were off site by the third week of December.

RAIL CAR DERAILMENT

CLIENT Union Pacific Rail Road

LOCATION Eunice, LA

VALUE $ 3.2 M

SAFETY Zero OSHA Recordables

Remediation

NorthStar was hired to introduce Zero Valent Iron (ZVI) at a rate of 6% by weight to a site that had a historical Rail Car Derailment. The volatile organic compound (VOC) was engrained into the tight clays to an average depth of 40' bgs. The site was further complicated by seasonal surface water releases from the upstream rice fields.

The site lay in a wetland bordered by a lake and large stream. Approximately 15,000 cy of soil was deep soil mixed using 10' diameter augers to an average depth of 40' bgs. An additional 9,000 cy was excavated and staged in a pre-treatment holding cell. The 9,000 cy was then put through a pug-mill and the soils were amended with the same 6% introduction of ZVI. The soils treated via the pugmill were then laid out and the area demarcated and allowed to treat. To date complete success of the VOC's.

LAUNCH COMPLEX 15 PILOT & PHASE II

CLIENT BEM Systems, Inc.

LOCATION Cape Canaveral Air Force Station, Florida

VALUE $2.3 M

SAFETY Zero OSHA Recordables

In-Situ Vertical Auger Soil Mixing

BEM Systems, Inc., and AFCEE contracted NorthStar to perform a field pilot demonstration to evaluate the viability of using in-situ vertical auger mixing technology to remediate volatile organic compound (VOC)-impacted soil and groundwater. Once the pilot demonstration was completed and proven effective, NorthStar implemented the full-scale project.

The pilot demonstration work took place at two locations - Launch Complex 15 (which was used as a waste burning facility) and a deluge basin (which was used as an oil/water separator for bilge wastes). Contaminants of concern included VOCs from solvents, PCBs, petroleum compounds, and metals in excess of Florida DEP soil cleanup target levels. Most significant among these compounds was trichloroethylene (TCE) and dense non-aqueous phase liquid (DNAPL).

In-situ auger mixing using a 7-foot-diameter auger was performed from depths ranging from 10 to 55 feet. A total of 37 columns were treated during the pilot study using hot air and steam (at 160°F) injection. Upon treatment with hot air and steam, some of the columns were further injected (as a polishing step) with various types of zero-valent iron (ZVI) filings with addition rates ranging from 1.0% to 2.5% to soil by weight. All off-gassing generated during the pilot study was collected under a shroud and treated through vapor-phase granular activated carbon. Analytical data from soil and groundwater samples collected before and after the treatment indicated a total VOC reduction of over 98% in groundwater and 90% in soil, significantly exceeding the project's 80% treatment reduction goal.

Following the success of the field pilot study, NorthStar performed the full-scale remedial effort using the in-situ large-diameter vertical auger mixing technology. The remedial action at the L15 site combined in-situ soil treatment using large diameter augers with steam, hot air, and ZVI injection to remove contamination in significant source areas as well as natural attenuation for non-source area groundwater. NorthStar determined that removal of a significant portion of the DNAPL mass would cause the groundwater plume to retract and shorten the overall length of the cleanup.

The treatment approach for the L15 site included treatment of the DNAPL source area by steam injection and in-situ soil mixing (including off-gas condensate treatment), introduction of ZVI into the steam-treated source areas,

installation of a monitoring well network, and the implementation of a natural attenuation and long-term monitoring process.

After mobilization of NorthStar's in-situ soil mixing equipment, hot air was delivered to the Kelly bar on the deep auger mixing equipment at approximately 150°F to 200°F with rates up to 900 cfm. Hot air was generated using a 100% oil free air compressor with a working pressure of approximately 135 psi. Steam was generated using a mobile boiler system capable of delivering up to 12,075 pounds of steam per hour at a temperature of up to 212°F at 250 psi.

NorthStar mixed ZVI with guar gum to generate a biopolymer slurry to facilitate injection into the soil. The batching of the ZVI-guar gum-water slurry was calculated by weight. The mix ratio consisted of a 0.5:1 blend (by weight) ZVI to water with guar gum added at the ratio of about 0.009:1 to water (ZVI:slurry = 0.496:1). The amount of guar gum slurry added to make the iron slurry pumpable varied to optimize workability.

As the mixing blade rotated and hot air and steam were injected into the soils, volatilized contaminants escaped to the surface through the annulus created by the rotating square Kelly bar. To capture the off-gases, NorthStar employed a vapor extraction and treatment system. The system consisted of a 14-foot diameter shroud that covered the active treatment area (mixing column). The shroud and the entire off-gas treatment system were maintained under negative pressure by a 1,800-cfm vacuum unit to prevent the exhaust of contaminated gases from migrating to the atmosphere. Additional components of the system included an air/water separator (demister), 1,500-cfm chiller, high moisture handling HEPA filter for dust particulate removal, flameless thermal oxidizer, wet scrubber for VOC treatment, and an in-line flame ionization detector/gas chromatograph for measuring the concentration of volatile organics in the off-gas stream.

Air collected under the shroud of the Kelly bar flowed into the air/water separator (AWS). Condensate collected at the bottom of the AWS and was pumped automatically into a portable tank for treatment and handling by the site engineer. Air leaving the AWS passed through a 1,500-cfm chiller for cooling to less than 100□F before passing through a particulate HEPA filter. A flameless thermal oxidizer/wet scrubber unit was then utilized for air treatment prior to discharge.

The full-scale treatment process was performed on approximately 44,000 cubic yards of material. This work consisted of initially treating the perimeter low concentration areas and gradually working inwards towards the high concentration locations. Initial air treatment work was performed utilizing vapor-phase granular activated carbon. This provided the ability to proceed with the project while the flameless thermal oxidizer was under the initial start-up testing mode. ZVI filings injection during full-scale implementation ranged from 1.0% to 2.5% depending on contamination concentrations at the site.

Site restoration work consisted of importing off-site clean soils and placing such soil over the top of the completed columns. This was necessary to compensate for the ground surface settlement that was created as a result of the hot air and steam injection. Subsequently, the remediation areas were graded to drain and revegetated.

Attachment 3

Certificate of Insurance

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 3/11/2022

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Alliant Insurance Services, Inc. 333 Earle Ovington Blvd, Suite 700 Uniondale NY 11553	**CONTACT NAME:** Forward All Certificate Revision Requests to **PHONE (A/C, No, Ext):** the Below E-Mail **FAX (A/C, No):** **E-MAIL ADDRESS:** NorthStarGroupServices@alliant.com
INSURED LVIENVI-01 NorthStar I&E, Inc. 2760 South Falkenburg Road Riverview, FL 33578-2561	**INSURER(S) AFFORDING COVERAGE** / **NAIC #** **INSURER A :** National Union Fire Insurance 19445 **INSURER B :** Zurich American Insurance Comp 16535 **INSURER C :** AIU Insurance Company 19399 **INSURER D :** Crum & Forster Specialty Insur 44520 **INSURER E :** Navigators Insurance Company 42307 **INSURER F :** Ascot Insurance Company 23752

COVERAGES **CERTIFICATE NUMBER:** 711075665 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A A	X **COMMERCIAL GENERAL LIABILITY** [ ] CLAIMS-MADE [X] OCCUR X Contractual Liab GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [X] LOC [ ] OTHER:	Y	Y	GL 746-88-43 (AOS) 746-88-44 (NY)	7/1/2021 7/1/2021	7/1/2022 7/1/2022	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG NY Limits:	$ 2,000,000 $ 300,000 $ 25,000 $ 2,000,000 $ 4,000,000 $ 4,000,000 $ 5M OCC/$10M Agg
A A	**AUTOMOBILE LIABILITY** X ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS X HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY	Y	Y	AL 134-14-52 (AOS) AL 134-14-53 (MA)	7/1/2021 7/1/2021	7/1/2022 7/1/2022	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 2,000,000 $ $ $
B D E F	[ ] **UMBRELLA LIAB** [X] OCCUR X **EXCESS LIAB** [ ] CLAIMS-MADE [ ] DED [ ] RETENTION $	Y	Y	SXS 0195929-05 SEO-114069 IS21EXC903238IV EXNA2110000045-01	7/1/2021 7/1/2021 7/1/2021 7/1/2021	7/1/2022 7/1/2022 7/1/2022 7/1/2022	EACH OCCURRENCE AGGREGATE	$ 25,000,000 $ 25,000,000 $
C C C C	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	Y	WC 12326669 (AOS) WC 012-32-6666 (CA) WC 013-75-1681 (NY) WC 012-32-6668 (WI)	7/1/2021 7/1/2021 7/1/2021 7/1/2021	7/1/2022 7/1/2022 7/1/2022 7/1/2022	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000
B	Pollution Professional	Y	Y	PEC 0194414-05	7/1/2021	7/1/2022	Ea Claim: $25,000,000 Occ/Agg	Agg: $25,000,000 $5,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

SAMPLE.

CERTIFICATE HOLDER

SAMPLE
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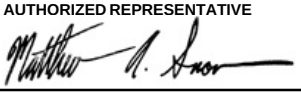
CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE



Sevenson
Proposal and SOQ

March 23, 2022

ERM
Woodfield Three
8425 Woodfield Crossing Blvd., Suite 560-W
Indianapolis, IN 46240
ATTENTION: Mr. Dwayne Keagy, MS, LPG

REGARDING: Ameren Central IL MGP
ISS Bench Study

Dear Mr. Keagy,

Thank you for providing us your request for ISS bench-scale study services dated March 16th, 2022, for the Ameren Central IL MGP Project. Sevenson is pleased to provide the following scope of services.

Provide analytical laboratory testing by Geotechnics Geotechnical Laboratory, Pittsburgh, PA, and Sevenson Geotechnical Laboratory, Niagara Falls, NY, and a PE Engineer/ISS Specialist, Mr. Chris Ryan, who will make recommendations to, and coordinate the required testing with Geotechnics and Sevenson laboratories. Samples will be collected by ERM during their site investigation and shipped by ERM to Geotechnics and Sevenson. At the direction of Mr. Ryan, and with consultation from ERM, Geotechnics and Sevenson will perform UCS (strength), K (permeability), and leachability testing (SPLP and LEAF 1316) on the pre-mixed, and post-mixed soil samples to determine the lower, mid, and upper range of the necessary reagent addition such that the stabilized soil meets the design goals (UCS of 50 psi or greater, a K of 1 x 10-6 cm/sec or less, and leachability), but uses the least amount of reagent with the goal of minimizing swell generation and cost. Laboratory testing will include variable mixes of Granulated Ground Blast Furnace Slag (GGBFS) and Portland cement (PC) recommended by Mr. Ryan and Sevenson based on our experience. Sevenson will prepare a summary report of the lab results, and based on our review of the results, we will recommend which mix designs should be selected for testing during the onsite Pilot Study. Sevenson's cost to perform this work is:

1. Analytical Laboratory Testing by Geotechnics - **$10,000.00.**
2. Consulting Services by Chris Ryan, PE, and Sevenson – **$ 6000.00**
3. Sevenson Laboratory Consumables and Consultation - **$4,000.00.**

The purpose of the Pilot Study will be to use the data obtained from the bench-scale testing, and using the proposed equipment (i.e. excavations/augers, tooling) and means/methods, determine which of the recommended mix designs will achieve the design goals, but also minimize cost (i.e. reduce reagent addition and minimize swell). The equipment used during the Pilot will not be demobilized from the site but will remain onsite until Pilot Study data is finalized and reviewed, and the final mix design is selected. The full-scale ISS implementation will then proceed assured that the selected mix design will be successful. Typically, it can take 28 days for laboratory data to confirm QC samples collected from the stabilized soil meet the design goals. If a Pilot Study is not performed, there is some risk that the bench-scale testing is not representative of the full-scale ISS implementation, and failures could occur. As an

example, if 1,000 CY of soil is stabilized per day, it is possible that up to 28,000 CY of stabilized soil could fail the design goals and require remixing. An onsite Pilot Study will prevent this from happening.

Sevenson looks forward to working with ERM on this important project. Mr. Chris Ryan, PE (resume attached), has more than 40 years' experience consulting for work of this type, and Sevenson has more than 30 years' experience performing ISS, including recently completing the Harrison Former MGP ISS Remediation Project, one of the largest MGP ISS projects of its type, requiring more than 420,000 CY of MGP impacted soil by both auger and bucket mixing. Sevenson completed this work with zero performance sample failures for strength (UCS) and K (permeability), > 840 total samples for each. Sevenson is uniquely qualified to perform your bench-scale treatability testing.

Sevenson is ready to be a part of the ERM and Ameren team to make the Central IL MGP ISS Remediation Project a success. If you have questions concerning this quote or wish to discuss Sevenson's capabilities in greater detail, please contact me at 716-523-8040 or BShanahan@sevenson.com.

We look forward to discussing our proposal with your team. Thank you for considering Sevenson for this important project.

Respectfully,

Brian Shanahan
Sevenson Environmental Services, Inc.

716-523-8040

Response to Request for Qualifications
Central Illinois MGP Site
ISS Bench Scale Study
Taylorville, IL

Submitted to:

ERM
8425 Woodfield Crossing Blvd
Indianapolis, IN 46240

Submitted by:

Sevenson Environmental Services, Inc.
Niagara Falls, NY

March 21, 2022

Sevenson's Response to Request for Qualifications; Central IL MGP ISS Bench Scale Study

Sevenson has prepared the following information in response to ERM's Request for Qualifications received by email on March 16, 2022.

ERM Requirement:

Please provide your Statement of Qualifications for this type of work.

Sevenson Response:

For over 40 years, Sevenson has been a respected industry provider of in-situ stabilization and solidification services, performing remediation work at former Superfund, MGP, and contaminated waterway sites throughout the United States. With expertise in conventional stabilization methodologies, Sevenson has used both traditional and custom equipment on past projects. These included excavators, pugmills, and caisson augers to solidify millions of tons of impacted material.

In 2019, Sevenson added a fleet of state-of-the-art ISS resources to the company's inventory of heavy civil and marine construction, excavation, and dredging equipment. The equipment, manufactured by BAUER Gruppe GmbH, includes two BG 45 BS 9 Premium Line rotary drilling rigs; one RTG 22S drilling rig; and three 45 cubic meter Containerized Mixing Systems (CMS). The equipment is multifunctional, easy to mobilize, and can be assembled efficiently on construction sites. Sevenson provides summaries for several current and recently completed projects where the scopes of work required in-situ stabilization.

FORMER HARRISON MANUFACTURED GAS PLANT REMEDIATION
PHASES 1 & 2
Harrison, NJ
$103,300,000
Period of Performance: July 2020 – February 2022

In-situ soil stabilization via deep soil mixing (auger) and shallow mixing with excavator. Pre-excavate 275,000 tons of soil/debris (concrete, timbers) to a depth of 7-ft. to create platform for ISS work. Clear obstructions down to depths of 25-ft. BGS to facilitate ISS work. ISS of 230,000 CY via deep auger mixing down to maximum depth of 45-ft. BGS. ISS of 145,000 CY via excavator down to a max depth of 25-ft. BGS. Process soils with reagent to comply with T+D facility requirements. Control odors and vapors using 300,000 gallons of RUSMAR odor suppressant foam (short and long term) and 60,000 gallons of SLSUPER odor neutralizing agent. Demolish existing site buildings and perform Hazardous Abatement. Dewatering for treatment via 200 GPM WWTP. Install 2,200 LF Hydraulic Barrier Wall (HBW) to depths down to 100-ft. BGS using DeWind One Passing Trencher. Jet grout termination at HBW interface/existing gas lines. Install utility corridor consisting of 16-in. and 36-in. gas lines. Restore 330,000 SF with 130,000 tons of clean import fill.

COAL ASH POND IN-SITU STABILIZATION (ISS) PILOT STUDY
Lansing, IA
$3,513,490
Period of Performance: October 2021 – November 2021

Sevenson was awarded a subcontract from Ames Construction, Burnsville, Minnesota to conduct an ISS Pilot Study on CCR material from an on-site pond at Alliant Energy's Lansing, Iowa generating station. If successful, Sevenson would continue to stabilize an additional 41,800 CY of material to create a berm along one side of the existing pond. The maximum drilling depth is 40-ft BGS. Sevenson utilized a state-of-the-art Bauer RT27 drill rig equipped with an 8-ft diameter auger to perform ISS. Prior to mobilization to the field, Sevenson conducted bench scale testing at its in-house treatability study laboratory in Niagara Falls, New York to develop and test reagent mix designs. Initially 3 reagent mixes were developed to meet the 8,000 PSF treatment specification. Upon completion of bench scale testing, Sevenson mobilized an experienced field team, the drill rig and ISS support equipment needed to initiate the full-scale Pilot Study. The objectives of the Pilot Study were to determine final means and methods to conduct full-scale ISS operations; optimize the reagent mixes; and determine production rates. Field sampling was performed during the Pilot Study including Unconfined Compressive Strength (UCS) for each of the 3 mix designs. All data and test results were shared with Ames' project team. This enabled Ames and Sevenson field teams to finalize our approach to executing the project at full-scale.

Full-Scale ISS Implementation

Sevenson's final report of the Pilot Study is currently under review by Ames and Alliant Energy. This includes all analytical testing on the samples taken during and after the Pilot Study. Currently, Sevenson is scheduled to begin full-scale ISS the 2nd Q 2022. In the meantime, we are providing Ames with the work plan, quality control plan and health and safety plan associated with the full-scale ISS operations. This includes preparing to mobilize the ISS rig, the grout plant and support equipment, and developing the final layout of the ISS columns.

FORMER VALLEJO MANUFACTURED GAS PLANT SITE
Vallejo, CA
$60,500,000
Period of Performance: June 2021 – November 2024

This project involves both heavy civil and environmental remediation services. Work activities included the demolition and abatement of ACM of above grade site structures, the installation of two (2) temporary fabric structures (TFSs), and the excavation and offsite T+D of ~216,000 tons of MGP impacted soil. Also includes ISS of ~83,000 CY of MGP-impacted soils via bucket mixing, 65% within TFS. Restoration activities will include storm sewer replacement, waterline installation, paving, and the replacement of concrete gutters, sidewalks, and aprons.

Excavation
Sevenson will excavate and loadout for disposal approximately 880 tons per day. This equates to approximately 40 trucks per day which is the maximum number of trucks allowed to enter/exit the site. Sevenson will be importing the clean fill to the site by barge. MGP soils will be excavated, managed, and loaded inside the TFS. Segregation and management of soil types will be required in stockpiles. Stockpiles will be properly covered with tarps and odor control foam until loaded out for T+D.

Sevenson will remove gasholder debris concurrent with excavation. Equipment for debris removal includes conventional excavators, and excavators with a hoe-ram, grapple, shear, concrete crusher, and/or universal processor attachment.

In-Situ Stabilization (ISS) Soil Mixing
Sevenson will self-perform in-situ soil solidification (ISS) of impacted soil using a modified bucket mixing technique. The reagents will be blended into the soil and processed to achieve the target treatment parameters. Mixing will be completed in rectangular cells approximately 15 to 25-ft long by 15 to 25-ft wide. Prior to initiating ISS mixing, Sevenson will prepare the treatment area by removing overburden and subsurface obstructions. A standard excavator (PC400) equipped with a custom-built rotary mixing head developed by Sevenson that allows Sodium Persulfate (SPS) to be injected at the deepest point of the excavation and continue to the top will be used. In addition to adding the SPS as a slurry, Sevenson will utilize a second excavator equipped with a modified bucket to homogeneously blend soils. A rotary mixing head for the final polishing of the cell for quality assurance will also be used.

The excavator operator uses GPS to record the coordinates of each corner of the treatment cell along the surface elevation of the treatment cell. Reagent will be delivered to the cell from the grout plant by hose. After the cell has been thoroughly mixed, Sevenson's quality control officer visually inspects the cell for consistency and uniformity. This process was repeated throughout.

PILOT STUDY IN-SITU STABILIZATION AND FULL -SCALE IMPLEMENTATION
Montgomery, AL
$123,000,000
Period of Performance: March 2019 – December 2023

Soil Stabilization Pilot Studies

Sevenson began planning for the in-situ stabilization scope of work during the design phase through the constructability review process. Working closely with the design engineer, Jacobs Engineering, on a collaborative basis, the project team was able to develop preliminary means and methods. Equipment and personnel were mobilized to the jobsite to enable Sevenson to initiate stabilization pilot study and field testing on excavated and containerized material as well as existing material in the pond. Each test was designed to optimize our approach and identify the most effective mix design to meet treatment objectives.

The initial pilot study, conducted in July 2019, utilized a roll-off box containing excavated pond sediments and an excavator-mounted augur-drill attachment to mix a combination of Portland cement, calcium chloride, Ag Lime, and water. This pilot study explored performing stabilization on existing ex-situ pond soil and sediment and transferring the processed material back into the pond for grading and compaction. Six mix designs were developed. Results for consistency, geotechnical parameters, and leaching behavior were documented for each mix.

The second pilot study, conducted in the winter of 2019-2020, used a PC 300 long stick excavator with a mounted auger drill attachment to perform in-situ soil stabilization within the pond working along the pond access road. This pilot focused on four specific mix designs. One objective of this pilot test was to test the methodology using a mixing head. The second objective was to determine if stabilized material could be produced with sufficient strength and durability to allow heavy equipment to operate from the stabilized material for full-scale operations. The third and final objective was to determine if a lower strength material could be produced to have sufficient strength and durability to support construction of wetlands during restoration.

A third full scale pilot study began in November 2020 to collect additional mix design performance data. Utilizing Sevenson's RTG22 Bauer Drill Rig and CMS-45 grout plant, an initial layout of over 300 columns was proposed for stabilization. After 80 columns were successfully installed with highly variable data, it was determined that additional data was needed, and the field pilot study area was expanded to 674 columns. Each column is augur-drilled to a variable depth ranging between 9-ft to 26-ft BGS and stabilized using a variety of mix designs. Over 30 mix designs were tested. Analysis focuses on the unconfined compressive strength of remolded samples collected during drilling and core samples drilled after a specified amount of in-situ curing time (2-3 days). Results have shown that four mix designs in particular have provided the most reliable data illustrating suitability to achieve the desired geotechnical parameters. Further analysis from the data of these four mix designs will assist with determining the final mix design(s) used for the full-scale ISS operation scheduled to begin 2nd Quarter 2022.

ISS Implementation
Sevenson will mobilize two additional Bauer Rigs and grout plants for a total of 3 ISS crews to simultaneously stabilize in separate areas of the slurry pond. Water treatment and discharge operations will resume and continue as necessary to ensure minimal water levels are maintained in the slurry pond to allow for continued ISS progress.

CENTRAL CHEMICAL SUPERFUND SITE - OU1
Hagerstown, MD
$7,500,000
Period of Performance: TBD

Excavation and onsite consolidation of 45,000 CY impacted materials. Installation of a steel sheet pile wall as protective shoring. Excavation dewatering/water management. In-situ solidification of 25,000 CY of former disposal area soils to 40 ft BGS. Installation of a 5-acre engineered cap and cover system. Backfill, seeding, restoration.

FORMER HAMMONTON MGP SITE REMEDIAL ACTION
Hammonton, NJ
$14,301,000
Period of Performance: March 2016 – April 2017

MGP site remediation involved demolition of existing site structures and concrete surfaces. Excavation, processing, and offsite disposal of MGP-impacted soils. Implemented odor control plan using foam during excavation. Installation of a perimeter soil-mixed wall to support in-situ solidification (ISS) operations. ISS of approximately 43,500 CY of contaminated soils. Placement of imported backfill material. Collection, testing, and disposal of MGP-impacted storm water. Scope of work also included installation of an eight-inch-thick aggregate layer earthen/asphalt cap. Site restoration activities include installing signage, fencing, and new asphalt/concrete surfaces, as well as placing topsoil and seeds for vegetative regrowth.

CLARK & MCMASTER STREET FORMER MGP SITE
Auburn, NY
$11,500,000
Period of Performance: June 2015 – June 2018

Excavation of 29,000 CY impacted material from in-situ stabilization barrier cells (soil, brick, concrete, former MGP structures). Installation of 2,080 LF of in-situ soil solidification barrier wall at varying widths using Portland Type 1 Cement to support excavation and resist

hydrostatic pressure. Develop a sanitary and storm sewer bypass plan to divert sewer flows around excavation limits; replace sewer lines and manholes upon backfill of work area. Erection of 96 LF by 115 LF fabric structure with stone and asphalt pad to house screening and stabilization operations; a carbon vapor extraction air handling system was operated during waste material processing. Construct, operate and maintain on-site temporary 100-gpm wastewater treatment plant. Excavate 9,000 CY of sediment and transfer to processing area. Restoration of river bottom and embankments to original grade and river contours.

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50 KENT AVENUE PROPERTY HOLDER AREA INTERIM REMEDIAL MEASURE
FORMER WILLIAMSBURG WORKS MGP SITE
Brooklyn, NY
$20,767,000
Period of Performance: November 2015 – March 2017

The project required the in-situ stabilization (ISS) and excavation of soils and underground structures from the former MGP holder No. 2. Installation of cement-bentonite (CB) slurry and sheet piles for support of deep excavation. Excavation and removal of holders and surrounding soil/fill for off-site treatment and disposal or onsite reuse following sampling and analytical testing. Dewatering of the deep excavation area. Onsite treatment of the water through a 200 GPM WWTP prior to discharge to the POTW. Backfill all areas to final grades and restoration of the site.

FORMER MGP SITE REMEDIATION
Sag Harbor, NY
$18,292,000
Period of Performance: September 2008 – September 2009

Remedial action executed in a densely populated community. Stringent health and safety and community relation plans were required. Excavation, characterization, T+D of soils containing MGP residual COCs. Excavation was conducted under a temporary fabric structure. Installation of 7,200 cubic yards of In-Situ Soil Mix Wall using a large diameter auger deep soil mixing method. The purpose of the wall was to provide structural support and act as a groundwater barrier during excavation. Shallow areas of wall were installed with a combination of 7, 8 and 10-foot auger columns. High ground water table required continuous dewatering. Developed optimum reagent mix design from comprehensive bench-scale program. Installation, operations and maintenance of a 200 gpm wastewater treatment system to process all water encountered during field operations.

ATLANTIC WOOD INDUSTRIES SUPERFUND SITE
Portsmouth, VA
$31,000,000
Period of Performance: October 2014 – October 2017

Mechanical dredging of 330,000 CY of DNAPL creosote contaminated sediments. Dredged materials stabilized with Portland cement and consolidated in two on-site designated containment areas. Other activities include the installation of approximately 425,000 LF of prefabricated vertical drains, underwater debris removal, and site grading and restoration.

FORMER MGP SITE
Nyack, NY
$5,380,625
Period of Performance: April 2004 – July 2006

Installation of an 85 lf x 110 lf temporary fabric structure with air treatment system. Excavated, transported and offsite disposal of MGP impacted soil and debris within structure. In-situ stabilization of additional soil by auger method and jet grouting. Site restoration included backfill, topsoil, and hydro seeding.

CWM CHEMCIAL SERVICES CORRECTIVE MEASURES – LAGOONS SOLIDIFICATION AND CLOSURE
Model City, NY
$5,800,000
Period of Performance: September 1999 – December 2003

Bench-scale treatability study conducted to develop stabilization reagent mix. In-situ stabilization of 90,000 cubic yards of VOC and SVOC sludges from inactive lagoons. Construction of multiple soil and geosynthetic caps over lagoon areas. Installation of an Air Pollution Control System to collect and treat air within a temporary enclosure.

TSCA clay liner and leachate collection system. Construction of a multi-layer RCRA cap. Installation and development of post construction perimeter monitoring well system.

ERM Requirement:

Please provide your Certificate of Insurance and 5-Year Safety Metrics.

Sevenson Response:

Sevenson provides an overview of our health and safety program. Also included are the company's EMR and OSHA Statistics in the tables below.

Health and Safety
Sevenson recognizes the fundamental importance of safety and health to company operations, employees, onsite personnel, clients, local communities, and the environment. To maintain the highest safety standards, Sevenson implements a behavior-based safety system known as a Job Safety Enhancement Program (JSEP). The three keys to a successful JSEP are education, identification, and participation. JSEP incorporates proven procedures for integrating safety into every facet of Sevenson's operations. To effectively manage safety and health issues associated with site activities, a site-specific Health and Safety Plan (HASP) is prepared by Sevenson's Director of Health and Safety, Paul Jung, CIH, CSP, RRPT. The HASPs are administered and implemented by Sevenson's experienced site safety and health officers and enforced by the site superintendent.

Sevenson's Responsibility
Sevenson is fully committed to fulfilling its responsibility to protect the health and safety of company personnel, and the public. To uphold this commitment to occupational health and safety, Sevenson emphasizes the following:

- Adhering to the doctrine that all accidents and incidences are preventable.
- Strictly complying with Sevenson, Client, and OSHA safety programs, policies, procedures, and regulations.
- Continually working to improve the corporate safety and health program.
- Maintaining the philosophy that each and every day safety is the first and foremost responsibility of everyone.
- Obtaining employee "buy in" for the health and safety program, empowering personnel, and creating awareness that everyone is responsible for maintaining a safe work environment.
- Achieving a project goal of zero injuries, illnesses, environmental releases, and incidences by eliminating at-risk behaviors through task observation, coaching, and education.

This proactive, behavior-based safety program has resulted in a proven safe track record, as evidenced by the **Experience Modification Rate (EMR)** summary provided below for the past five (5) years.

Years	2017 – 2018	2018 – 2019	2019 – 2020	2020-2021	2021-2022
EMR	0.62	0.59	0.61	0.62	0.68

*EMR Policy year is July 1st to June 30th.

OSHA INJURY AND ILLNESS STATISTICS

Year	*Total Recordable*	*Total Recordable Incidence Rate*	*DART Cases*	*DART Rate*	*Lost Time Cases*	*Lost Time Incidence Rate*	*Man-hours*
2021	**8**	**1.32**	**5**	**0.82**	**2**	**0.33**	**1,214,168**
2020	**7**	**1.27**	**4**	**0.73**	**2**	**0.36**	**1,100,070**
2019	**10**	**1.93**	**3**	**0.58**	**2**	**0.39**	**1,037,483**
2018	**2**	**0.40**	**2**	**0.40**	**0**	**0.00**	**1,010,688**
2017	**6**	**1.11**	**0**	**0.00**	**0**	**0.00**	**1,080,234**

Health and COVID-19

Since the start of the SARS-CoV2 virus (coronavirus) pandemic in late-February 2020, Sevenson's workforce has been classified as essential, and has successfully executed over 2 million labor hours of project work across the United States with minimal disruption and no shutdowns of its active projects. Sevenson's Health & Safety team monitors local, state, and federal COVID-19 work and travel requirements/restrictions, which are incorporated into our work activities to minimize potential disruptions and maintain the safety of employees, clients, and the general public. For travelers, management factors in both testing and/or quarantine time requirements for the jurisdictions in which our projects are located, to ensure our staff and the communities in which we work are safe and unimpacted by our workers.

Certificate of Insurance

The following page contains a sample Certificate of Insurance.

Client#: 1719064 SEVENENV1

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 6/28/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer any rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Scott Letina
USI Insurance Services LLC 726 Exchange St. Ste 618 Buffalo, NY 14210 716 314-2000	PHONE (A/C, No, Ext): 716 314-2000 FAX (A/C, No): E-MAIL ADDRESS: Scott.Letina@usi.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Berkley Insurance Company	32603
INSURER B : Zurich American Insurance Company	16535
INSURER C : Great American Insurance Company of NY	22136
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Sevenson Environmental Services Inc
2749 Lockport Road
Niagara Falls, NY 14305

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY X PRO-JECT LOC OTHER:	X	X	ECP202941812	07/01/2021	07/01/2022	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$1,000,000 $500,000 $10,000 $1,000,000 $2,000,000 $2,000,000 $
B	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY SCHEDULED AUTOS X HIRED AUTOS ONLY X NON-OWNED AUTOS ONLY X $500 Coll Ded X $250 Comp Ded	X	X	0381572	07/01/2021	07/01/2022	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$1,000,000 $ $ $ $
A	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $	X	X	FFX202941912	07/01/2021	07/01/2022	EACH OCCURRENCE AGGREGATE $	$15,000,000 $15,000,000 $
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	X	0381570	07/01/2021	07/01/2022	X PER STATUTE OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000
C	Build & Contents			MAC429724006	07/01/2021	07/01/2022	Blkt Limits $15,776,485	
C	Leased/Rented Equ			MAC429724006	07/01/2021	07/01/2022	Any One Equip 1,000,000	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
For Bid Purposes Only

CERTIFICATE HOLDER

Sample Certificate

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

ERM Requirement:

Please provide your Avetta status.

Sevenson Response:

Sevenson is currently registered with Avetta.

ERM Requirement:

Can you provide Union Labor?

Sevenson Response:

Sevenson is a union contractor and will perform the work using Union Labor.

ERM Requirement:

Do you have an existing contract with Ameren, and what work have you completed for Ameren in the past?

Sevenson Response:

Sevenson currently has no contract with Ameren but has completed two projects in the past. Below, please see brief descriptions of the work that Sevenson completed with Ameren:

FORMER MGP SITE REMEDIATION P&H MANUFACTURING FACILITY
Shelbyville, IL
$657,000

Project consisted of the excavation and loadout of 18,000 tons of MGP waste and debris within a temporary structure. Sevenson operated a 180GPM temporary water treatment plant and managed Ameren's air handling system. Once it was determined the excavation was within the regulatory limits, the area was backfilled and compacted with

¾ inch stone. The unique aspect of this project was a portion of the existing manufacturing plant had to be demolished to access the impacted area. Once demolition was completed, the temporary structure was erected and the excavation commenced. At no time during the remediation was the manufacturing process interrupted resulting in zero lost production hours.

FORMER MGP SITE REMEDIATION
Decatur, IL
$3,695,000

Project required Sevenson to remove ~70,000 tons of MGP impacted soils and associated tars, oils, and water from inside and around gas holders, tar wells, tar separators, etc. in an active substation.

Sevenson provided the equipment and materials to excavate, stage and load impacted materials and coordinate waste transportation to a designated landfill. A dual slide rail shoring system was chosen by Sevenson based on its ability to allow safe and stable excavation to 25 ft below ground surface. The reversible nature of the shoring system (which allows one wall to stay in place in the ground after backfilling) provided a physical barrier between contaminated materials, yet to be excavated, and clean, placed backfill. This minimized contact and the potential for clean material needing to be handled as impacted material. An initial cut of the excavation footprint was undertaken to lower the working grade inside the tent enclosure. Once the excavation footprint was resurfaced, the shoring system was installed in the section to be excavated. The excavation of contaminated soils was advanced in the shored excavation section until sufficient material had been removed. Next, additional shoring system panels and bracing were installed, and the next section of the excavation below- ground surface was advanced. Upon completion of the excavation and approval of confirmation samples, the shoring system was retracted from the excavation. The shoring system was advanced across the excavation footprint in this fashion until all contaminated material had been excavated and backfilled. Once final backfill was placed, graded, and compacted the tent structure was relocated (by others) to the next excavation phase location and the sequence was repeated. Sevenson's excavation approach allowed for deep excavations to be conducted in confined areas with limited overhead. This approach limited the amount of clean material needing to be disposed of due to cross-contamination with unexcavated sections.

In-Situ Stabilization Support

Sevenson has included the resume of our In-Situ Stabilization Expert, Christopher R. Ryan P.E., D.G.E.

Mr. Ryan founded the firm of Geo-Solutions Inc. that established an international clientele in specialty contracting on projects involving soil and groundwater in 1996. Geo-Solutions was and is still involved in projects throughout the US, Canada, and multiple other foreign countries. Previously, in 1979, he had founded and led a similar company, Geo-Con, Inc. In 2013, the two companies were combined through an acquisition process.

Both companies were pioneers and innovators in the field of soil mixing, and they led the US market in what is now a more common geotechnical and geo-environmental technology. This resume focuses on Mr. Ryan's background and experience in Soil Mixing, particularly in environmental applications.

In early 2014, Mr. Ryan retired from Geo-Solutions. He established an independent consulting practice working for contractors, owners, and engineers to assess cost and feasibility of specialized underground construction technologies, including soil mixing.

In addition, Mr. Ryan has designed and supervised the construction of large-scale reagent mixing plants that were designed to accurately mix components and apply known volumes of reagents to soil mix columns. He also was responsible for concocting and testing dozens of design mixes to treat soils or wastes to meet required standards of strength, permeability and/or leachability for all kinds of site conditions. Under his leadership, his companies completed more than 200 soil mixing projects, most of them for environmental applications.

Mr. Ryan's resume begins on the following page.

Christopher R. Ryan. P.E., D.G.E

Slurry Wall / Mix Design / In-Situ Stabilization Technical Expert

EXPERIENCE & EXPERTISE:

- ✓ Mr. Ryan has had in excess of 40 years' experience constructing solutions to soil and groundwater problems. These include:
- ✓ Deep Soil Mixing (DSM) with triple shaft augers (Jackson Lake Dam WY 1986).
- ✓ Construction of the first US triple shaft DSM rig.
- ✓ DSM as an environmental containment barrier.
- ✓ Large diameter single shaft soil mixing for high production soil mixing at lesser depths. (Texas 1989).
- ✓ Soil mixing for stabilizing hazardous wastes in the underground environment.
- ✓ Soil mixing to stabilize oily lagoon sludge ponds.
- ✓ Hot air and soil mixing to strip volatile organics from contaminated soil.
- ✓ Mixing sediments under water.
- ✓ Two stage application of reagents for more cost-effective environmental remediation.
- ✓ Use of oxidizers and other specialized reagents like potassium permanganate and zero-valent iron applied with soil mixing to decontaminate sites.

EXPERIENCE & EDUCATION:

- ✓ Years of Experience: 40
- ✓ BS Civil Engineering, M.I.T. (1969)
- ✓ MS Civil Engineering, M.I.T. (1972)
- ✓ Civil Engineer Degree, M.I.T. (1972)
- ✓ Professional Engineer - Pennsylvania (Inactive-Retired status)
- ✓ Diplomate of Geotechnical Engineering – American Society of Civil Engineers, Geo-Institute (Inactive-retired)
- ✓ Licensed Contractor – Formerly held licenses in various states as required (including CA, NV, UT, AZ, NC, TN, LA and FL)
- ✓ Dispute Resolution Board Certified Member with DBRF Admin and Practice Training

- ✓ **CERTIFICATIONS:**
- ✓ OSHA 40 Hour HAZWOPER Training
- ✓ OSHA 8 Hour HAZWOPER Refresher

PAST PROJECT EXPERIENCE:

Former Harrison Manufactured Gas Plant Remediation, Harrison, NJ

In-situ soil stabilization via deep soil mixing (auger) and shallow mixing with excavator. Pre-excavated 275,000 tons of soil/debris (concrete, timbers) to a depth of 7-ft. to create platform for ISS work. Cleared obstructions down to depths of 25-ft. BGS to facilitate ISS work. ISS of 230,000 CY via deep auger mixing down to maximum depth of 45-ft. BGS. ISS of 145,000 CY via excavator down to a max depth of 25-ft. BGS. Processed soils with reagent to comply with T+D facility requirements. Controlled odors and vapors using 300,000 gallons of RUSMAR odor suppressant foam (short and long term) and 60,000 gallons of SLSUPER odor neutralizing agent. Demolished existing site buildings and perform Hazardous Abatement. Dewatering for treatment via 200 GPM WWTP. Installed 2,200 LF Hydraulic Barrier Wall (HBW) to depths down to 100-ft. BGS using DeWind One Passing Trencher. Jet grout termination at HBW interface/existing gas lines. Installed utility corridor consisting of 16-in. and 36-in. gas lines. Restored 330,000 SF with 130,000 tons of clean import fill.

Dam Foundation Improvement, Morgantown, NC (2017)

Consulting with General Contractor to determine merits of a claim involving alleged differing site conditions and contract changes on a soil mixing project to improve the foundations under a new section of an embankment dam.

MGP Site Remediation, Santa Rosa, CA (2012)

Source treatment and containment at a former manufactured Gas Plant (MGP) site. Source area was treated with soil mixing to mitigate environmental impacts to local groundwater environment.

Seattle DOT, Seattle, WA (2012)

Subconsultant to design team for replacement of old seawall in downtown Seattle tourist district. The specific problem was soil liquefaction during potential earthquake. The solution involved a major jet grouting and soil mixing project.

Stabilization of MGP-Impacted Soils, Cincinnati, OH (2012)

Single shaft mixing to stabilize 100,000 CY of impacted soils using a mixture of Portland cement, slag and bentonite to depths of 40 ft.

Dam Foundation Improvement, Morgantown, NC (2017)

Consulting with General Contractor to determine merits of a claim involving alleged differing site conditions and contract changes on a soil mixing project to improve the foundations under a new section of an embankment dam.

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Stabilization of MGP-Impacted Soils, Cincinnati, OH (2012)

Single shaft mixing to stabilize 100,000 CY of impacted soils using a mixture of Portland cement, slag and bentonite to depths of 40 ft.

Environmental Resource Management, Robbinsville, NJ (2011)

Single auger soil mixing to treat pesticide and xylene contaminated soils in two stages. In-situ chemical oxidation was achieved on this project.

East Rutherford, NJ (2010)

Large diameter auger used to mix TCE-contaminated soils in two steps to decontaminate and then stabilize the materials for future development of a post office.

BCEER, Beijing, China (2010)

Development of design mixes for soil mixing at a former chemical facility with contaminated water underground. The project involved on site visit, formulation of trial mix program and mixing the actual trial mix samples on site.

Rochester Gas and Electric, Rochester, NY (2008)

Single large diameter shaft mixing of MGP impacted soils on the banks of the Genesee River in downtown Rochester. 13,000 CY mixed at depths of up to 20 ft.

USEPA, Utica, NY (2007)

15,000 CY of PCB-contaminated soils were stabilized with single shaft equipment to meet specified strength and leachability criteria.

Orange and Rockland Utilities, Nyack, NY (2006)

2,400 CY of MGP-contaminated soils were stabilized with single shaft equipment to meet specified strength and leachability criteria.

US Navy, Camp Lejeune, NC (2005)

Treat 7000 CY of TCE-contaminated soil using ZVI Clay and single shaft equipment.

Atlanta Gas Light, Augusta, GA (2001)

Treat 200,000 CY of semi-volatile impacted soil to depths of 30 ft using single-shaft soil mixing.

South 8th Street Landfill Superfund Site, West Memphis, AR (2000)

66,000 CY of material treated with two-step reagent process to meet EPA requirements for strength and leachability.

Department of Energy, Piketon, OH (1994)

Volatiles in 28,000 CY of soil were first stripped with hot air and then stabilized with cement in a two-stage soil mixing operation to depths of 22 ft.

Dzuz Fastener Superfund Site, West Islip, NY (1996)

10,000 CY of ISS single shaft auger mixing 18 ft deep, to stabilize organic compounds in the soil and groundwater.

Amoco Oil, Whiting, IN (1993)

Stabilization of oily wastes in a lagoon filled with surface water drainage using single shaft augers working through the accumulated water. 100,000 CY of materials were stabilized, and storage tanks were later built on the stabilized material.

DESIGN MIX STUDIES

Mr. Ryan has extensive experience in designing admixture formulations to meet specified physical and chemical properties of In-Situ Stabilized materials, including many types of soil and sludge. He uses his extensive construction experience to design mixes that also will work for the particular process and method of application for each site. He has hands-on and supervisory experience in over 200 such design processes including, in most cases, subsequent field application and verification of success. A few examples are:

Constructability Review and Bench Scale Study, Manhattan, NY (2012)

Bench scale study to determine an efficient reagent combination for the stabilization of the impacted soils.

Water Street Former MGP Site, Troy, NY (2012)

Bench scale study to determine an efficient reagent combination for the stabilization of MGP coal tar impacted soils.

Bench Scale Study Wood Treating Site, Warsaw, VA (2011)

Bench scale study of reagent combinations in the presence of creosote-contaminated soils and groundwater.

Field Pilot Study Former Coking Plant, Beijing, China (2010)

A bench scale and pilot scale project to determine a good admixture for this project that had 1.2 million CM of contaminated soil.

Treatability Study North Cavalcade Superfund Site, Houston, TX (2010)

Performed a bench scale treatability test with a large number of reagents and mixtures to optimize reagent combination for the stabilization of BTEX and PAH impacted soils.

Design Mix, El Dorado, KS (2010)

Consultation services for the development of an efficient and cost-effective mix design to stabilize refinery sludge ponds.

Design Mix Testing NYSEG – Madison Ave Former MGP Site, Elmira, NY (2009)

Laboratory design mix studies to develop a mixture that would decrease the permeability and increase the strength of the soils.

Design Mix former MGP Site for Consolidated Edison, New York City, NY (2009)

Laboratory design mix study, and related tasks for ISS treatment of MGP impacted soils.

MGP Site at East Station for Rochester Gas & Electric, Rochester, NY (2007)

Laboratory design mix study, work plan, review of specifications, and related tasks for ISS barrier and treatment of MGP impacted soils.

Professional Societies/Affiliations:

- American Society of Civil Engineers (Formerly served on Environmental Geotechnics, Grouting and Soil Mixing Committees)
- Chi Epsilon (Civil Engineering Honorary Fraternity)
- Deep Foundations Institute (inactive)
- The Moles (Emeritus status)
- American Institute of Entrepreneurs
- Young Presidents Organization/World Presidents Organization

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7 November 2022

Mr. Greggory Miller
Illinois Environmental Protection Agency
Federal Site Remediation Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
greggory.miller@illinois.gov

Subject: EPA ID: ILD981781065
Ameren CIPS Site, Taylorville, IL
Response to IEPA Review of Remedial Delineation Field Sampling Plan

Dear Mr. Miller:

On behalf of the Ameren Services (Ameren), Environmental Resources Management Inc. (ERM) is pleased to submit this Response Letter for the former manufactured gas plant (FMGP) site located at 917 South Webster Street in Taylorville, IL ("Site"). The Remedial Evaluation Work Plan for the Site was prepared by ERM and dated July 2022. The Plan was submitted by ERM and disapproved with comments by the Illinois Environmental Protection Agency (IEPA) in a letter to Mr. Dave Palmer of Ameren dated 17 August 2022. Per IEPA comments, the previous Remedial Evaluation Work Plan has been renamed to the Remedial Delineation Field Sampling Plan (FSP) and will be referred to as such going forward.

Ameren appreciates the review by the IEPA and submits the following responses and additional information related to the FSP, as appropriate:

Universal Changes to the FSP:

For clarity and/or context, the following unsolicited changes have been made by ERM in this revision of the FSP:

- The Plan has been renamed to a Field Sampling Plan, associated with the remedial delineation activities to evaluate ISS as a remedial alternative at the Site.
- Sections have been numbered to ease navigation and cross-referencing of the document and comments.
- Additional historical details have been added in Section 3.2 Regulatory Approach as a result of ERM's most recent review of the IEPA file archive.

***IEPA General Comments**:*

- *General Comment 1: Please include sections discussing:*
  - *The purpose of both the work plan and the Quality Assurance Project Plan (QAPP) in the superfund process.*
  - *Project organization, listing members of the project team as well as their roles responsibilities, and contact information. In addition, please designate which of these individuals is the legal contact person for the facility in the event there are questions or issues regarding the site.*

The FSP has been revised to include, in Section 3.1, a purpose statement for the FSP and how it, along with the QAPP, make up the components of a Sampling Analyses Plan (SAP).

ERM has also added a Project Organization section, Section 3.3, to present the information requested by this IEPA comment.

- *General Comment 2: EPA encourages use of the Unified Federal Program (UFP) QAPP format for all QAPPs. Details on a UFP QAPP can be found at: https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-training-materials.*

A statement that the QAPP will utilize the UFP format has been added to Section 4.2. The associated UFP-formatted QAPP was submitted to IEPA on 14 September 2022.

- *General Comment 3: Illinois EPA requests the title and scope of the work plan be modified to meet the NCP requirement for a Sampling and Analysis Plan (40 CFR 300.430(b)(8)) demonstrating data of sufficient quantity and quality will be collected to satisfy data needs. It is suggested that the work plan itself be re-titled and modified as necessary to be the Field Sampling Plan, which along with the QAPP constitute the SAP required by the NCP.*

The document has been retitled and a statement added in Section 3.1 noting that this FSP and the Remedial Delineation QAPP, submitted on 14 September 2022, constitute the SAP required by the NCP.

- *General Comment 4: Please be advised the USEPA will not be reviewing the QAPP. Without formal approval of the QAPP by USEPA prior to commencing work, the work will be done at some risk to Ameren. However, given the treatability study nature of the work to be completed, Illinois EPA believes this risk to be low.*

This comment is noted.

***IEPA Specific Comments**:*

1. *Site Description, Page 2: In the 2015 FS Ameren owned 43 Acres of land in the area. The total acres discussed total 40.2. Please clarify if Ameren owns any other land beyond what is discussed here in the Site Description.*

ERM has corrected and clarified the parcel that the Site is located upon ("parent parcel") and the parcels to which Ameren owns to the south of the Site. Section 2.1 Site Description has been revised, in part, to read:

> *"The former Ameren/Taylorville Manufactured Gas Plant (MGP) is located at 917 South Webster Street in Taylorville, Christian County, Illinois. The footprint of the former MGP is approximately one acre in size. The Site is located on a 2.56-acre parent parcel (PIN# 17-13-27-331-005-00), that is owned by Ameren. Adjacent to the parent parcel's southern border there is a 15.56-acre combined parcel (PIN# 17-13-27-300-001-00) and immediately south of it is a 2.74-acre parcel (PIN# 17-13-34-100-010-00). These two southern adjacent parcels are owned by Ameren and, along with the parent parcel, make up an approximate area of 20.8 acres that are under an Environmental Covenant (EC) with the IEPA, restricting disturbance of soil and use of groundwater for potable purposes from the EC Area. In addition, Ameren owns a 20.29-acre parcel (PIN# 17-13-34-200-003-01), further to the southeast, across South Webster Street."*

The actual boundaries of the Site and the adjacent, Ameren-owned properties will be confirmed by the surveying activities to be conducted as part of this investigation. The completion of the surveying activities is anticipated to be in the fall/winter of 2022 when leaves are no longer present on trees and the boundaries in wooded areas can be confirmed. A general understanding of the boundaries is now being mapped and will be included in the Long-Term Stewardship Plan that is being prepared currently for the Site and will be submitted to the IEPA in the November 2022 timeframe.

2. *Site MGP History, Page 2: Please include a summary of relevant data on previous investigations. This includes but is not limited to historical structures, tanks which were removed, and the capacity of the tanks removed from the ground.*

ERM conducted a file review to obtain details on the size of the tanks that were removed and were not able to find documentation on the volumes of the tanks referenced in the original USEPA documents. We were able to find the diameter of the gas holder – 40 feet – and a list of structures removed and have included them in the revised FSP. Therefore, the following text has been added to Section 2.2. Site MGP History of the revised FSP:

"An immediate removal action taken by Ameren in 1987 resulted in the demolition and removal of all former gas plant structures above and below ground, excavation and offsite disposal of heavily-impacted source materials, and backfilling of affected areas with clean soils. Structures that were removed during the IRA include a 40-foot diameter, partially buried gas holder, a smaller tar well, along with the former brick MGP building, retaining walls, a septic tank, and two tar separators. Approximately 9,000 yd^3 of soil to a depth of 10 feet bgs on the Site and 3,000 yd^3 to a depth of 3 feet bgs offsite, adjacent to the south of the Site.

3. *Site History, Page 3: Please include a few sentences on the contaminants of concern and their maximum contaminant levels.*

The following text has been added to Section 2. 2. Site MGP History of the revised FSP:

"Residual impacts of VOCs and semi-volatile organic compounds (SVOCs), including PAHs, are suspected to remain below the limits of the 1987 excavation and water table. The level of impact in soil that currently exists will be determined through implementation of this FSP. The VOC, benzene, and the SVOC, naphthalene, have been the primary COCs to exceed remediation objectives in groundwater. Currently, the highest levels of impact in groundwater, which has been monitored since 1995, is noted at GW-4R (see Figure 3). Benzene concentrations in groundwater samples from MW-4R have dropped from almost 1,800 ug/L in 2015 to about 1,000 ug/L in 2022, while naphthalene in groundwater samples from this well had a maximum concentration of 5,500 ug/L but is currently approximately 3,300 ug/L.

4. *Regulatory Approach, Page 4: Please include the shutdowns in 2017 and 2019 when discussing cession of operations of the pump and treat system.*

The following text has been added to Section 3.2 Regulatory Approach of the revised FSP:

"The groundwater P&T system began operation in 1995 and has operated continuously, with the exception of time periods in 2006-2007 and 2010-2012 for the implementation of ISCO and subsequent monitoring activities. The P&T system was also shut down for a period in 2017 as there were staffing and contractual issues with the City of Taylorville's operator . Groundwater continued to be monitored during this period of time and significant decreases were seen in onsite

wells as expected with the P&T system shut down. An increase in benzene and naphthalene was noted in two central wells onsite in 2019 and the P&T system was put back into operation."

5. *Regulatory Approach, Page 4: This section states, "The ESD is currently being modified…" For the changes being described, a full ROD Amendment is required, not a modified ESD. Please clarify this in the text.*

The subject text in Section 3.2 Regulatory Approach of the revised FSP has been modified to read:

"The 2015 ESD has been withdrawn from IEPA and Ameren is now pursuing this potential change of remedy through an eventual ROD amendment."

6. *Task 6, Page 9: Please include the source of operation goals discussed in the text.*

Additional details have been added to Section 4.6. Task 6 – ISS Bench-Scale Treatability Study of the revised FSP along with a reference to the source of the goals for Task 6 as follows:

"These remedial goals are general field requirements for ISS and are consistent with the July 2011 Interstate Technology and Research Council (ITRC) guidance document "Development of Performance Specifications for Solidification/Stabilization"."

7. *Monitoring Well Abandonment, Page 10: When discussing the abandonment of monitoring wells, please note they must be abandoned pursuant to regulations promulgated by the Illinois Department of Public Health at 77 Ill. Adm. Code 920.120.*

The text in Section 4.9. Task 9 – Monitoring Well Abandonment & Post Remediation Sampling Program has been modified to include:

"Monitoring wells will be abandoned in accordance with the Illinois Department of Public Health requirements 77 Illinois Administrative Code 920.120. Ameren will notify the local county health department for documentation of abandonment activities."

Should you have any questions or comments please do not hesitate to contact Dan Wilkens at 314-733-4489.

Yours sincerely,

Dan Wilkens, P.G.
Partner

Pam Holley
Principal Consultant

Enclosures: ERM *Remedial Delineation Field Sampling Plan, Ameren CIPS Site, Taylorville, Illinois*, November 2022

cc: Dave Palmer, Ameren Services
Amy Weber, Ameren Services
Dan Wilkens, ERM