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December 20, 2016

HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503

Attn: Mr. Jacques Annandale, PE

RE: REPORT TRANSMITTAL

The purpose of this letter is to transmit our December 2016, *Geotechnical Engineering Report, ARRC Sewer Line Extension _ Phase IV, Anchorage, Alaska*. We truly appreciate this opportunity and hope that we can continue to provide you with geotechnical or environmental consulting services. Please give me a call if you have any questions about the enclosed report. Hard copies to follow.

Sincerely,

SHANNON & WILSON, INC.

Grover L. Johnson, PE

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Geotechnical Engineering Report
ARRC Sewer Line Extension – Phase IV
Anchorage, Alaska

December 2016

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ANCHORAGE, ALASKA

1.0 INTRODUCTION

This report presents the results of subsurface explorations, laboratory testing and geotechnical engineering studies conducted by Shannon & Wilson, Inc. for a proposed new sewer line in the Ship Creek area of Anchorage, Alaska. The purpose of this geotechnical study was to gather subsurface geotechnical and environmental data and make geotechnical engineering recommendations for design and construction of the proposed new sewer utility line. To accomplish this we advanced four geotechnical borings. Selected soil samples recovered from the borings were tested in our Anchorage laboratory, as well as by SGS North America (SGS), and Coffman Engineers. Presented in this report are descriptions of the site and project, subsurface exploration and laboratory test results, an interpretation of subsurface conditions, and our geotechnical engineering recommendations for design and construction of the new sewer line.

Authorization to proceed with this work was received in the form of a signed subconsultant agreement from Mr. Timothy Gallagher of HDR Alaska, Inc. (HDR) on September 27, 2016. Our work was conducted in general accordance with our August 17, 2016 proposal with the exception that Boring B-1 was continued to a depth of 41.5 feet below the ground surface (bgs) because soft clays were encountered.

2.0 SITE AND PROJECT DESCRIPTION

The project is generally located in the Ship Creek area, approximately 900 feet to the west of the intersection of East Whitney Road and Post Road, of Anchorage, Alaska. We understand that the Alaska Railroad Corporation (ARRC) owns this property and wishes to install approximately 577 feet of new sewer line to service the businesses within this area. This phase of the project alignment runs roughly north to south from an existing sewer main in East Whitney Road, through the eastern utility easement of the property occupied by Alaska West Express (1048 East Whitney Road), and then along the western utility easement of the property occupied by RWC Group (1301 Post Road) before terminating in an alleyway to the south of the RWC Group property. The alignment is bisected between the two properties by the ARRC mainline. We understand that then new sewer line extension is planned to be installed with traditional open trench excavations at the ends of the alignment, but that trenchless methods will be used beneath the mainline. We also understand that five manholes will also be installed as part of this phase of the project. One manhole will be placed in East Whitney Road at the connection with the existing sewer main, two will be placed adjacent to both sides of the ARRC mainline, and two will be in the alleyway at the south end of the sewer extension.

This area is developed with numerous industrial buildings and the ARRC mainline. Ship Creek lies to the south of the proposed new alignment. The overall topography of this area slopes slightly down from north to south with an overall elevation change of approximately five feet from one end of the project to the other. However, there is a relatively small ARRC embankment at the mainline and a fill embankment at the RWC Group property that is approximately 6 to 8 feet high relative to the adjacent ground surface north and south of the property. A vicinity map indicating the general project location is presented as Figure 1. A site plan, included as Figure 2, shows prominent site features and the approximate boring locations.

3.0 SUBSURFACE EXPLORATIONS

Subsurface explorations for this study consisted of drilling and sampling four borings, designated Borings B-1 through B-4, along the project alignment on October 24 and 25, 2016. The general boring locations were selected to provide relatively even coverage along the alignment and to collect information near the proposed new manhole locations. The approximate boring locations, shown on Figure 2, were recorded with a handheld global positioning system (GPS) capable of horizontal accuracies of ±20 feet. It should be noted that GPS accuracy may be affected by tree canopies, geographic features, and other atmospheric anomalies. Elevations shown on the boring logs were extrapolated from topographic contours provided by the Municipality of Anchorage GIS department. Therefore the boring locations shown on the site plan and elevations reported on the boring logs should be considered approximate.

Drilling services for this project were provided by Discovery Drilling of Anchorage, Alaska, using a track mounted Geoprobe 7822DT drill rig. An engineer from our firm was present during drilling to locate the borings, observe drill action, collect samples, log subsurface conditions, and observe groundwater conditions.

The borings were advanced with $3^1/_4$-inch inner diameter (ID), continuous flight, hollow-stem augers. Borings were generally advanced to depths of between approximately 21.5 and 41.5 feet bgs. As the borings were advanced, samples were typically recovered using modified penetration test (MPT) methods at 2.5-foot intervals to 15 feet bgs, and then at 5-foot intervals thereafter to the bottom of the borings. In the MPT method, samples are recovered by driving a 3-inch outer diameter (OD) split-spoon sampler into the bottom of the advancing hole with blows of a 340-pound hammer free falling 30 inches onto the drill rod. For each sample, the number of blows required to drive the sampler the final 12 inches of an 18-inch penetration into undisturbed soil is recorded. Blow counts are shown graphically on the boring log figures as “penetration resistance” and are displayed adjacent to sample depth. The penetration resistance values give a measure of the relative density (compactness) or consistency (stiffness) of cohesionless or cohesive soils, respectively. In addition to the split spoon samples, a grab sample of the near-surface soils was collected from the auger cuttings in the upper 1.5 to 2 feet of each boring.

The soil samples collected above the depth where groundwater was encountered during drilling were "screened" for volatile organic vapors using a photoionization detector (PID) and an Alaska Department of Environmental Conservation (ADEC) approved headspace screening technique. The PID was calibrated before screening activities with 100 parts per million (ppm) isobutylene standard gas. The field screening samples were collected in re-sealable plastic bags and generally tested once they had been warmed to at least approximate room temperature. PID results are shown on the boring logs presented as Figures 5 through 8.

The soils were visually classified in the field in general accordance with the classification system described by ASTM International (ASTM) D 2487. Selected samples recovered during drilling were tested in our laboratory to refine our soil descriptions in general accordance with the Unified Soil Classification System (USCS) presented as Figure 3, Sheets 1 through 3. USCS classification symbols are presented on the boring logs where gradation testing was performed. Frost classifications were also estimated for samples based on laboratory testing (sieve analyses) and are shown on the boring logs. The frost classification system is presented as Figure 4. Summary logs of the borings are presented as Figures 5 through 8.

Borings were completed by installing a 1-inch, polyvinyl chloride (PVC) casing that were slotted at the bottom to facilitate future observation of groundwater levels. The annular space between the borehole wall and casing was backfilled with cuttings produced during drilling activity. Where vehicle traffic was likely (Borings B-1 and B-2), a steel, flush-mount monument was installed to protect the top of the casing. Where no traffic was expected (Borings B-3 and B-4), the PVC was left with some casing sticking up above the ground surface. The installation details for the observation wells are shown on the corresponding boring logs. Our field representative went back to the site on November 30, 2016 to take water level readings in the wells. These readings are documented on the corresponding borings logs.

4.0 ENVIRONMENTAL RECORDS REVIEW

State database records were researched for pertinent information regarding the environmental conditions within the project area. For the purposes of this search the project area, designated the "Project", is defined as starting at an existing sewer main on East Whitney Road, approximately 900 feet west of the Post Road intersection, and ending approximately 577 feet south from the existing sewer main on East Whitney Road.

4.1 Leaking Underground Storage Tank Database

The ADEC Leaking Underground Storage Tank (LUST) database was reviewed December 15, 2016. Six LUST sites are located within 0.25 mile of the project. The two closest LUST sites are described below. Information regarding the LUST sites listed on the database is summarized in Table 1.

ARRC Mammoth Alaska site is an active site located approximately 125 feet west of the Project. In 1990, contaminated soil was encountered when five underground storage tanks (USTs) were removed. Contaminated soil was excavated and stockpiled during removal. The site was added to the database on October 9, 1990. According to the database, six monitoring wells were installed. Groundwater flow is to the south. Site characterization activities have been ongoing at the site since June 1994, including soil characterization and groundwater monitoring.

The ARRC Corp Redevelopment site is located 550 feet west of the Project. A UST was removed from the ground. According to the ADEC, no soil staining was present during the removal of the UST. The site was added to the database on May 21, 1998. The ADEC granted site closure on November 12, 1998. No other information regarding the contamination at the site or remediation activities is listed on the ADEC database

4.2 Contaminated Sites Database

The ADEC Contaminated Sites database was reviewed November 15, 2016. Seventeen contaminated sites are located within 0.25 mile of the project. The two closest contaminated sites and the closest active contaminated site are described below. Information regarding the contaminated sites listed on the database is summarized in Table 2.

Service America is located approximately 75 feet northeast of the Project. The site was added to the database in 1990 when diesel contaminated soil was encountered while removing two heating oil USTs. The contaminated soil was excavated and stockpiled until groundwater was reached. According to the database, approximately 75 cubic yards of contaminated soils were removed and disposed off-site. During a site visit, visual and olfactory evidence of the presences of significant amount of petroleum contaminated groundwater was found. Groundwater contamination was monitored from 1990 to 1992. Site cleanup was considered complete with institutional control in 2009.

ARRC Operations Building is located approximately 400 feet northwest of the Project. The site was added to the database in 2005 when two tanks were removed, including a 3,000-gallon heating oil UST and a 2,500-gallon diesel UST and associated dispenser. During the initial tank excavation, 20 cubic yards of petroleum impacted soil were excavated and transported to Alaska Soil Recycling (ASR) for thermal treatment. Soil Samples taken from the limits of the excavation indicated that total petroleum hydrocarbons were present in concentration up to 15,300mg/kg. Benzene was present in one sample at a concentration of 0.035 mg/kg. An additional excavation was conducted at the former site of the USTs. Guiding by field screening with a PID, approximately 1,337 cubic yards of petroleum impacted soil was removed from around the former USTs and transported to ASR for treatment. Confirmation soil samples taken from the limits of the excavation indicated that diesel range organics (DRO) up to 447 mg/kg and trichloroethylene (TCE) concentrations up to 0.64 mg/kg remained in the soil at the site. The excavation was backfilled with a combination of clean fill and treated soil that had been returned by ASR.   Site cleanup was considered cleanup complete in 2007.

ARRC – Arctic Cooperage is the closest active contaminated site located approximately 500 feet west of the Project. The site was added to the database in 1992 during a phase II site assessment found the site to be an oil refinery operation, which was destroyed during the 1964 earthquake. The site was also later used from 1977-1988 as a barrel reconditioning operation. Visual signs of the site use included machinery, drums, spills, a UST, and a gasoline UST. The two USTs, which were found to be the main source of contamination, were removed from the site and soil boring samples and monitoring wells indicated high diesel range organics (DRO) levels. Site characterization activities have been ongoing at the site since 1996, including soil characterization and groundwater monitoring.

5.0 LABORATORY TESTING

Laboratory tests were performed on selected samples recovered from the borings to confirm field classifications and to estimate the index properties of the typical materials encountered. The laboratory testing was formulated with emphasis on estimating the material gradation and in-situ water content.

Water content tests were performed in general accordance with ASTM D 2216. The results of the water content measurements are presented graphically on the boring logs presented as Figures 5 through 8.

Grain size classification (gradation) testing was performed to estimate the particle size distribution of selected samples from the borings. The gradation testing generally followed the procedures described in ASTM C 136. The grain size testing results are presented in Figure 9 (three sheets) and summarized on the boring logs as percent gravel, percent sand, and percent fines. Percent fines on the boring logs are equal to the sum of the silt and clay fractions indicated by the percent passing the No. 200 sieve. Note that sieve testing indicates particle size only and visual classification under USCS designates the entire fraction of soil finer than the No. 200 sieve as silt unless Atterberg limit data shows plasticity properties consistent with clay.

Atterberg limits were evaluated for samples of the native, fine-grained soils encountered during our explorations to identify plasticity characteristics. This test generally followed procedures described in ASTM D 4318. The results of this test are presented on the boring log and on the Atterberg Limits Results which is presented as Figure 10.

Selected samples were submitted to Coffman for a corrosivity evaluation. The samples were analyzed for pH and resistivity by ASTM G 51-95 and ASTM G 57-95a, respectively. The corrosivity testing and evaluation results are presented in Appendix A.

One sample from each of Borings B-1 through B-3 and two samples from Boring B-4 were collected and analyzed by SGS for volatile organic compounds (VOCs) according to Environmental Protection Agency (EPA) Method 8260D; gasoline range organics (GRO) by Alaska Method 101 (AK101); diesel range organics (DRO) by AK102; and residual range organics (RRO) by AK103. The results of the analytical testing are presented in Table B-1 of Appendix B, discussed in Section 6.2, and presented in Appendix B.

6.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered are presented graphically on the boring logs presented as Figures 5 through 8. The results of limited analytical testing performed during our field effort are discussed below and summarized in Table B-1 of Appendix B. The Level II Laboratory Data Report from SGS is included in Appendix B.

6.1 Soil Conditions

In general, our borings encountered about 4.5 feet of granular fill soils with varying amounts of silt in Borings B-1 and B-2, about 8 feet in Boring B-3, and about 6 feet in Boring B-4. Trace to little amounts of organics were observed in the fill soils in Borings B-2, B-3, and B-4. Wire and plastic debris were observed within the fill layer in Boring B-2. Roughly 8 inches of peat were found between approximately 6.3 and 7 feet bgs in Boring B-4, at the south end of the project.

Layers of native granular and fine grained soils were found beneath the fill, and they extended to the Bootlegger Cove clay soils that were encountered at approximately 13 feet bgs in Borings B-1 and B-2, 17 feet bgs is Boring B-3, and at about 15 feet bgs in Boring B-4. Our borings ended in Bootlegger Cove clay that was typically very soft. Boring B-1 was extended to a depth of 41.5 feet bgs in an unsuccessful attempt to find more firm conditions. Thin seams of silt and sand were observed throughout the Bootlegger Cove clay soils in our borings.

Coarse grained materials encountered in our borings generally consisted of gravel with silt and sand, sand with silt and gravel, and silty sand with gravel. The relative density of these soils was generally medium dense to dense, with blow counts typically ranging between 12 and 45 blows per foot (bpf) with an approximate average at about 24 bpf. Loose conditions were encountered in the fill material (the upper 6.3 feet) in Boring B-4, with average blow counts of about 6 bpf. According to our laboratory tests, typical moisture contents in the coarse grained material above the groundwater table ranged between approximately 3 and 18.5 percent, with the higher moisture content in the soils with higher fines contents. Gradation tests performed in the laboratory show estimated fines contents of the coarse grained soils ranging between approximately 7 and 42 percent in the samples tested. The fill and native material in Borings B-2 and B-3 had similar characteristics, making it difficult to discern a contact that would delineate the exact depth of fill.

Fine grained soils encountered in our borings generally consisted of sandy silt and lean clay. The consistency of the fine grained material was very soft to very stiff with blow counts ranging from 0 to 14 bpf. According to our laboratory tests, typical moisture contents in the fine grained material generally ranged between approximately 16.5 and 50 percent. One gradation test was performed in the laboratory on a sample of fine grained soils overlying the Bootlegger Cove formation showed an estimated fines content of approximately 62 percent.

Groundwater was observed during drilling between approximately 7 and 13.2 feet bgs. Groundwater depths are presented on the corresponding boring logs in Figures 5 through 8. Static water levels were measured between depths of approximately 7.1 and 10.9 feet bgs on

November 30, 2016. It should be noted that groundwater levels may fluctuate by several feet seasonally.

Selected samples collected from approximately 7.5 to 11.5 feet bgs in each boring were submitted to Coffman Engineers for a corrosivity evaluation. Based on the results of the Coffman report, the resistivity of the samples tested ranged between 3,500 and 120,000 ohm-cm in the ‘as-received’ state and the pH ranged between 5.94 and 6.92. Consistent with Coffman Engineers corrosivity evaluation, the soils at the approximate burial depth of 7.5 to 10 feet bgs should be considered corrosive. Detailed discussion by Coffman Engineers is presented in Appendix A.

6.2 Environmental Subsurface Conditions

One (two from Boring B-4) soil sample from each boring was selectively analyzed for GRO, DRO, RRO, and VOCs to provide background information regarding the environmental subsurface conditions encountered by our borings. Samples were collected in approximately the upper 7.5 to 14 feet of each boring, depending at the depth where groundwater was encountered during drilling. Sample selection was based on the highest PID reading recorded in each boring during drilling. One soil trip blank was also returned to the laboratory for quality control. The trip blank was used to evaluate potential cross contamination of volatile constituents. The trip blank was analyzed for GRO and VOCs.

Under the sample numbering scheme used for this project, a typical analytical sample number is 02549-B1 S1. The ‘02549-’ indicates the last five digits of the Shannon & Wilson job number. The ‘B1 S1’ designations represent the boring and sample identification numbers (Boring B-1 Sample S1). For brevity in the text of this report, the ‘02549-’ prefix is omitted and samples are identified by their boring and sample identification number.

The applicable soil and groundwater cleanup levels are presented in the Oil and Other Hazardous Substances Pollution Control Regulations of 18 AAC 75 (2016). The soil cleanup levels were developed using Tables B1 and B2 of 18 AAC 75.340 for Method Two ‘migration to groundwater’ cleanup criteria. The ‘under 40-inches’ precipitation zone cleanup criteria are used.

In summary, target analytes were detected at concentrations greater than the applicable cleanup levels in three of the samples submitted. Dichloroethane analytes were found to exceed the ADEC regulatory cleanup level in Sample B4 S6B. TCE analytes were found to exceed the ADEC regulatory cleanup level in Samples B2 S1, B4 S5, and B4 S6B. A summary of the analytical results is included as Table B-1 in Appendix B, and the laboratory report is also included in Appendix B.

Data quality for this project was assessed using one soil trip blank. The trip blank accompanied the soil sample bottles from the laboratory to the site during sampling activities and back again to SGS. The trip blanks did not contain detectable concentrations of GRO or VOCs, indicating that the samples were not cross contaminated or exposed to contamination during the sample handling and storage process.

7.0 ENGINEERING CONCLUSIONS

Geotechnical considerations associated with this project consist of soil bearing capacity, controlling trench excavation slopes, developing pipe bedding, trench backfill and compaction, potential settlements, repairing or replacing pavements, construction drainage, and planning for possible dewatering needs for excavations below the groundwater table. Based on the conditions encountered by our borings, the soils in the project area include loose to dense granular material with varying amounts of silt and organics overlying very soft to medium stiff clay. In our opinion, the clay soils at depth are susceptible to consolidation if additional loads, such as large replacements of existing soils with structural fill materials, are applied during this project. In order to limit loading these soft soils, we recommend that the existing fill and native granular and fine grained soils be used as backfill above the bedding and piping as much as possible. Proper control of excavation (including possible construction dewatering) and backfilling activities will also be paramount in achieving a well constructed project.

7.1 Trenchless Installations

We understand that trenchless construction techniques are being evaluated for installation of the new sewer line beneath the ARRC mainline. Geotechnically, these techniques will primarily need to consider potential ground movements, construction related settlements, the presence of groundwater, potential obstructions, and excavation requirements for sending and receiving pits. The fill and native soils encountered on either side of the ARRC mainline (Borings B-2 and B-3) generally consisted of medium dense to dense, relatively clean (low fines content) sands and gravels to approximately 17 feet bgs. The coarse grained soils were underlain by very soft to soft clays. In our opinion, the soils at the site are generally suitable for trenchless construction assuming the contractor is prepared to deal with relatively shallow groundwater and soft clay soils. Groundwater was measured at depths of about 7 and 10 feet bgs in observation wells installed in Borings B-2 and B-3, respectively, which may impact excavation work needed to construct the project. The recommendations provided for trench excavation and backfill

(Sections 7.2 and 7.3, respectively) can generally be applied to excavations needed for trenchless installations.

We do not anticipate that construction related ground movements caused by trenchless operations will cause significant, large-scale deflections at the ground surface. However, we recommend maintaining a contingency for addressing possible isolated areas of surface repairs as a result of the construction method. Before selecting a method for this project, we recommend that a trenchless construction contractor and/or engineer be allowed to review the available subsurface information and conduct a constructability evaluation.

7.2 Trench Excavation

Trenches will also be required for portions of construction for the proposed new sewer line and for trenchless construction access and receiving pits. Buried utilities may be present in relatively close proximity to the alignment. Utilities encountered near an excavation should be adequately supported and braced during construction. Excavations should generally be constructed as presented in Figure 11. If the excavations are within 10 feet of buildings or active paved surfaces, the open excavation (including undercutting caused by wall caving) should not penetrate a plane line extending out and down from the outer edge of the structure at a slope of 1 horizontal (H) to 1 vertical (V) unless shoring is provided to support the excavation side and building/pavement surcharge loads.

During excavation, the granular soils above the water table may initially tend to stand relatively steeply due to the apparent cohesion associated with the soil moisture. However, as the soils dry, they will tend to ravel and slough to their natural angle of repose, which for planning purposes is estimated at about 1.5 H to 1 V. The fine grained soils may also initially stand steeply due to cohesion, however, as they dry, they will tend to ravel and slough to their natural angle of repose, which for planning purposes is estimated at approximately 1.8 H to 1 V.

Static groundwater levels were found to be between roughly 7 and 11 feet bgs and therefore may be encountered during construction. Most of the soils observed below the water table and above the Bootlegger clays had relatively low fines contents, but heaving conditions were generally minimal during drilling. Depending on the permeability of the soils, the type of dewatering required for the project could range from making low spots and using sumps and pumps, to dewatering the site with a series of closely spaced well points. The contractor should be prepared to use sections of shoring and/or dewater the excavation with sumps and pumps or well points during construction as needed to maintain stable slope and bottom conditions. During excavation, the contractor should be prepared for large-scale sloughing of wet sand and gravel if excavations are to extend more than 1 to 2 feet below the groundwater level. It will also be important to monitor the excavation to reduce the potential for damage to nearby pavement and structures. The trench side slopes and bottom conditions should be made the responsibility of the contractor, who is present on a day to day basis and can adjust efforts to obtain the needed stability and meet the applicable Alaska and Federal (OSHA) safety regulations. Recommendations for construction drainage and dewatering are discussed in Section 7.7.

If wet conditions persist at the excavation bottom, crushed aggregate may be used to stabilize the trench bottom (i.e., provide a firm unyielding surface on which to support the new pipe) and pea gravel may be used as a substitute for pipe bedding material. This should only be done if it is too wet to compact mineral soils as, pea gravel may be placed in relatively wet conditions and can be compacted with hand equipment.

Trace to little organic material was encountered within the fill soils in three of our borings in the project area (from the surface to depths of up to approximately 13 feet bgs). Loose and soft soils were encountered in Boring B-4 in the upper 9 feet, and the Bootlegger Cove clay soils were typically found to be very soft to medium stiff. We assume that the new sewer line will be buried between 8 and 10 feet bgs (with the exception of the section of alignment under the fill embankment on the RWC Group property) and therefore, deep pockets of organic soils and/or loose or soft material may be encountered. If encountered, deep pockets of organic soils should be removed from below planned utilities or manholes and replaced with compacted structural fill as outlined in Section 7.8. Silty materials may be moisture sensitive and loose strength if disturbed in the presence of excess moisture. In these soils, water should not be allowed to collect on the excavation floor. We recommend that excavations be kept as dry as possible with drainage controls, including sumps and pumps, to maintain trench bottom stability.

7.3 Trench Backfill

Below areas that are receiving pavement sections or are to be used as a driving surface, pipe bedding and trench backfill should be placed in maximum 12-inch loose lifts and compacted to at least 95 percent of the Modified Proctor maximum dry density, as discussed in Section 7.8. The bedding and fill material around the pipe should be compacted to at least 95 percent of the Modified Proctor maximum dry density or per manufacturer recommendations to support and hold the pipe firmly in place. In areas where no driving surface is planned, less compaction is required and material above the bedding may be placed in thicker lifts (14 to 18 inches) and moderately compacted to achieve at least 90 percent compaction.

Utility trenches should be backfilled existing soils placed in original stratigraphic sequence as much as practical so that the existing soil loads supported by the underlying Bootlegger clays is matched to the extent practicable. This is to reduce the risk of future consolidation settlement of the pipe. Existing inorganic native soils should be placed between the top of the pipe bedding and the bottom of the road subgrade as discussed in Section 7.4. This procedure limits the contrast between trench backfill and the surrounding soil conditions that can lead to adverse settlement or frost heave behavior. Bulking of backfill into trenches should be discouraged as this can cause variable subgrade support or voids and lead to differential movement and surficial distress.

As stated previously, silty materials may be moisture sensitive and loose strength if disturbed in the presence of excess moisture. In these soils, water should not be allowed to collect on the excavation floor and we recommend that it be kept as dry as possible with drainage controls to maintain bottom stability. A flat-edged excavator bucket should be used to reduce disturbance to the soils at the bottom of the excavations and equipment should not be allowed to operate on the excavation bottoms. The initial lift of fill should be placed on the bottom of the excavation as soon as practicable and static compaction equipment should be used to compact the first two lifts.

7.4 Asphalt Pavement Repairs

Asphalt pavement will need to be repaired in areas where excavations penetrate East Whitney Road and the Alaska West Express storage yard. New asphalt pavements placed over trench excavations must be able to support the anticipated applied loads from vehicles. In designing the pavement repairs, the strength and frost susceptibility of the existing adjacent prism and backfill soils must be considered. We assume that the grade of the road and storage yard will remain consistent with current grades and that these surfaces will continue to be used for mixed (light to relatively heavily-loaded) vehicle traffic.

Repair work should focus on creating new pavements that will behave similarly to the existing surface. To accomplish this, the materials and section thickness used to repair the pavement structural section and asphalt should generally match the existing conditions, especially East Whitney Road pavements, which is subjected to heavy traffic loading. For planning purposes, we recommend reviewing the East Whitney Road design drawings for pavement and structural section thicknesses. Reuse of the existing fill materials should be considered on a case by case basis during construction based on the gradation properties of the materials. Pockets of notably silty (generally greater than 20 percent fines) or organic material should not be reused in pavement structural sections. Soil fills beneath the asphalt should be placed and compacted according to the recommendations of Section 7.8.

The performance of pavement is controlled by the details of construction and by the quality (gradation characteristics) of the materials used to develop the needed structural section. MOA gradation requirements are presented in Figure 12. Quality control inspection is strongly recommended when placing pavement support soils.

7.5 Manholes

We understand that new manholes will be added during construction. We understand that the manholes will generally consist of hollow, cylindrically shaped, precast concrete structures and that the structure bottoms will typically be buried to depths between about 8 to 10 feet bgs. Design of below ground structures will need to consider the bearing support capabilities and frost characteristics of the soil, lateral earth pressures, and buoyancy.

7.5.1 Subgrade Preparation

Potential frost heaving forces should be considered in preparing the subgrade for the manhole structures. Based on laboratory testing, the existing near surface soils are moderately to highly frost susceptible with frost classifications of F1 to F4. For structures buried deeper than about 8 feet in the project area and supported on relatively clean, native soils; the structures may be founded on the compact, native materials. Backfill around the sides of the structures should consist of Type IIA structural fill extended horizontally a minimum of 2 feet outward, placed and compacted as outlined in Section 7.8.

7.5.2 Soil Bearing Capacities and Earth Pressures

Assuming the subgrade for the manhole structures are prepared as described in Section 7.5.1 and soils beneath the structures have not experienced significant strength loss due to saturation or disturbance, the soils supporting the structures should have an allowable bearing capacity of approximately 1,500 pounds per square foot (psf). This value assumes a minimum burial depth of the manholes of 8 feet bgs. This bearing value may be increased by 1/3 for short-term seismic loading. Loading on the top of the structures from cover fills should be included in the weight calculation and should be estimated by calculating the volume of the soil directly over the structure and multiplying that volume by the fill soils unit weight. The unit weight of the fill over the structure will vary depending on the gradation of the fill materials and could range between 115 and 140 pounds per cubic foot for sandy and gravelly fills, respectively.

Hollow structures below ground should be designed to resist lateral earth pressures. The magnitude of the pressure is dependent on the method of backfill placement, the type of backfill material, and drainage provisions. If the structure walls are allowed to deflect laterally or rotate an amount equal to about 0.001 times the height of the wall, an active earth pressure condition under static loading would prevail and an equivalent fluid weight of 38 pounds per cubic foot (pcf) is recommended for design of the walls. For rigid walls that are restrained from deflecting at the top, an at-rest earth pressure condition would prevail and an equivalent fluid weight of 59 pcf is recommended. To simulate seismic loading, at-rest and active earth pressures should be increased with a uniformly distributed, rectangular pressure prism of 14 pounds per square foot (per linear foot of wall) of wall height. Active and passive pressures are prismatic and act on the wall accordingly. Lateral resistance may also be developed in friction against sliding along the base of the manhole structure and may be computed using a coefficient of 0.4 between concrete and soil.

7.5.3 Settlement and Buoyancy

The magnitudes of the settlements that will develop under the manhole structures are dependent upon the applied loads, the gradation properties of the bedding and fill material, and the care with which the bedding and structural fills are placed and compacted. Given the generally compact nature of the granular soils encountered in our borings, but the relatively soft Bootlegger clays underlying the proposed manholes, static (non-seismic) settlement of the manhole structures should be limited to about 1 inch or less provided the subgrade is prepared according to Section 7.5.1 and the allowable bearing capacity is adhered to.

Based on groundwater observations made during drilling some of the structure bottoms will likely be below the groundwater table and buoyant forces will need to be considered. Buoyant forces should be estimated as the volume of the submerged structure multiplied by 62.4 pounds per cubic foot (pcf). These forces will largely be compensated for by the weight of the structure and the skin friction between the soil and sides of the structure. For a densely compacted, uniform, granular fill, skin friction can be approximated by multiplying together the surface area of the sides of the structure in contact with the soil, the total active force of the soil acting on the side of the below grade structure (see Section 7.5.2), and a frictional coefficient of 0.4. If buoyant forces are not compensated by the weight of the structure and skin friction along the sides of the structure, additional elements to increase the weight should be incorporated as necessary for additional resistance against buoyant forces.

7.6 Settlements

The magnitudes of the settlements that will develop around the new utility are dependent upon the applied loads (including possible increases to the existing soil loads overlying the Bootlegger clays), the gradation properties of the bedding and fill material, and the care with which the bedding and structural fills are placed and compacted. Additionally, careful excavation and construction practices to minimize disturbance to support soils should be employed for this project. With proper soil type, placement, and compaction it is estimated that total maximum settlements will be limited to elastic deflection of the bedding, or about ½-inch or less, of which all of it may be differential over a length of approximately 40 feet.

7.7 Construction Drainage

Groundwater in the project area was observed at depths between approximately 7 and 13 feet bgs during drilling and measured in observation wells installed in the borings at approximately 7 to 11 feet bgs. Based on these groundwater depths, water may be encountered during excavation work depending on the burial depth of the utility.

If required, dewatering with sumps and pumping equipment may be appropriate in excavations that penetrate 1 to 2 feet into water bearing zones. Local well points or other dewatering methods may be required if excavations extend more than several feet below the water table. These measures may also need to be used in tandem with temporary shoring or trench boxes to control trench walls, especially where trenches are to be excavated near existing structures or paved driving surfaces. In general, excavation and backfill work should be closely coordinated such that surface runoff is not allowed to collect and stand in open excavations. Excavation bottoms should be graded to drain to a sump or topographic low to provide drainage during wet weather. The ground surface around excavations should also be contoured to drain away from the area.

We recommend that the contractor be required to submit an excavation plan once the utility layout and depths have been determined. The excavation plan should describe the methods and sequencing for excavation, as well as additional information for dewatering and shoring as necessary. The plan should highlight areas that may require dewatering, and include details for the type or types of dewatering that will be undertaken (including, but not limited to, pumping rates, discharge locations, treatment, etc.). The excavation plan should also include the types and locations of shoring to be used and engineered plans for the shoring, if required. We recommend that we be retained to review the excavation plan prior to authorizing work to proceed at the site to ensure that the plan contains the necessary information and is appropriate for the conditions at the site.

7.8 Structural Fill and Compaction

Structural fill will be needed to support pavements for driving surfaces and the new utilities. Structural fill that is imported should be clean, granular soil free of organic material to provide drainage and frost protection. These soils should contain less than about six percent passing the No. 200 sieve. Generally, Type II or Type IIA material as specified in the MASS works well for this application and as the subbase layer since it can be placed under both wet and dry weather conditions. Gradation properties for the classified materials mentioned above are included in Figure 12.

Based on laboratory test results from our borings in the project area, the granular material encountered above the Bootlegger clays generally consisted of relatively clean to silty sands and gravels with fines contents ranging between approximately 7 and 42 percent; however, sandy silt layers were also encountered. Therefore, these soils generally do not meet the gradation requirements for Type II/IIA classified fill as shown on Figure 12 and, in our opinion, should not be used to support the pipe or manholes, but may be used for backfill in nonstructural areas, including between the pipe bedding and the pavement structural section.

Structural fills below pavements or driving surfaces should be placed in lifts not to exceed 10 to 12 inches loose thickness, and compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor compaction procedure (ASTM D 1557). Non-structural fills, including fills outside of the road prism or beneath landscape areas that are not subject to building or traffic loads, should be compacted to at least 90 percent of the Modified Proctor optimum dry density. Bulking of backfill into the trench should be discouraged as this can cause voids and lead to large future surface settlements. During fill placement, we recommend that large cobbles or boulders with dimensions in excess of 3 inches be removed from any structural fills.

8.0 CLOSURE AND LIMITATIONS

This report was prepared for the exclusive use of our client and their representatives for evaluating the site as it relates to the geotechnical aspects discussed herein. The conclusions contained in this report are based on site conditions as they were observed on the drilling date. It is assumed that the exploratory borings are representative of the subsurface conditions throughout the site, i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the explorations.

If there is a substantial lapse of time between the submittal of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the conclusions considering the changed conditions and time lapse. Unanticipated soil conditions are commonly encountered and cannot fully be determined by merely taking soil samples or advancing borings. Shannon & Wilson has prepared the attachments in Appendix C *Important Information About Your Geotechnical/Environmental Report* to assist you and others in understanding the use and limitations of the reports.

Copies of documents that may be relied upon by our client are limited to the printed copies (also known as hard copies) that are signed or sealed by Shannon & Wilson with a wet, blue ink signature. Files provided in electronic media format are furnished solely for the convenience of the client. Any conclusion or information obtained or derived from such electronic files shall be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, or you question the authenticity of the report please contact the undersigned.

We appreciate this opportunity to be of service. Please contact the undersigned at (907) 561-2120 with questions or comments concerning the contents of this report.

SHANNON & WILSON, INC.

Russell Hepner, E.I.T.
Geotechnical Engineering Staff

STATE OF ALASKA
1/2/2016
49TH
GROVER L. JOHNSON
CE - 8833
REGISTERED PROFESSIONAL ENGINEER

Grover L. Johnson, P.E.
Senior Engineer III

TABLE 1
LEAKING UNDERGROUND STORAGE TANK SITES WITHIN A 0.25-MILE RADIUS

Facility Name	Street Address	Status	Office File ID*	Approximate Distance From Property
ARRC Mammoth Alaska	1048 Whitney Road	Active	2100.26.202	125 feet west
ARRC Corp Redevelopment	920 Whitney Road	Cleanup Complete	2100.26.261	550 feet west
ARRC - Arctic Cooperage	932 Whitney Road	Active	2100.26.260	725 feet west
ARRC - 900 Whitney Road (Black Gold Express)	900 Whitney Road	Cleanup Complete	2100.26.230	800 feet west
Craig Taylor Equipment Company	733 East Whitney Road	Cleanup Complete	2100.26.353	1,050 feet west
Dean's Auto Salvage UST's	720 East Whitney Road	Cleanup Complete	2100.26.563	1,175 feet west

Notes:
* The Office File ID is the ADEC file number.

TABLE 2
CONTAMINATED SITES WITHIN A 0.25-MILE RADIUS

Facility Name and Street Address	Office File ID~	Status/Priority	Problem, as listed by ADEC*	Approximate Distance From Property
Service America 1115 East Whitney Road	2100.38.035	Cleanup Complete - Institutional Controls	Diesel contaminated soils encountered while removing 2 heating oil USTs. Approximately 75 cubic yards of contaminated soils removed. Trace of halogenated organics detected in north UST waste soils. Extent of residual contamination, human health threat, date and quantity of release unknown. The property is owned by Alaska Railroad, leased to the Robert Pfiel Estate, and subleased to Service America. ADEC in 12/91 requested additional site assessment to determine extent and impact on groundwater of residual contamination. Lots 127 and 128, Alaska Railroad Corporation Terminal Reserve. Last staff assigned was Olson.	75 feet northeast
ARRC Operations Building 825 Whitney Road	2100.38.418	Cleanup Complete	On October 31, 1991 a 2,500 gallon diesel UST and its associated dispenser pump was removed. The following day a 3,000 gallon heating oil UST was removed from the same site. The sizes of the excavations were limited to the extent necessary to remove the tanks. Additional soil was not removed. Approximately 20 cubic yards of soil was excavated during the removal of the USTs. Soil was taken to Alaska Sand and Gravel for thermal processing. Soil samples collected from the limits of the excavation from the diesel tank indicated that total petroleum hydrocarbons (TPH) were present in concentrations up to 15,300 mg/kg. Benzene was not detected in this excavation. Two samples were collected from the excavation of the heating oil tank. TPH was present in both samples at 539 and 937 mg/kg. Benzene was present in one sample at a concentration of 0.035 mg/kg. A PVC pipe gallery was installed around the perimeter of each excavation. The excavations were backfilled with clean fill and remediation activities did not commence again until September 2003. In March 1996 Science Applications International Corporation (SAIC) under contract to EPA, released a RCRA Facility Assessment Report of ARRC properties in the Lower Ship Creek Basin. EPA designated the Former Bridges and Building Shop located at 825 Whitney as Solid Waste Management Unit (SWMU) 28. SWMU 28 was reported to have waste oil and solvent drums stored prior to being transferred to railcars or sent off site. On September 11, 2003 soil was excavated at the location of the former underground tanks and stockpiled on site to the west of the excavation. A PID was used to determine the presence of hydrocarbon contamination and the stockpiles were segregated accordingly. Soil removal continued until groundwater was reached at approximately 10 feet below ground surface. A total of 1,337 cubic yards of impacted soils was transported to Alaska Soil Recycling September 25-26, 2003. Soil samples taken from the limits of the excavation indicated that diesel range organics (DRO) contamination was still present in 3 of 14 samples in concentrations up to 447 mg/kg. Trichloroethane (TCE) was present in four samples in concentrations up to 0.642 mg/kg. Three test pits were dug at SWMU 28 to depths between one and three feet below ground surface. TCE was present in a sample taken from the test pits at the former SWMU 28 at 0.439 mg/kg. Soil stockpiles associated with the excavation and test pits were removed and transported to Alaska Soil Recycling (ASR). The soil treated at ASR was determined to meet DEC cleanup levels and was returned to the site. The treated soil was used in combination with the clean stockpiles as backfill for the excavation and test pits. The subject property is currently being used as the new Anchorage Operations Center and adjacent parking lot for the Alaska Railroad Corporation.	400 feet northwest

Notes:

~ The Office File ID is the ADEC file identification number

* Narrative taken directly from ADEC summary statement in the on-line database. This summary may not fully describe the nature of the environmental concern and/or potential risk to human health, safety, welfare, or the environment

TABLE 2
CONTAMINATED SITES WITHIN A 0.25-MILE RADIUS

Facility Name and Street Address	Office File ID~	Status/Priority	Problem, as listed by ADEC*	Approximate Distance From Property
ARRC - Arctic Cooperage 932 East Whitney Road	2100.38.042	Active	A 1996 phase II site assessment found the site to be an oil refinery operation, which was destroyed during the 1964 earthquake. The site was also later used from 1977-1988 as a barrel reconditioning operation. Visual signs of the site uses included machinery, drums, spills, a Process underground storage tank (UST), and a gasoline UST. The two USTs, which were found to be the main source of contamination, were removed from the site in 1995 and 1996. 1996 soil boring samples and monitoring wells indicated high diesel range organics (DRO) levels. An 1997 investigation found free phase arctic-grade diesel in the groundwater which is speculated from an upgradient, northeast, offsite source. A 2000 field sampling report found high levels of DRO as well as chorinated solvents. A 2003 groundwater assesment report found DRO and benzene, toluene, ethylbenzene, and xylenes (BTEX) levels decreasing due to natural attenuation, but a few select wells still had high levels of DRO, gasoline range organics (GRO), and benzene. Futhermore, well CHMW2 had 2.2 feet of free-phase product with the the thickness of the free-phase product in the formation of 0.55 foot. A 2007 ATR FS remedial investigations indicate that while trichloroethylene (TCE), benzene, and DRO contamination exist, the plume appears stable and is not migrating toward Ship Creek. Visibly contaminated soil with waste oil in suspected 100 feet by 100 feet area. Alaska Railroad/U.S. Department of Transportation (DOT), ARR contract 4716, lot 87 off Whitney Road, leased property from 1958 to 1988 to Arctic Cooperage who used as waste oil refinery and reportedly accepted transformers from local electric utility companies that may have contained polychlorinated biphenyls (PCBs). Administrative order on consent (U.S. Environmental Protection Agency (EPA) Docket No. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 10-2004-0065) signed to include ARRC terminal, Area 3, and designated leased properties.	500 feet west
AMFAC Warehouse 200/250 North Post Road, South of Railroad Tracks	2100.38.489	Cleanup Complete	Diesel contaminated soils encountered during 5/90 underground storage tank removal. Polychlorinated biphenyl contamination discovered during site assessment in 8/90 at a waste oil disposal system. Partial remediation occurred in 1990. Date and quantity of spill unknown. Areal extent of site contamination estimated under 10,000 square feet. Public health threat to transients camping in the immediate area. This is the same property as AMFAC Warehouse Reckey 1990210917301, a closed site. A consultant hired to evaluate potential environmental problems for Kelly-Moore Paint Company performed a field investigation in 1999 that led to the discovery of TCE in soils and groundwater. Wastes are likely to have been generated by an electric transformer and motor repair shop which occupied the site at one time. The present lease holder has identified Westinghouse Electric Corporation as the operator of the repair shop and is likely to seek cleanup costs. Assigning cleanup liability stalled the 1990 cleanup efforts. Property description formerly Alaska Railroad Reserve, Block 46A. Administrative order on consent (US EPA Docket No. CERCLA 10-2004-0065) signed on 6/29/04 to include ARRC terminal and leased properties.	515 feet southeast

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TABLE 2
CONTAMINATED SITES WITHIN A 0.25-MILE RADIUS

Facility Name and Street Address	Office File ID~	Status/Priority	Problem, as listed by ADEC*	Approximate Distance From Property
Kelly-Moore Paint Store & Warehouse 250 Post Road, South of Railroad Tracks	2100.38.036	Active	This is the same property as AMFAC Warehouse at 200/250 North Post Road, CS57.05, Reckey 1990210917301 (a closed site that contains PCB and DRO contamination above cleanup levels.) A consultant hired to evaluate potential environmental problems for Kelly-Moore Paint Company performed a field investigation in 1999 that led to the discovery of TCE in soils and groundwater. Source of TCE remains uncertain. As per the 2003 & 2005 site chacterization and action report, TCE levels are high in select MWs. Further investigations are needed to catagorize possible migration of contaminants in to the groundwater. Note; there is an Remedial Investigation(RI) for the Alaska Railroad Corporation Anchorage Terminal Reserve U.S. EPA Docket No. CERCLA 10-2004-0065. The RI for Ship Creek identified groundwater Area 8, aka Kelly-Moore Paints as an area of concern for further evaluation in the feasibility study.	515 feet southeast
Municipal Light & Power - Power Plant 1 821 East 1st Avenue	2100.38.326	Active	ML&P's Plant Number 1 on First Avenue in Anchorage was the site of a 250,000 to 400,000 gallon diesel spill during the 1964 earthquake. Soils and groundwater were contaminated with diesel fuel. Subsequent releases occurred on the site including PCBs from electrical equipment.	700 feet southwest
Development Managers Inc. HOT 1301 East Whitney Road	2100.38.023	Cleanup Complete - Institutional Controls	A 2,000 gallon heating oil tank was removed in June 1991. Tank had leaked, evident by rust holes, and contamination was found in the soil underneath. During the removal of the UST in June 1991, it was observed that the tank had been leaking. Approximately 8 cubic yards of contaminated soil was removed and stockpiled. Soil samples collected beneath the tank had total petroleum hydrocarbons (TPH) up to 10,200 mg/kg. Three groundwater monitoring wells were installed to evaluate potential groundwater contamination. In 1992 two more monitoring wells, a product recovery well, and four test pits were installed. No free product was found at the location of the recovery well. Soil samples indicated TPH levels below ADEC cleanup levels. Contaminates found in groundwater were above ADEC cleanup levels. Additional groundwater samples collected from 1993 to 2000 contained varying concentrations of contaminates, with DRO detected above the ADEC Table C cleanup level on several occasions. No further action granted January 8, 2008 subject to intitutional controls. In 2001 three soil borings were advanced to approximately 10 feet below ground surface with samples collected at 2.5 foot intervals. Groundwater was encountered from 6 to 10 feet below ground surface. Contamination in the soil samples was found to be below ADEC Method Two migration to groundwater cleanup levels. Stockpiled soil was no longer on site, and was believed to have been spread over the parking lot accidently during snow removal activities. Two groundwater samples were also analyzed for DRO during the 2001 event. Well B2MW, located near the former UST, had contamination above ADEC cleanup levels with DRO detected at 8.63 mg/l.; however a more recent groundwater sample collected from a monitoring well in the vicinity of B2MW as part of a Remedial Investigation conducted by the Alaska Rail Road Corporation in 2005 did not detect contaminants of concern in groundwater.	750 feet east

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TABLE 2
CONTAMINATED SITES WITHIN A 0.25-MILE RADIUS

Facility Name and Street Address	Office File ID~	Status/Priority	Problem, as listed by ADEC*	Approximate Distance From Property
Municipal Light & Power Operations 1201 East 1st Avenue 1201 and 1121 East 1st Avenue	2100.38.513	Active	During installation of utilities, free phase petroleum product was found on the surface of the groundwater apparently from a nearby UST. A sample of the product within the UST contained PCBs at 17 mg/l.	775 feet south
Municipal light & Power Operations 1201 East 1st Avenue 1201 and 1121 East 1st Avenue	2100.38.513	Active	During installation of utilities, free phase petroleum product was found on the surface of the groundwater apparently from a nearby UST. A sample of the product within the UST contained PCBs at 17 mg/l.	800 feet southeast
Municipal Light & Power Fmr Storage 1120 East 1st Avenue, at Karluk Street	2100.38.385	Cleanup Complete-Institutional Controls	In 1989 and 1993, Harding Lawson Associates (HLA) conducted assessments of the storage area. Reports indicate the presence of petroleum and hazardous substances, including halogenated volatile organics and trace levels of polychlorinated biphynels (PCB’s). 1120 East First Avenue has both LUST issues and Contaminated Sites issues. Lust issues can be found in the underground storage tank database Reckey 1989210021401, event ID 000102, Ledger Code 148576, File Number L69.09	825 feet south
ARRC Water Line Abandonment HOT 900 East Whitney Road	2265.38.033	Cleanup Complete	During abandonment of a buried water line an unregulated UST was discovered that leaked. It is hypothesized that due to the absence of a plug sealing the piping penetration in the tank, water entered the tank until it filled and displaced heating oil in the tank. The displaced hydrocarbons flowed south into surrounding soils. Soil samples Ex-2 and its duplicate for GRO, DRO, and BTEX were above ADEC Method 2 Cleanup levels taken from below a sewer line immediately south of the former UST excavation for DRO and benzene. Soil samples for GRO, DRO, and BTEX were below ADEC Method 2 Cleanup levels taken from under the UST site and the trench. DRO levels were to 867 mg/kg and benzene to 0.094 mg/kg. Stockpile soil sample maximum results were up to 957 mg/kg for GRO, 11,100 mg/kg for DRO, 0.708 mg/kg benzene, 8.79 toluene, 10.4 ethylbenzene, and 50.3 total xylenes. All but total xylenes exceeded Method 2 soil cleanup levels. Stockpiled soils were delivered to Alaska Soil Recycling for thermal remediation. Soil cannot be removed from beneath sewer line without removing the line or jeopardizing the integrity of it.	900 feet west
Firestone Shop 105 South Post Road, 1st Avenue & S. Post Road	2100.38.082	Cleanup Complete	Petroleum contaminated soil, sediment and sludge associated with 3 floor drain sumps operating as injection wells has spread to on-site groundwater. Elevated levels of Barium in sump sediments and surrounding soils was also detected. Barium is used as filler material in tire manufacturing. Phone number for Bridgestone Firestone's contact person has changed from (847) 981-2200 to (630) 259-9377. Lot 1B, Block 32A, East Addition Subdivision.	1,050 feet southeast

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TABLE 2
CONTAMINATED SITES WITHIN A 0.25-MILE RADIUS

Facility Name and Street Address	Office File ID~	Status/Priority	Problem, as listed by ADEC*	Approximate Distance From Property
Municipal Light & Power Former Paint and Sign Shop 940 East 1st Avenuw , East of Ingra Street	2100.38.085	Cleanup Complete	In August 1997, Golder Associates Inc. conducted assessment activities which indicated that 350 mg/kg DRO, 350 mg/kg total lead and 0.032 mg/kg methylene chloride was present beneath the floor drain. The building was previously owned by the Municipality of Anchorage and used as a paint and sign shop.	1,050 feet southwest
Residence - 1046 Northpointe Bluff Drive 1046 Northpointe Bluff Drive	2100.38.561	Active	In July 2016, during construction of a residence on a vacant lot, a 1,000-gallon underground heating oil tank was encountered in the foundation excavation. The tank still contained some fluid, which was removed, and the tank was removed from the ground. Contaminated soil was observed in the excavation and 60 cubic yards of contaminated soil were subsequently removed. The base of the excavation, approximately 18 feet below ground surface, contains diesel range organics above DEC cleanup levels.	1,175 feet northwest
Dean's Auto Salvage UIC's 720 East Whitney Road	2100.38.484	Cleanup Complete-Institutioal Controls	In 2006, the Dean's Auto Salvage was initially investigated under EPA's Underground Injection Control Program (UIC Program). Two of three floor drains investigated were found to be clean. The third, warehouse floor drain, contained RCRA hazardous sludge which was containerized and shipped off site for disposal. Additional contaminated soil was excavated and stockpiled on site pending further investigation of the corrugated metal pipe (CMP) and UIC drain field. In 2009, the CMP and 10 cubic yards of “septic” odor contaminated soil was removed. The contaminated soil was added to the historic stockpile that was generated in 2006. Three confirmation soil samples collected at 5 to 5.5 feet below ground surface (bgs) contained diesel range organics (DRO) up to 7,780 mg/kg, gasoline range organics (GRO) up to 349 mg/kg, and residual range organics (RRO) up to 17,200 mg/kg. In 2012, the 50 cy contaminated soil stockpile was transported offsite and thermally remediated at ASR.	1,215 feet west

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CONTAMINATED SITES WITHIN A 0.25-MILE RADIUS

Facility Name and Street Address	Office File ID~	Status/Priority	Problem, as listed by ADEC*	Approximate Distance From Property
Odom Corportation 135 South 135 South Post Road, MOA Listed as 1347 East 2nd Avenue	2100.38.097	Cleanup Complete - Institutional Controls	Contaminated soil and groundwater were encountered during the March 15, 2000 removal of a 500-gallon underground heating oil storage tank (UST) located south of the west end of the warehouse/office building at this 0.9-acre property. Soil contamination appeared to begin at approximately 5 feet below ground surface (bgs), extending to groundwater at about 7 feet bgs. DRO and benzene contaminated soil were cleaned up with the exception of an estimated maximum of 5.5 cubic yards of DRO-contaminated soil located adjacent to and below the building foundation 6 feet north of the former tank location. Groundwater was monitored for four events from 2002 to 2009, with the HVOC TCE present above the cleanup level and related compounds (HVOCs) present below the cleanup level during the first event in 2002, and were below the cleanup level or non-detect during subsequent monitoring events. The consultant provided information supporting their contention that the low-level HVOCs migrated onto the subject site from an upgradient source.	2,300 feet northwest
ARRC Ship Creek North Bluff North Ship Creak Yard, E. Bluff Dr. & Plum St.	2100.38.044	Active	Seepage from the face of the bluff at Elmendorf Air Force Base transporting contaminates above ADEC cleanup levels. Groundwater is main concern Site is directly below the intersection of East Bluff Drive and Fairchild Ave in Government Hill. Groundwater is approximately 40 to 48 feet below ground surface. This site borders Elmendorf Air Force Base Wetland Remediation System for Operating Unit 5. Administrative order on consent (US EPA Docket No. CERCLA 10-2004-0065) signed on this date to include ARRC terminal, Area 3 and designated lease properties.	1,315 feet north

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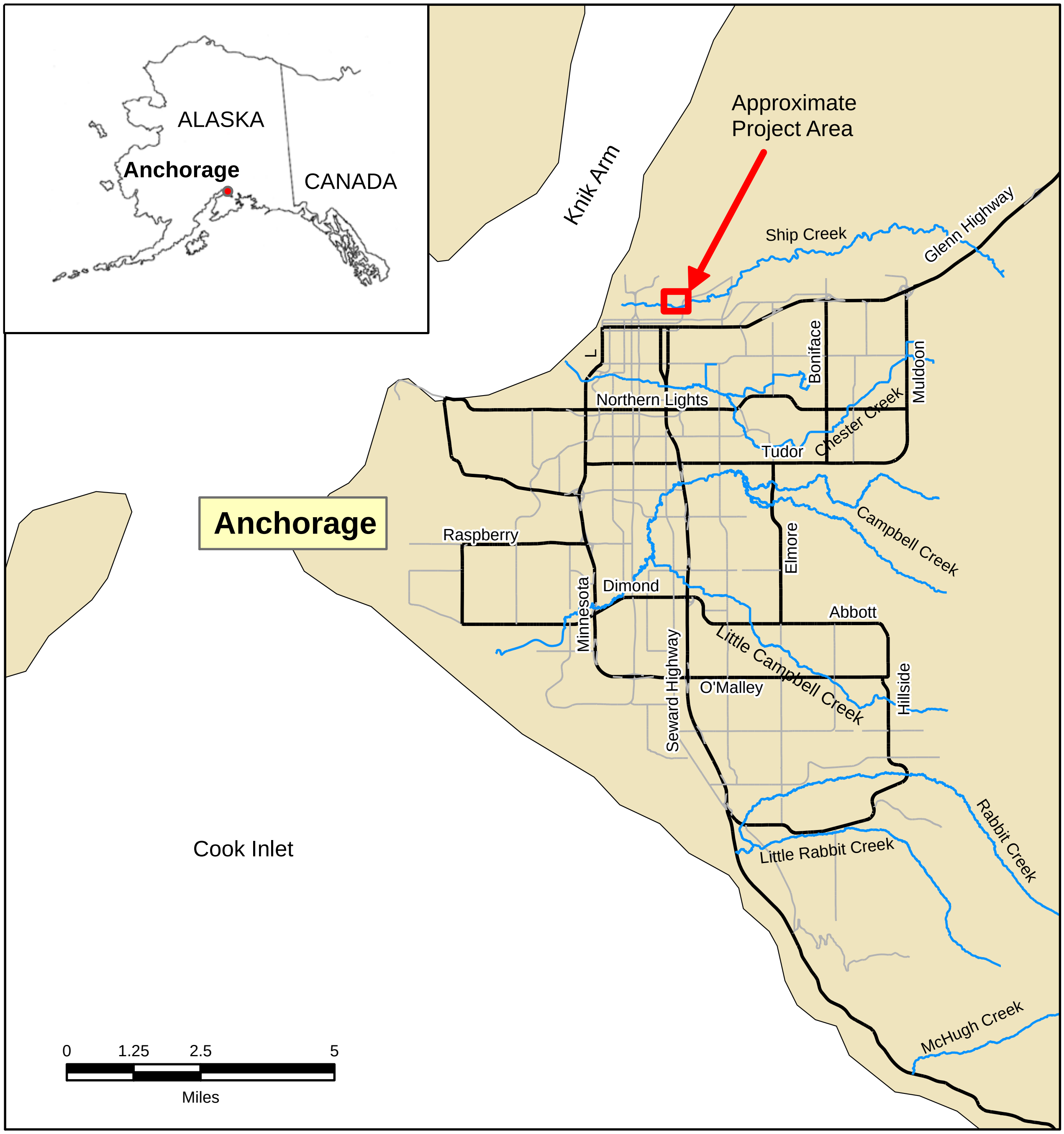

Map adapted from files provided by the Municipality of Anchorage, Geographical Information Systems website

LEGEND

— Streams

Streams and Roads

— Major

— Secondary

N

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

VICINITY MAP

December 2016 32-1-02549

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Aerial imagery and base drawing provided by HDR Alaska, Inc.

LEGEND

⊕ B-1	Approximate location of Boring B-1, advanced by Shannon & Wilson, Inc., October 2016.
⊕ MH-1	Approximate location of proposed new Phase IV sewer extension Manhole MH-1.
🟩	Approximate location of previous phases of the new sewer line alignment.
🟧	Approximate location of Phase IV alignment of the proposed new sewer extension.

0 100 200 400
APPROXIMATE SCALE IN FEET

N

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

SITE PLAN

December 2016
32-1-02549

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1] All percentages are by weight of total specimen passing a 3-inch sieve.
[2] The order of terms is: *Modifying Major with Minor*.
[3] Determined based on behavior.
[4] Determined based on which constituent comprises a larger percentage.
[5] Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

▧	Bentonite Cement Grout	▒	Surface Cement Seal
▨	Bentonite Grout	■	Asphalt or Cap
▩	Bentonite Chips	▦	Slough
░	Silica Sand	□	Inclinometer or Non-perforated Casing
▤	Perforated or Screened Casing	▮	Vibrating Wire Piezometer

PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1] Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

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ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

SOIL DESCRIPTION AND LOG KEY

December 2016
32-1-02549

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3
Sheet 1 of 3

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW	●	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP	○	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM	○	Silty Gravel; Silty Gravel with Sand
			GC	○	Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW	░	Well-Graded Sand; Well-Graded Sand with Gravel
			SP	░	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM	░	Silty Sand; Silty Sand with Gravel
			SC	▨	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML	▥	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	▨	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	▤	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH	▥	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	▨	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	▤	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	⁂	Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

ARRC Sewer Line Extension - Phase IV
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SOIL DESCRIPTION AND LOG KEY

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FIG. 3
Sheet 2 of 3

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

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SOIL DESCRIPTION AND LOG KEY

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FIG. 3
Sheet 3 of 3

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FROST CLASSIFICATION

(after Municipality of Anchorage)

GROUP		**0.02 Mil.**	**P-200***	**USC SYSTEM (based on P-200 results)**
NFS	Sandy Soils	0 to 3	0 to 6	SW, SP, SW-SM, SP-SM
	Gravelly Soils	0 to 3	0 to 6	GW, GP, GW-GM, GP-GM
F1	Gravelly Soils	3 to 10	6 to 13	GM, GW-GM, GP-GM
F2	Sandy Soils	3 to 15	6 to 19	SP-SM, SW-SM, SM
	Gravelly Soils	10 to 20	13 to 25	GM
F3	Sands, except very fine silty sands**	Over 15	Over 19	SM, SC
	Gravelly Soils	Over 20	Over 25	GM, GC
	Clays, PI>12			CL, CH
F4	All Silts			ML, MH
	Very fine silty sands**	Over 15	Over 19	SM, SC
	Clays, PI<12			CL, CL-ML
	Varved clays and other fined grained, banded sediments			CL and ML CL, ML, and SM; SL, SH, and ML; CL, CH, ML, and SM

P-200 = Percent passing the number 200 sieve
0.02 Mil. = Percent material below 0.02 millimeter grain size

*Approximate P-200 value equivalent for frost classification. Value range based on typical, well-graded soil curves.

** Very fine sand : greater than 50% of sand fraction passing the number 100 sieve

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

FROST CLASSIFICATION LEGEND

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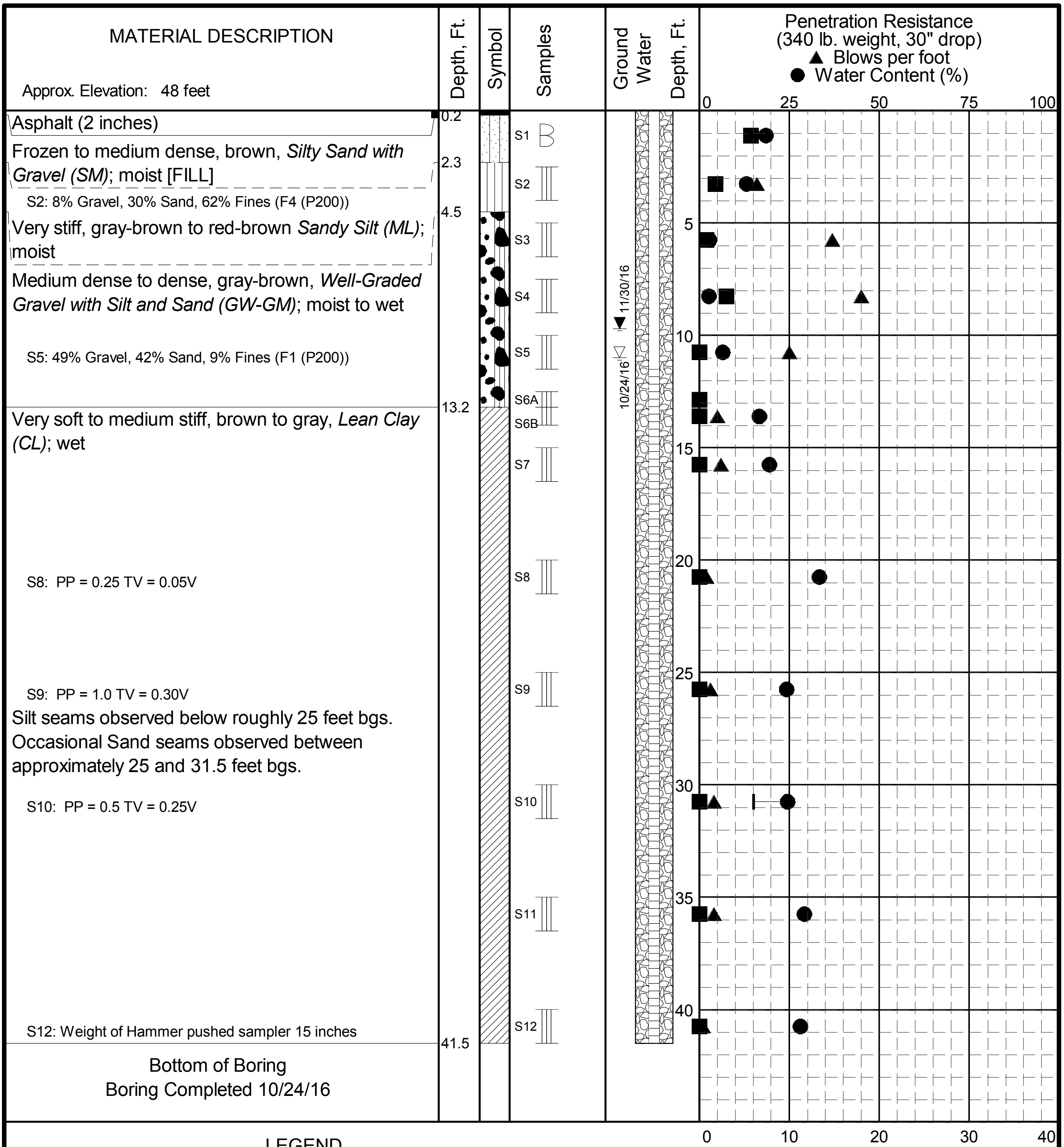
FIG. 4



MATERIAL DESCRIPTION

Approx. Elevation: 48 feet

Asphalt (2 inches)

Frozen to medium dense, brown, *Silty Sand with Gravel (SM)*; moist [FILL]

S2: 8% Gravel, 30% Sand, 62% Fines (F4 (P200))

Very stiff, gray-brown to red-brown *Sandy Silt (ML)*; moist

Medium dense to dense, gray-brown, *Well-Graded Gravel with Silt and Sand (GW-GM)*; moist to wet

S5: 49% Gravel, 42% Sand, 9% Fines (F1 (P200))

Very soft to medium stiff, brown to gray, *Lean Clay (CL)*; wet

S8: PP = 0.25 TV = 0.05V

S9: PP = 1.0 TV = 0.30V

Silt seams observed below roughly 25 feet bgs. Occasional Sand seams observed between approximately 25 and 31.5 feet bgs.

S10: PP = 0.5 TV = 0.25V

S12: Weight of Hammer pushed sampler 15 inches

Bottom of Boring
Boring Completed 10/24/16

LEGEND

*	Sample Not Recovered	▽	Ground Water Level At Time Of Drilling
⌶	Grab Sample	▼	Static Water Level
Ⅲ	3" O.D. Split Spoon Sample	▨	Blank Section, Cuttings Backfill
B	Auger Cuttings	▨	Slotted Section, Cuttings Backfill
■	Frozen		

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

LOG OF BORING B-1

December 2016 32-1-02549

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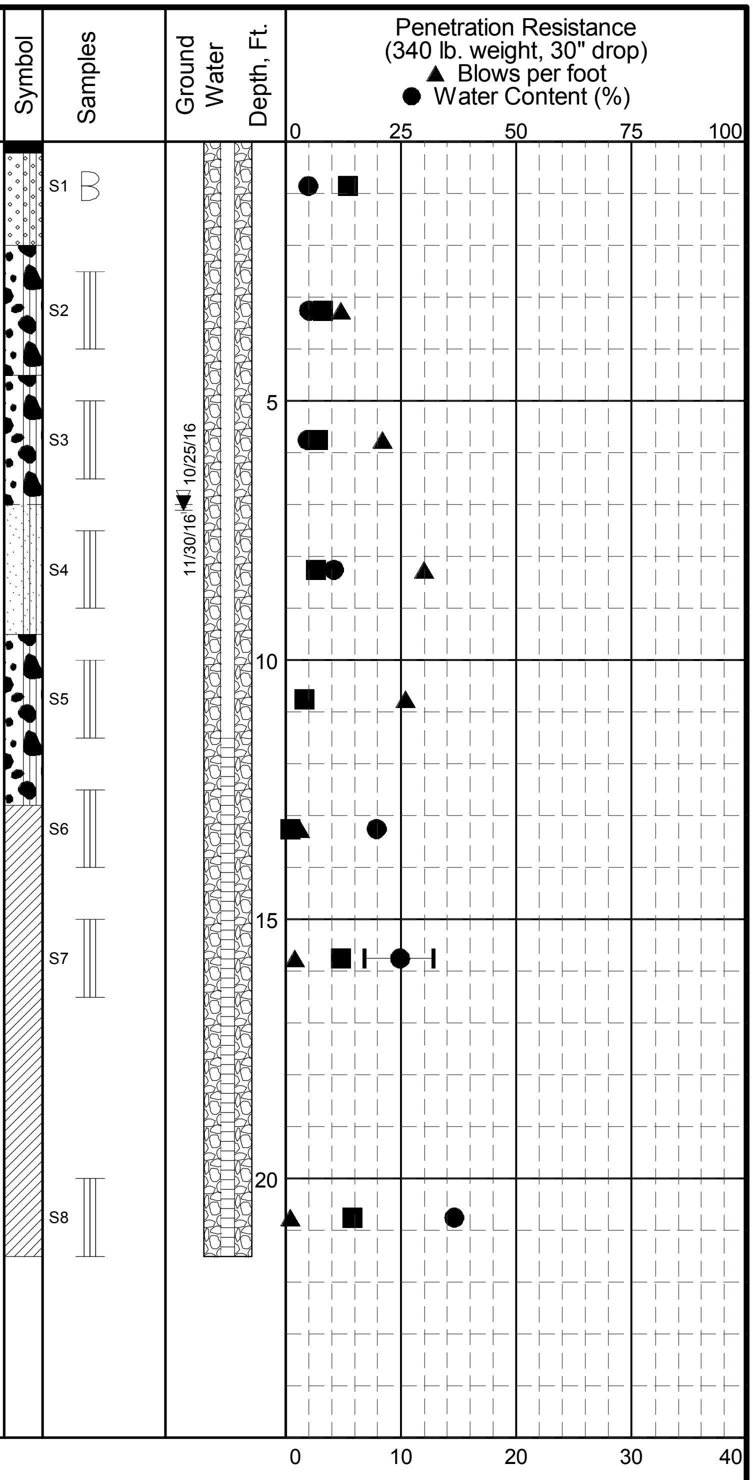
FIG. 5

GEOTECHNICAL LOG 02549 LOGS_REV1.GPJ S&W GEO1.GDT 12/14/16

REV 3 - Approved for Submittal

MATERIAL DESCRIPTION Approx. Elevation: 46 feet	Depth, Ft.
Asphalt (2 inches)	0.2
Frozen to medium dense, brown, *Well-Graded Sand with Silt and Gravel (SW-SM)*; moist [FILL]	2.0
Medium dense, brown, *Well-Graded Gravel with Silt and Sand (GW-GM)*; trace organics and few to little wire and plastic debris; moist [FILL] S2: 49% Gravel, 39% Sand, 12% Fines (F1 (P200))	4.5
Medium dense, brown, *Well-Graded Gravel with Silt and Sand (GW-GM)*; moist	7.0
Dense, brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet S4: 39% Gravel, 53% Sand, 8% Fines (F2 (P200))	9.5
Medium dense, brown, *Well-Graded Gravel with Silt and Sand (GW-GM)*; wet	12.8
Very soft to soft, gray, *Lean Clay (CL)*; wet S8: Weight of Hammer pushed sampler 12 inches PP = 0.0 TV = 0.20V	21.5

Bottom of Boring
Boring Completed 10/24-25/16



LEGEND

*	Sample Not Recovered
𝔹	Grab Sample
Ⅲ	3" O.D. Split Spoon Sample
B	Auger Cuttings
■	Frozen
▽	Ground Water Level At Time Of Drilling
▼	Static Water Level
▨	Blank Section, Cuttings Backfill
▨	Slotted Section, Cuttings Backfill

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

LOG OF BORING B-2

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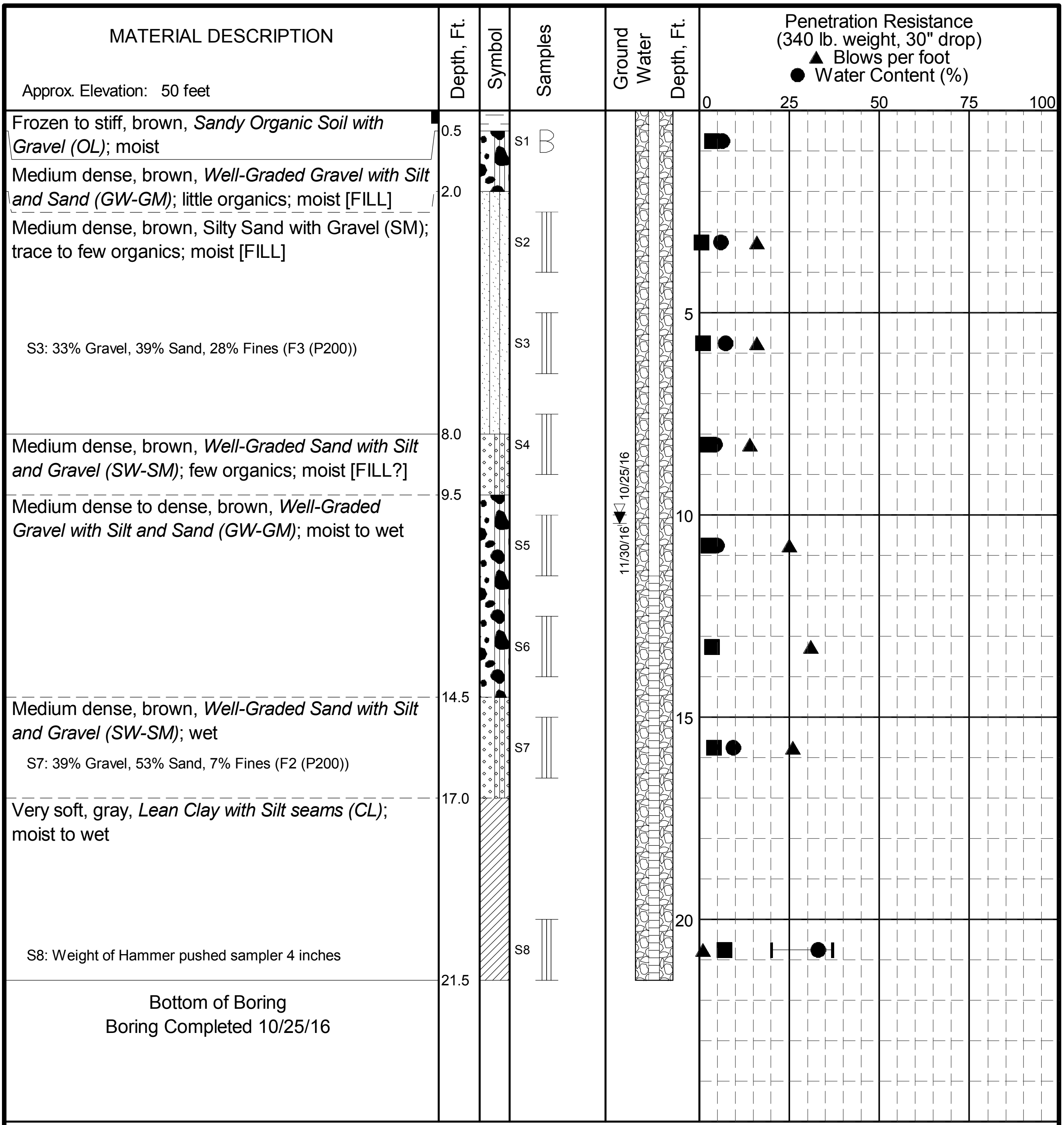
FIG. 6



Approx. Elevation: 50 feet

Frozen to stiff, brown, *Sandy Organic Soil with Gravel (OL)*; moist

Medium dense, brown, *Well-Graded Gravel with Silt and Sand (GW-GM)*; little organics; moist [FILL]

Medium dense, brown, Silty Sand with Gravel (SM); trace to few organics; moist [FILL]

S3: 33% Gravel, 39% Sand, 28% Fines (F3 (P200))

Medium dense, brown, *Well-Graded Sand with Silt and Gravel (SW-SM)*; few organics; moist [FILL?]

Medium dense to dense, brown, *Well-Graded Gravel with Silt and Sand (GW-GM)*; moist to wet

Medium dense, brown, *Well-Graded Sand with Silt and Gravel (SW-SM)*; wet

S7: 39% Gravel, 53% Sand, 7% Fines (F2 (P200))

Very soft, gray, *Lean Clay with Silt seams (CL)*; moist to wet

S8: Weight of Hammer pushed sampler 4 inches

Bottom of Boring
Boring Completed 10/25/16

LEGEND

- * Sample Not Recovered
- Ⅲ Grab Sample
- Ⅲ 3" O.D. Split Spoon Sample
- B Auger Cuttings
- ■ Frozen
- ▽ Ground Water Level At Time Of Drilling
- ▼ Static Water Level
- ▨ Blank Section, Cuttings Backfill
- ▨ Slotted Section, Cuttings Backfill

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

LOG OF BORING B-3

December 2016 32-1-02549

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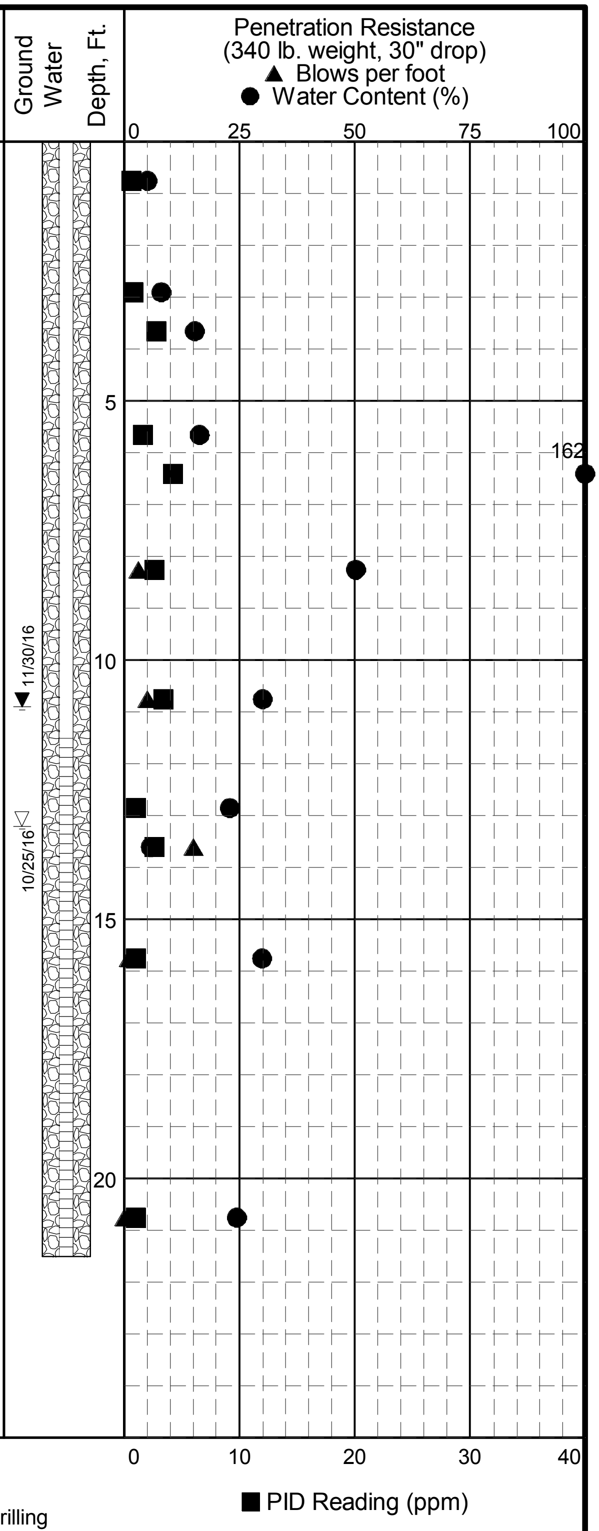
FIG. 7

REV 3 - Approved for Submittal

Approx. Elevation: 43 feet

MATERIAL DESCRIPTION	Depth, Ft.	Samples
Frozen, brown, *Sandy Organic Soil (OL)*; moist	0.2	S1
S1: 43% Gravel, 47% Sand, 11% Fines (F2 (P200))		
Frozen to medium dense, brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; few organics; moist [FILL]	2.0	
Loose, brown to gray, *Silty Sand with Gravel to Silty Sand (SM)*; trace organics; moist [FILL]		S2A S2B
S3A: 9% Gravel, 49% Sand, 42% Fines (F3 (P200))	6.3	S3A S3B
Soft, dark brown *Peat (PT)*; moist	7.0	
Soft to medium stiff, dark brown to gray, *Sandy Silt (ML)*; few to some organics; moist	13.2	S4 S5 S6A
Medium dense, gray, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; wet	15.4	S6B
Very soft, gray, *Lean Clay (CL)*; moist to wet		S7
S8: Weight of Hammer pushed sampler 18 inches	21.5	S8

Bottom of Boring
Boring Completed 10/25/16



LEGEND

*	Sample Not Recovered
⌶	Grab Sample
⌶	3" O.D. Split Spoon Sample
B	Auger Cuttings
■	Frozen
▽	Ground Water Level At Time Of Drilling
▼	Static Water Level
▨	Blank Section, Cuttings Backfill
▨	Slotted Section, Cuttings Backfill

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

LOG OF BORING B-4

December 2016
32-1-02549

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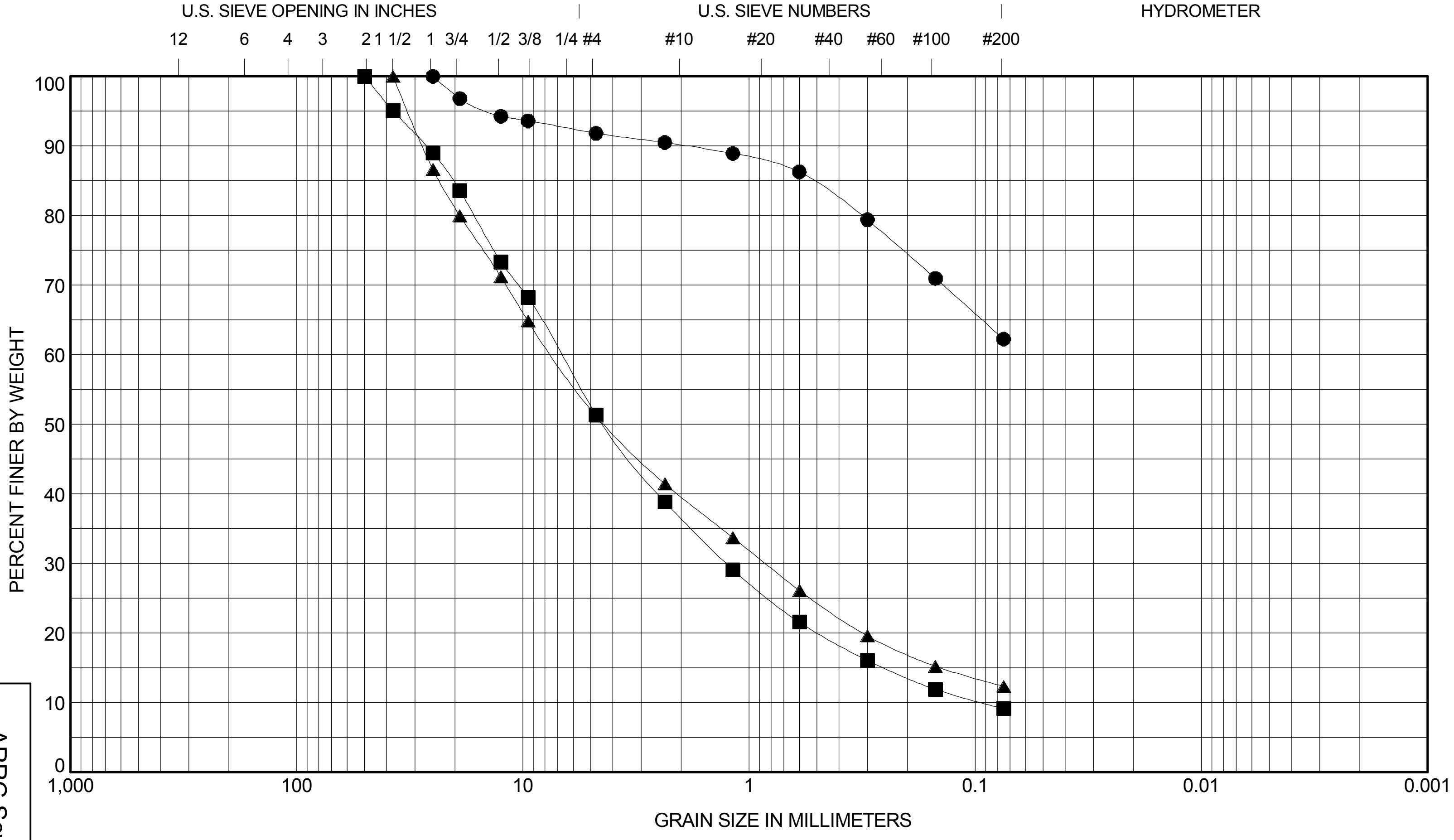
FIG. 8

REV 3 - Approved for Submittal

GEOTECHNICAL LOG 02549 LOGS_REV1.GPJ S&W GEO1.GDT 12/14/16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
● **B-1 S2**	**2.5 - 4.0**	**Sandy Silt (ML)**					
■ **B-1 S5**	**10.0 - 11.5**	**Well-Graded Gravel with Silt and Sand (GW-GM)**				**2.5**	**72.6**
▲ **B-2 S2**	**2.5 - 4.0**	**Well-Graded Gravel with Silt and Sand (GW-GM)**				**2.2**	**172.9**

Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-1 S2**	**2.5 - 4.0**	**25**				**8**	**30**	**62**	
■ **B-1 S5**	**10.0 - 11.5**	**50**	**6.78**	**1.26**	**0.09**	**49**	**42**	**9**	
▲ **B-2 S2**	**2.5 - 4.0**	**37.5**	**7.43**	**0.85**		**49**	**39**	**12**	

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GRAIN SIZE CLASSIFICATION

December 2016

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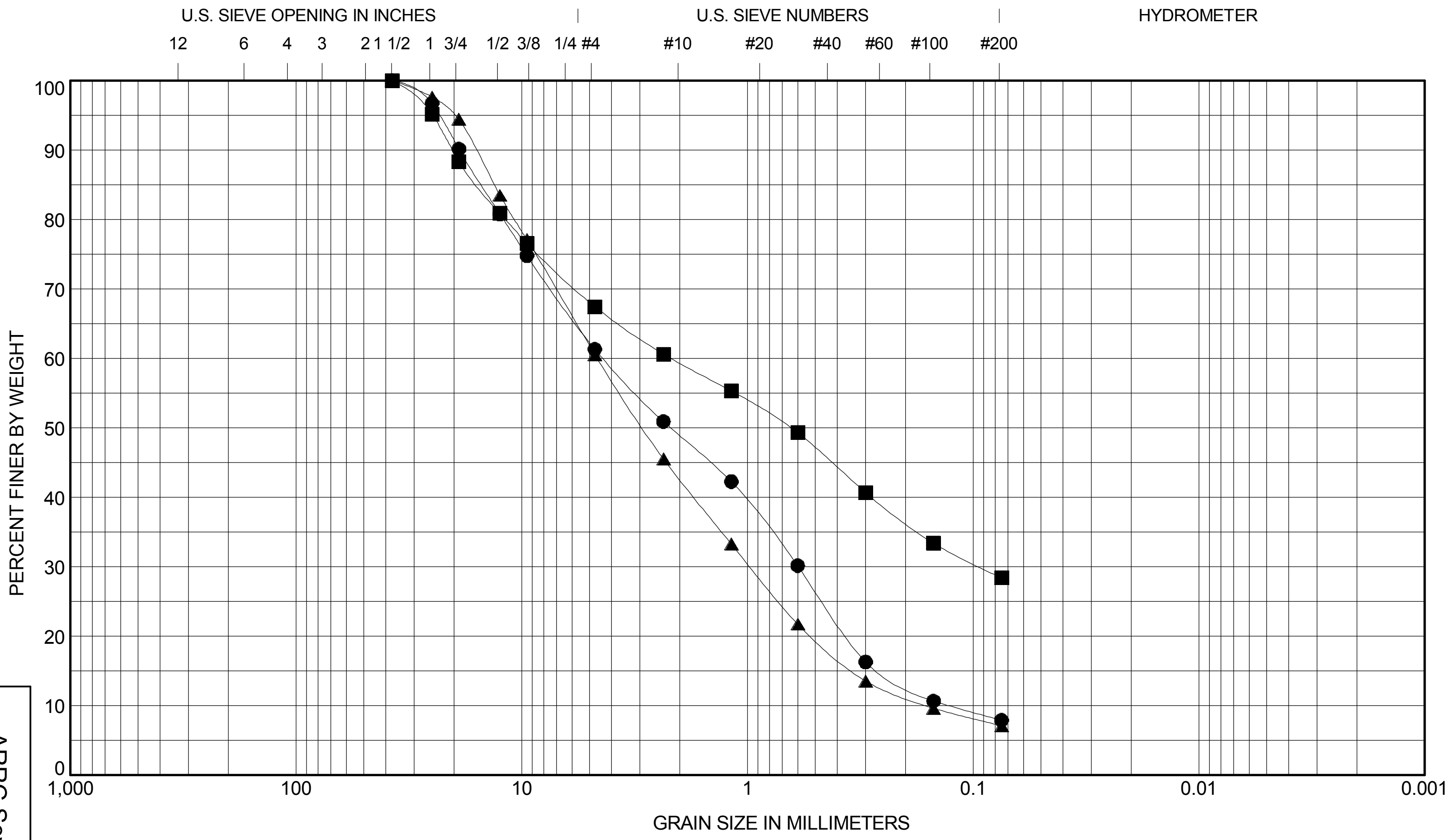
FIG. 9
Sheet 1 of 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
● **B-2 S4**	**7.5 - 9.0**	**Poorly Graded Sand with Silt and Gravel (SP-SM)**				**0.6**	**34.2**
■ **B-3 S3**	**5.0 - 6.5**	**Silty Sand with Gravel (SM)**					
▲ **B-3 S7**	**15.0 - 16.5**	**Well-Graded Sand with Silt and Gravel (SW-SM)**				**1.3**	**28.8**

Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-2 S4**	**7.5 - 9.0**	**37.5**	**4.35**	**0.6**	**0.13**	**39**	**53**	**8**	
■ **B-3 S3**	**5.0 - 6.5**	**37.5**	**2.18**	**0.09**		**33**	**39**	**28**	
▲ **B-3 S7**	**15.0 - 16.5**	**37.5**	**4.63**	**0.97**	**0.16**	**39**	**53**	**7**	

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GRAIN SIZE CLASSIFICATION

ARRC Sewer Line Extension - Phase IV
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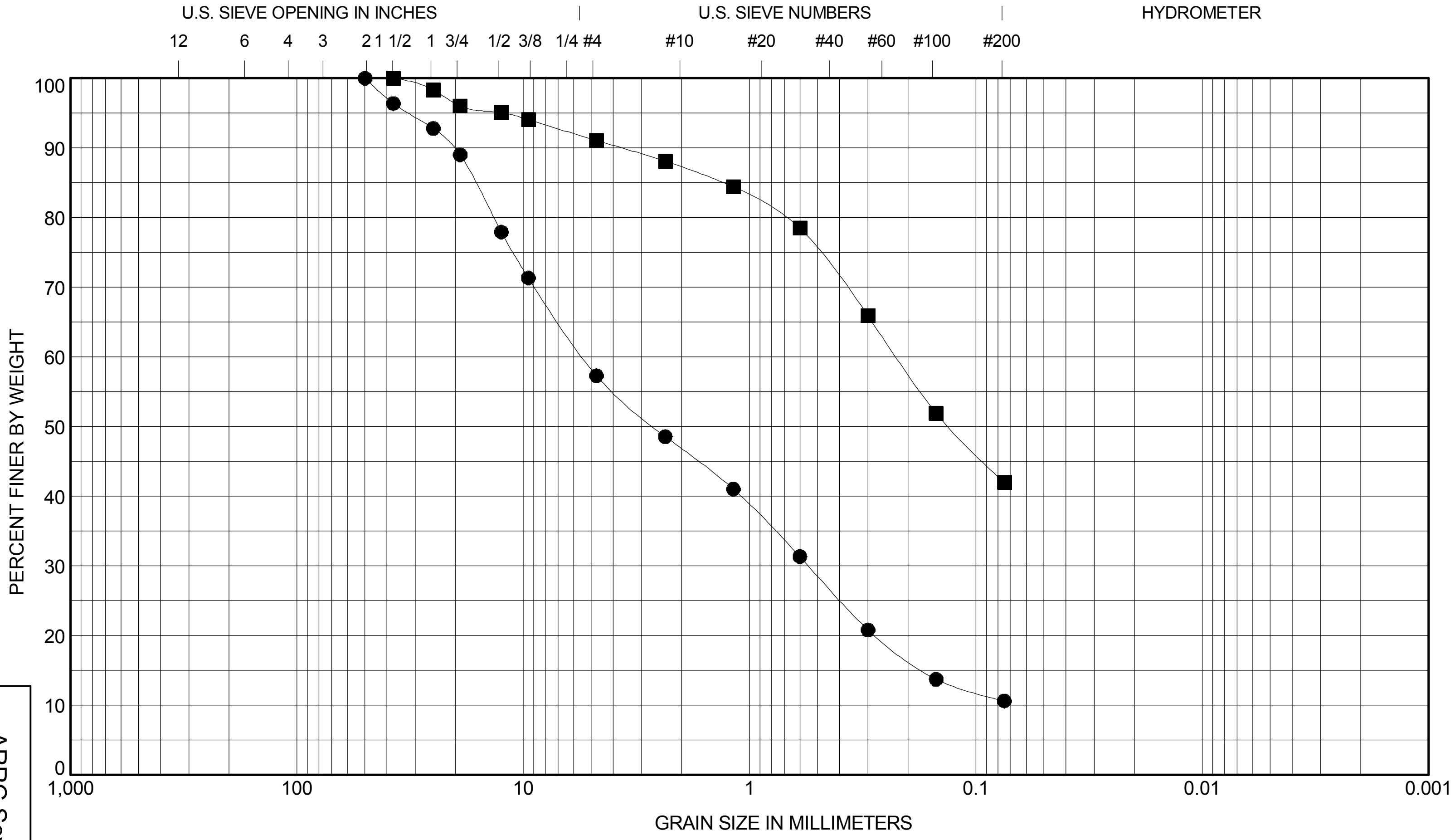
FIG. 9
Sheet 2 of 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-4 S1**	**0.0 - 1.5**	**Poorly Graded Sand with Silt and Gravel (SP-SM)**				**0.8**	**83.0**
■	**B-4 S3A**	**5.0 - 6.3**	**Silty Sand (SM)**					

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-4 S1**	**0.0 - 1.5**	**50**	**5.43**	**0.55**		**43**	**47**	**11**	
■	**B-4 S3A**	**5.0 - 6.3**	**37.5**	**0.22**			**9**	**49**	**42**	

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GRAIN SIZE CLASSIFICATION

ARRC Sewer Line Extension - Phase IV
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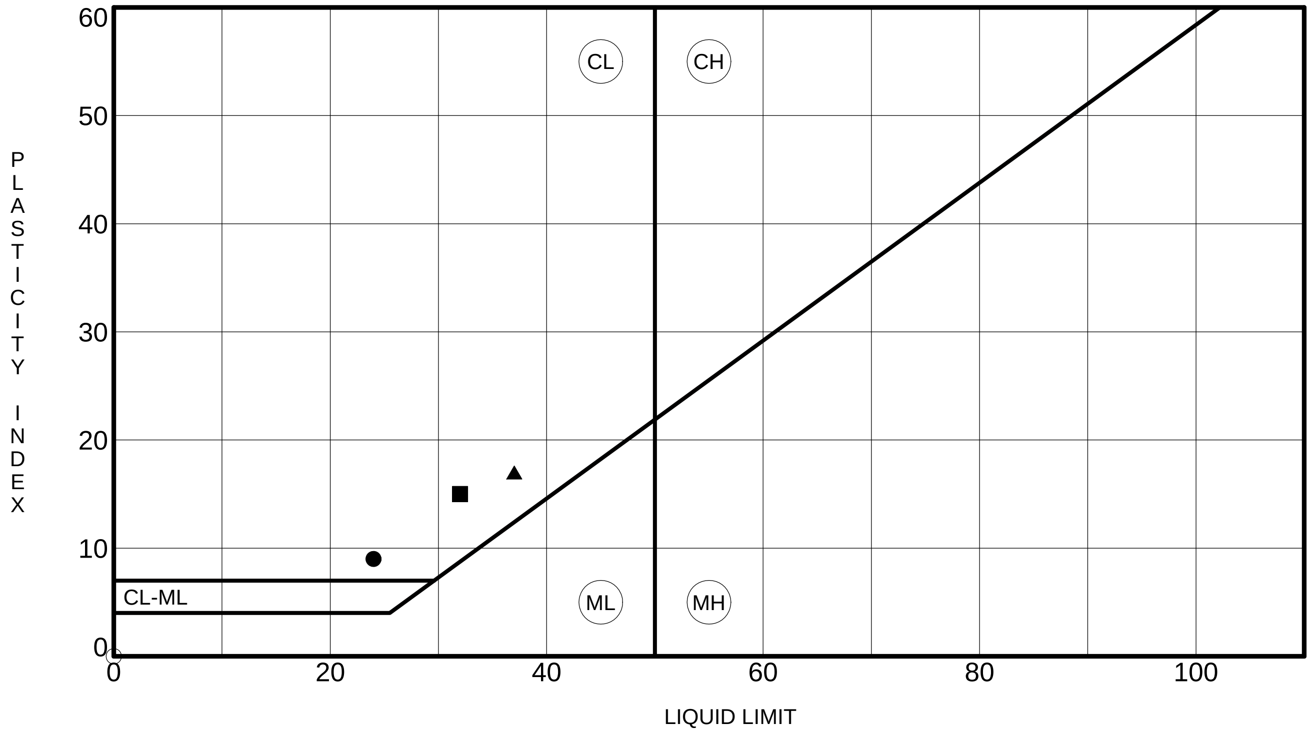
FIG. 9
Sheet 3 of 3



	Boring	Depth, Ft	LL	PL	PI	Fines	Classification
●	**B-1, S10**	**30.0 - 31.5**	**24**	**15**	**9**		**CL**
■	**B-2, S7**	**15.0 - 16.5**	**32**	**17**	**15**		**CL**
▲	**B-3, S8**	**20.0 - 21.5**	**37**	**20**	**17**		**CL**
○	**B-4, S6A**	**12.5 - 13.2**	**NP**	**NP**	**NP**		**ML**

ARRC Sewer Line Extension - Phase IV
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ATTERBERG LIMITS RESULTS

December 2016
32-1-02549

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FIG. 10

GRADATION REQUIREMENTS

(Adapted from Municipality of Anchorage Standard Specifications, 2009)

LEVELING COURSE

U.S. STANDARD SIEVE SIZE		PERCENT PASSING BY WEIGHT
English	Metric	
1 in.	25.0 mm	100
3/4 in.	19.0 mm	70 - 100
3/8 in.	9.5 mm	50 - 80
No. 4	4.75 mm	35 - 65
No. 8	2.36 mm	20 - 50
No. 50	0.30 mm	10 - 30
No. 200	0.075 mm	3 - 8*

TYPE II BASE

U.S. STANDARD SIEVE SIZE		PERCENT PASSING BY WEIGHT
8 in.	-	100
3 in.	75 mm	70 - 100
1-1/2 in.	37.5 mm	55 - 100
3/4 in.	19.0 mm	45 - 85
No. 4	4.75 mm	20 - 60
No. 10	2.00 mm	12 - 50
No. 40	0.425 mm	4 - 30
No. 200	0.075 mm	2 - 6**

TYPE II-A BASE

U.S. STANDARD SIEVE SIZE		PERCENT PASSING BY WEIGHT
3 in.	75 mm	100
3/4 in.	19.0 mm	50 - 100
No. 4	4.75 mm	25 - 60
No. 10	2.00 mm	15 - 50
No. 40	0.425 mm	4 - 30
No. 200	0.075 mm	2 - 6***

CLASS C BEDDING

U.S. STANDARD SIEVE SIZE		PERCENT PASSING BY WEIGHT
2 in.	50 mm	100
1/2 in.	12.5 mm	40 - 100
No. 4	4.75 mm	20 - 75
No. 10	2.00 mm	12 - 60
No. 40	0.425 mm	2 - 30
No. 200	0.075 mm	0 - 6***

* The fraction passing the No. 200 sieve shall not exceed 75 percent of the fraction passing the No. 50 sieve.

** The fraction passing the No. 200 sieve shall not exceed 15 percent of the fraction passing the No. 4 sieve.

*** The fraction passing the No. 200 sieve shall not exceed 20 percent of the fraction passing the No. 4 sieve.

ARRC Sewer Line Extension - Phase IV
Anchorage, Alaska

GRADATION REQUIREMENTS

December 2016 32-1-02549

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

FIG. 12

APPENDIX A

RESULTS OF CORROSIVITY EVALUATION BY COFFMAN ENGINEERS

COFFMAN ENGINEERS

Structural ▲ Mechanical ▲ Electrical ▲ Civil
Corrosion Control ▲ PM/CM

November 22, 2016

Shannon & Wilson, Inc.
5430 Fairbanks Street, Suite 3
Anchorage, Alaska 99518

Attention: Russell Hepner

Reference: ALASKA RAILROAD SEWER LINE EXTENSION- PHASE 4 SOIL CORROSIVITY EVALUATION REPORT
S & W PROJECT #32-1-02549-001

Dear Russell:

A soil corrosivity evaluation was performed on four samples obtained for testing. The soil samples were tested and evaluated by Coffman Engineers. Testing was performed in accordance with ASTM G57-06 (Reapproved 2012) “Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method” and ASTM G51-95 (Reapproved 2005) “Standard Test Method for Measuring pH of Soil in Corrosion Testing”.

The correlation between soil corrosivity and the physical and chemical constituents that comprise the soil were evaluated. Factors that affect the corrosivity of soils include soil resistivity, soluble salt content, pH, soil type (permeability), aeration, moisture content, Redox potential, amount of microbes in the soil and stray currents. No single factor or measurement should be used to determine the corrosivity of soil.

The corrosion rate of metallic structures in soil depends on the nature of the soil and other environmental factors, such as the availability to moisture and oxygen. These factors can lead to extreme variations in the rate of the attack. For example, under extreme conditions a buried metallic structure may perforate and lose integrity in less than one year, conversely archeological digs in arid desert regions have uncovered iron tools that are hundreds of years old. The following general guidelines may be formulated: Soils with high moisture content, high electrical conductivity, high acidity, and high dissolved salts will typically be the most corrosive.

Soil Resistivity & Uniformity

One of the best criterions for estimating the corrosivity of a soil is to determine its resistivity, which depends largely upon the nature and amount of dissolved salts in the soil. It is generally recognized that soluble salts, such as chloride and sulfate ions, increase the corrosivity of soil. Temperature, moisture content, compaction and presence of inert materials also affect soil resistivity.

Soil resistivity affects corrosion in several ways. The lower the resistivity, the better the soil conducts current flow and the greater the soil corrosivity. Low resistivity soils may contain high concentrations of soluble salts. The salts attack the protective oxide films on the steel surface, accelerating the rate of the electrochemical reactions, therefore increasing the corrosivity of the soil.

A general guideline for soil corrosivity as related to resistivity is listed below:

Soil Resistivity (Ohm-cm)	Soil Corrosivity
Below 1,000	Very Corrosive
1,000 – 2,000	Corrosive
2,000 – 5,000	Moderately Corrosive
5,000-10,000	Mildly Corrosive

Above 10,000	Progressively Less Corrosive

The preceding guideline may be used as a soil corrosivity indicator, but no single measurement or criterion should be used to determine the corrosivity of soil. Corrosion of structures, where bacteria, oxygen concentration cells and other corrosion mechanisms exist, has been documented in soils in excess of 100,000 ohm-cm.

Soil uniformity is important because of the possible development of localized corrosion cells caused by discontinuous soils. Different soil types in contact with a metallic structure can cause anodic (where corrosion occurs) and cathodic areas within a structure. The extent of corrosion is determined by soil resistivity, pH and other factors.

Soil pH

The chemical composition and the degree of acidity or alkalinity of the soil affect corrosion of metals in soils. In general, decreasing pH increases soil corrosivity. The pH of most soils falls within the range of 3 to 10. Typically, a neutral soil pH range is considered to be 6.5 to 7.5. Above 7.5 is considered alkaline and below 6.5 is considered acidic.

Soil pH is often considered to be one of the controlling factors in underground corrosion. Soil pH is a measure of the environment's hydrogen-ion activity. In low pH environments (acidic), the protective corrosion films on steel are de-stabilized, resulting in localized or accelerated corrosion. In neutral pH environments, sulfate-reducing anaerobic bacteriological corrosion may occur. In high pH environments (alkaline), steel develops protective passive films.

Results & Conclusions

The results of the testing follow:

Sample # & Depth	**Soil Resistivity (As-received)**	**Soil Resistivity (Saturated)**	**pH**	**Comments**
B-1 S-4 7.5'	120,000 ohm-cm	16,000 ohm-cm	6.07	moist gray sandy silt and gravel
B-2 S-5 10.0'	24,000 ohm-cm	24,000 ohm-cm	6.92	wet brown silty gravel and sand
B-3 S-5 10.0'	36,000 ohm-cm	36,000 ohm-cm	6.34	wet brown silty sand and gravel
B-4 S-4 7.5'	3,500 ohm-cm	3,500 ohm-cm	5.94	wet brown sandy silt with organics

The soil characteristics, at the test location, should be considered potentially corrosive.

Groundwater was observed at approximately 7 to 13.5 feet (see the geotechnical logs and map showing the sample collection locations). The soil at the time of testing was moist to wet and may vary seasonally.

The soil resistivities varied significantly, which may present a corrosion risk. The magnitude and variation in resistivity is often of greater significance than the absolute value of resistivity. When a structure is in contact with soils which vary significantly in resistivity, corrosion concentration cells may develop between the high and low resistivity areas. Sections in low resistivity areas become anodic to sections in high resistivity areas, and therefore corrode. Many of the saturated soil resistivities were low by Anchorage bowl standards. The resistivities may also vary with seasonal soil moisture content.

The soil pH was neutral to acidic. In acidic pH environments, the protective corrosion films on metallic structures are de-stabilized, which may result in localized or accelerated corrosion. Dense neutral soil (silts and clays) and/or soils that contain organics are favorable to sulfate-reducing anaerobic bacteriological corrosion. This aggressive corrosion mechanism can substantially reduce the design life of the structures.

Adequate corrosion control mitigation measures should be implemented to attain the AWWU specified 70-year design life of the structures. Corrosion resistant materials (i.e., non-metallic materials, stainless steel, etc.) should be used or metallic materials with a tightly bonded exterior coating and cathodic protection are recommended.

From a corrosion control perspective, non-metallic materials would be the preferred pipeline material for this project due to the soil corrosivity characteristics. If non-metallic pipeline materials are used, magnesium anodes should be installed on all below grade metallic features (flanges, valves, etc.). The features should also have a tightly bonded coating applied to them.

If ductile iron pipe is used, polyethylene encasements (baggies) should not be used unless it is used in combination with a tightly bonded coating such as Zinc coated ductile iron pipe as distributed by US Pipe. If polyethylene encasements (baggies) are used, the polyethylene encasements should also have corrosion control and bacteriological prevention additives built into the encasements to mitigate the potential for corrosion (i.e., VBio^{TM} polyethylene encasements as distributed by US Pipe). Additionally, the AWWU standard cathodic protection design and construction practices for buried pipelines should also be followed (install one 70-pound packaged weight high potential magnesium anode on each joint of pipe and install two #2 AWG CP bond cables across each pipe joint).

If ductile iron pipe is used, without polyethylene encasements and Zinc coated pipe as described above, then a tightly bonded coating with cathodic protection should be used. The AWWU standard cathodic protection design and construction practices for buried pipelines should also be followed (install one 70-pound packaged weight high potential magnesium anode on each joint of pipe and install two #2 AWG CP bond cables across each pipe joint).

Thank you for the opportunity to work with you on this project. Please let me know if you need additional information or if I can be of further assistance.

Sincerely,

COFFMAN ENGINEERS, INC.
C. Dan Stears

C. Dan Stears, Vice President
Coffman Corrosion Control Engineering
NACE Cathodic Protection Specialist #3527

APPENDIX B

RESULTS OF ANALYTICAL TESTING
SGS NORTH AMERICA INC., ALASKA DIVISION

Table B-1	Summary of Soil Analytical Results

TABLE B-1
SUMMARY OF SOIL ANALYTICAL RESULTS

Parameter Tested	Method*	Cleanup Level (mg/kg)**	Sample ID Number^, and Collection Depth in Feet bgs					
			Soil Samples					**Trip Blank**
			B1S1	B2S1	B3S1	B4S5	B4S6B	STB
			0.2-2 feet	0.2-1.5 feet	0-1.5 feet	10-11.5 feet	13.2-14 feet	-
Gasoline Range Organics (GRO) - mg/kg	AK 101	300	<1.16	**0.736 J**	<1.03	<1.45	<0.700	<1.25
Diesel Range Organics (DRO) - mg/kg	AK 102	250	**105**	**113**	**76.7**	**22.0 J**	**12.9 J**	-
Residual Range Organics (RRO) - mg/kg	AK 103	10,000	**780**	**827**	**384**	**81.8**	<11.1	-
Volatile Organic Compounds (VOCs)								
Benzene - mg/kg	EPA 8260B	0.022	**0.00579 J**	**0.00877**	<0.00515	**0.00841 J**	**0.00590 J**	<0.00625
Toluene - mg/kg	EPA 8260B	6.7	**0.0197 J**	**0.0324**	**0.00744 J**	**0.0142 J**	**0.00646 J**	<0.0125
Ethylbenzene - mg/kg	EPA 8260B	0.13	<0.0116	**0.00893 J**	<0.0104	<0.0145	<0.00700	<0.0125
Xylenes - mg/kg	EPA 8260B	1.5	<0.0348	**0.0453 J**	<0.0310	<0.0435	**0.0133 J**	<0.0375
1,1,1-Trichloroethane - mg/kg	EPA 8260B	32	<0.0116	<0.00825	<0.0104	**0.0154 J**	**0.0168**	<0.0125
1,1-Dichloroethane - mg/kg	EPA 8260B	0.092	<0.0116	<0.00825	<0.0104	<0.0145	**0.0222**	<0.0125
1,2,4-Trimethylbenzene - mg/kg	EPA 8260B	0.16	<0.0231	**0.0342**	<0.0206	<0.0290	<0.0141	<0.0251
1,2-Dichloroethane - mg/kg	EPA 8260B	0.0055	<0.00463	<0.00331	<0.00413	**<0.00580**	**0.0150**	<0.00500
1,3,5-Trimethylbenzene - mg/kg	EPA 8260B	1.3	<0.0116	<0.0165 B	<0.0104	<0.0145	<0.00700	<0.0125
1,4-Dichlorobenzene - mg/kg	EPA 8260B	0.037	<0.0116	<0.00825	<0.0104	**0.0209 J**	**0.00491 J**	<0.0125
4-Isopropyltoluene - mg/kg	EPA 8260B	-	<0.0116	<0.0165 B	<0.0104	<0.0145	<0.00700	<0.0125
Chloromethane - mg/kg	EPA 8260B	0.61	<0.0116	**0.00612 J**	<0.0104	**0.0139 J**	<0.00700	<0.0125
cis-1,2-Dichloroethene - mg/kg	EPA 8260B	0.12	<0.0116	<0.00825	<0.0104	<0.0145	**0.0364**	<0.0125
Naphthalene - mg/kg	EPA 8260B	0.038	<0.0231	**0.0159 J**	<0.0206	<0.0290	<0.0141	<0.0251
n-Butylbenzene - mg/kg	EPA 8260B	20	<0.0116	<0.00825	<0.0104	<0.0290 B	<0.00700	<0.0125
n-Propylbenzene - mg/kg	EPA 8260B	9.1	<0.0116	<0.0165 B	<0.0104	<0.0145	<0.00700	<0.0125
Styrene - mg/kg	EPA 8260B	10	**0.00903 J**	**0.00761 J**	<0.0104	<0.0145	<0.00700	<0.0125
Tetrachloroethene - mg/kg	EPA 8260B	0.19	<0.00580	**0.0106**	**0.0138**	<0.00725	<0.00351	<0.00625
Trichloroethene - mg/kg	EPA 8260B	0.011	<0.00580	**0.189**	**0.00785 J**	**0.0255**	**0.0152**	<0.00625
Vinyl chloride - mg/kg	EPA 8260B	0.00080	**<0.00463**	**<0.00331**	**<0.00413**	**<0.00580**	**0.0117**	**<0.00500**
Other VOC Analytes	EPA 8260B	Various	ND	ND	ND	ND	ND	ND

Notes:

*	= See laboratory report in Appendix B for compounds tested, methods, and laboratory reporting limits
**	= The most stringent ADEC Method Two cleanup level listed in Table B1 or B2, 18 AAC 75 (November 2016), for the "under 40 inches (precipitation) zone"
^	= Sample ID number preceded by "02549-" on the chain-of-custody form
bgs	= below ground surface
ppm	= parts per million
mg/kg	= milligrams per kilogram
<1.16	= Analyte not detected; laboratory limit of detection is 1.16 mg/kg
<0.00463	= Laboratory limit of detection is greater than the ADEC Method Two cleanup level
105	= Analyte detected
0.189	= Analyte concentration exceeds ADEC regulatory cleanup level
-	= Not applicable or sample not tested for this analyte
J	= Estimated concentration less than the limit of quantitation. See the SGS laboratory report for more details.
B	= Compound detected in method blank at an estimated concentration. The associated sample is assigned a non-detect value at the limit of quantitation (LOQ).
ND	= Not detected

Laboratory Report of Analysis

To:
Shannon & Wilson, Inc.
5430 Fairbanks St Suite 3
Anchorage, AK 99518
907-433-3243

Report Number: **1166464**

Client Project: **02549 ARRC Sewer Ph4**

Dear Russell Hepner,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Victoria at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Victoria Pennick Date
Project Manager
Victoria.Pennick@sgs.com

Print Date: 11/04/2016 10:30:20AM

Case Narrative

SGS Client: **Shannon & Wilson, Inc.**
SGS Project: **1166464**
Project Name/Site: **02549 ARRC Sewer Ph4**
Project Contact: **Russell Hepner**

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Print Date: 11/04/2016 10:30:22AM

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.
All DRO/RRO analyses are integrated per SOP.

Print Date: 11/04/2016 10:30:24AM

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
02549-B1 S1	1166464001	10/24/2016	10/26/2016	Soil/Solid (dry weight)
02549-B1 S4	1166464002	10/24/2016	10/26/2016	Solid/Soil (Wet Weight)
02549-B2 S1	1166464003	10/24/2016	10/26/2016	Soil/Solid (dry weight)
02549-B2 S2	1166464004	10/24/2016	10/26/2016	Solid/Soil (Wet Weight)
02549-B3 S1	1166464005	10/25/2016	10/26/2016	Soil/Solid (dry weight)
02549-B4 S5	1166464006	10/25/2016	10/26/2016	Soil/Solid (dry weight)
02549-B4 S6B	1166464007	10/25/2016	10/26/2016	Soil/Solid (dry weight)
02549-STB	1166464008	10/24/2016	10/26/2016	Soil/Solid (dry weight)

Method	Method Description
AK102	Diesel/Residual Range Organics
AK103	Diesel/Residual Range Organics
AK101	Gasoline Range Organics (S)
SM21 2540G	Percent Solids SM2540G
SW8260B	VOC 8260 (S) Field Extracted

Detectable Results Summary

Client Sample ID: **02549-B1 S1**
Lab Sample ID: 1166464001

	Parameter	Result	Units
Semivolatile Organic Fuels	Diesel Range Organics	105	mg/Kg
	Residual Range Organics	780	mg/Kg
Volatile GC/MS	Benzene	5.79J	ug/Kg
	Styrene	9.03J	ug/Kg
	Toluene	19.7J	ug/Kg

Client Sample ID: **02549-B2 S1**
Lab Sample ID: 1166464003

	Parameter	Result	Units
Semivolatile Organic Fuels	Diesel Range Organics	113	mg/Kg
	Residual Range Organics	827	mg/Kg
Volatile Fuels	Gasoline Range Organics	0.736J	mg/Kg
Volatile GC/MS	1,2,4-Trimethylbenzene	34.2	ug/Kg
	1,3,5-Trimethylbenzene	12.9J	ug/Kg
	4-Isopropyltoluene	6.12J	ug/Kg
	Benzene	8.77	ug/Kg
	Chloromethane	6.12J	ug/Kg
	Ethylbenzene	8.93J	ug/Kg
	Naphthalene	15.9J	ug/Kg
	n-Propylbenzene	8.10J	ug/Kg
	o-Xylene	14.9J	ug/Kg
	P & M -Xylene	30.4J	ug/Kg
	Styrene	7.61J	ug/Kg
	Tetrachloroethene	10.6	ug/Kg
	Toluene	32.4	ug/Kg
	Trichloroethene	189	ug/Kg
	Xylenes (total)	45.3J	ug/Kg

Client Sample ID: **02549-B3 S1**
Lab Sample ID: 1166464005

	Parameter	Result	Units
Semivolatile Organic Fuels	Diesel Range Organics	76.7	mg/Kg
	Residual Range Organics	384	mg/Kg
Volatile GC/MS	Tetrachloroethene	13.8	ug/Kg
	Toluene	7.44J	ug/Kg
	Trichloroethene	7.85J	ug/Kg

Client Sample ID: **02549-B4 S5**
Lab Sample ID: 1166464006

	Parameter	Result	Units
Semivolatile Organic Fuels	Diesel Range Organics	22.0J	mg/Kg
	Residual Range Organics	81.8	mg/Kg
Volatile GC/MS	1,1,1-Trichloroethane	15.4J	ug/Kg
	1,4-Dichlorobenzene	20.9J	ug/Kg
	Benzene	8.41J	ug/Kg
	Chloromethane	13.9J	ug/Kg
	n-Butylbenzene	13.0J	ug/Kg
	Toluene	14.2J	ug/Kg
	Trichloroethene	25.5	ug/Kg

Detectable Results Summary

Client Sample ID: **02549-B4 S6B**
Lab Sample ID: 1166464007

	Parameter	Result	Units
Semivolatile Organic Fuels	Diesel Range Organics	12.9J	mg/Kg
Volatile GC/MS	1,1,1-Trichloroethane	16.8	ug/Kg
	1,1-Dichloroethane	22.2	ug/Kg
	1,2-Dichloroethane	15.0	ug/Kg
	1,4-Dichlorobenzene	4.91J	ug/Kg
	Benzene	5.90J	ug/Kg
	cis-1,2-Dichloroethene	36.4	ug/Kg
	P & M -Xylene	13.3J	ug/Kg
	Toluene	6.46J	ug/Kg
	Trichloroethene	15.2	ug/Kg
	Vinyl chloride	11.7	ug/Kg
	Xylenes (total)	13.3J	ug/Kg

Results of **02549-B1 S1**

Client Sample ID: **02549-B1 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464001
Lab Project ID: 1166464

Collection Date: 10/24/16 11:55
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):85.0
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	105		93.8	29.1	mg/Kg	4		10/28/16 19:00
Surrogates								
5a Androstane (surr)	84.7		50-150		%	4		10/28/16 19:00

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK102
Analyst: CRA
Analytical Date/Time: 10/28/16 19:00
Container ID: 1166464001-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.096 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	780		93.8	29.1	mg/Kg	4		10/28/16 19:00
Surrogates								
n-Triacontane-d62 (surr)	90.3		50-150		%	4		10/28/16 19:00

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK103
Analyst: CRA
Analytical Date/Time: 10/28/16 19:00
Container ID: 1166464001-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.096 g
Prep Extract Vol: 1 mL

Results of **02549-B1 S1**

Client Sample ID: **02549-B1 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464001
Lab Project ID: 1166464

Collection Date: 10/24/16 11:55
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):85.0
Location:

Results by **Volatile Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.16 U	2.32	0.695	mg/Kg	1		11/02/16 12:45
Surrogates							
4-Bromofluorobenzene (surr)	50.4	50-150		%	1		11/02/16 12:45

Batch Information

Analytical Batch: VFC13449
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/02/16 12:45
Container ID: 1166464001-B

Prep Batch: VXX29910
Prep Method: SW5035A
Prep Date/Time: 10/24/16 11:55
Prep Initial Wt./Vol.: 102.289 g
Prep Extract Vol: 40.2992 mL

Results of **02549-B1 S1**

Client Sample ID: **02549-B1 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464001
Lab Project ID: 1166464

Collection Date: 10/24/16 11:55
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):85.0
Location:

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,1,1-Trichloroethane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,1,2,2-Tetrachloroethane	5.80	U	11.6	3.61	ug/Kg	1		10/27/16 22:16
1,1,2-Trichloroethane	4.63	U	9.27	2.87	ug/Kg	1		10/27/16 22:16
1,1-Dichloroethane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,1-Dichloroethene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,1-Dichloropropene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,2,3-Trichlorobenzene	23.1	U	46.3	13.9	ug/Kg	1		10/27/16 22:16
1,2,3-Trichloropropane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,2,4-Trichlorobenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,2,4-Trimethylbenzene	23.1	U	46.3	13.9	ug/Kg	1		10/27/16 22:16
1,2-Dibromo-3-chloropropane	46.4	U	92.7	28.7	ug/Kg	1		10/27/16 22:16
1,2-Dibromoethane	4.63	U	9.27	2.87	ug/Kg	1		10/27/16 22:16
1,2-Dichlorobenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,2-Dichloroethane	4.63	U	9.27	2.87	ug/Kg	1		10/27/16 22:16
1,2-Dichloropropane	4.63	U	9.27	2.87	ug/Kg	1		10/27/16 22:16
1,3,5-Trimethylbenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,3-Dichlorobenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
1,3-Dichloropropane	4.63	U	9.27	2.87	ug/Kg	1		10/27/16 22:16
1,4-Dichlorobenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
2,2-Dichloropropane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
2-Butanone (MEK)	116	U	232	72.3	ug/Kg	1		10/27/16 22:16
2-Chlorotoluene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
2-Hexanone	116	U	232	72.3	ug/Kg	1		10/27/16 22:16
4-Chlorotoluene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
4-Isopropyltoluene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
4-Methyl-2-pentanone (MIBK)	116	U	232	72.3	ug/Kg	1		10/27/16 22:16
Benzene	5.79	J	11.6	3.61	ug/Kg	1		10/27/16 22:16
Bromobenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Bromochloromethane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Bromodichloromethane	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Bromoform	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Bromomethane	92.5	U	185	57.4	ug/Kg	1		10/27/16 22:16
Carbon disulfide	46.4	U	92.7	28.7	ug/Kg	1		10/27/16 22:16
Carbon tetrachloride	5.80	U	11.6	3.61	ug/Kg	1		10/27/16 22:16
Chlorobenzene	11.6	U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Chloroethane	92.5	U	185	57.4	ug/Kg	1		10/27/16 22:16

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J flagging is activated

Results of **02549-B1 S1**

Client Sample ID: **02549-B1 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464001
Lab Project ID: 1166464

Collection Date: 10/24/16 11:55
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):85.0
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Chloromethane	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
cis-1,2-Dichloroethene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
cis-1,3-Dichloropropene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Dibromochloromethane	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Dibromomethane	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Dichlorodifluoromethane	23.1 U	46.3	13.9	ug/Kg	1		10/27/16 22:16
Ethylbenzene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Freon-113	46.4 U	92.7	28.7	ug/Kg	1		10/27/16 22:16
Hexachlorobutadiene	23.1 U	46.3	13.9	ug/Kg	1		10/27/16 22:16
Isopropylbenzene (Cumene)	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Methylene chloride	46.4 U	92.7	28.7	ug/Kg	1		10/27/16 22:16
Methyl-t-butyl ether	46.4 U	92.7	28.7	ug/Kg	1		10/27/16 22:16
Naphthalene	23.1 U	46.3	13.9	ug/Kg	1		10/27/16 22:16
n-Butylbenzene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
n-Propylbenzene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
o-Xylene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
P & M -Xylene	23.1 U	46.3	13.9	ug/Kg	1		10/27/16 22:16
sec-Butylbenzene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Styrene	9.03 J	23.2	7.23	ug/Kg	1		10/27/16 22:16
tert-Butylbenzene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Tetrachloroethene	5.80 U	11.6	3.61	ug/Kg	1		10/27/16 22:16
Toluene	19.7 J	23.2	7.23	ug/Kg	1		10/27/16 22:16
trans-1,2-Dichloroethene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
trans-1,3-Dichloropropene	11.6 U	23.2	7.23	ug/Kg	1		10/27/16 22:16
Trichloroethene	5.80 U	11.6	3.61	ug/Kg	1		10/27/16 22:16
Trichlorofluoromethane	23.1 U	46.3	13.9	ug/Kg	1		10/27/16 22:16
Vinyl acetate	46.4 U	92.7	28.7	ug/Kg	1		10/27/16 22:16
Vinyl chloride	4.63 U	9.27	2.87	ug/Kg	1		10/27/16 22:16
Xylenes (total)	34.8 U	69.5	21.1	ug/Kg	1		10/27/16 22:16
Surrogates							
1,2-Dichloroethane-D4 (surr)	120	71-136		%	1		10/27/16 22:16
4-Bromofluorobenzene (surr)	98.4	55-151		%	1		10/27/16 22:16
Toluene-d8 (surr)	98.9	85-116		%	1		10/27/16 22:16

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J flagging is activated

Results of **02549-B1 S1**

Client Sample ID: **02549-B1 S1**	Collection Date: 10/24/16 11:55
Client Project ID: **02549 ARRC Sewer Ph4**	Received Date: 10/26/16 17:15
Lab Sample ID: 1166464001	Matrix: Soil/Solid (dry weight)
Lab Project ID: 1166464	Solids (%):85.0
	Location:

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS16343	Prep Batch: VXX29862
Analytical Method: SW8260B	Prep Method: SW5035A
Analyst: S.P	Prep Date/Time: 10/24/16 11:55
Analytical Date/Time: 10/27/16 22:16	Prep Initial Wt./Vol.: 102.289 g
Container ID: 1166464001-B	Prep Extract Vol: 40.2992 mL

Results of **02549-B2 S1**

Client Sample ID: **02549-B2 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464003
Lab Project ID: 1166464

Collection Date: 10/24/16 10:28
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):94.1
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	113		84.2	26.1	mg/Kg	4		10/28/16 19:10
Surrogates								
5a Androstane (surr)	90.7		50-150		%	4		10/28/16 19:10

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK102
Analyst: CRA
Analytical Date/Time: 10/28/16 19:10
Container ID: 1166464003-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.271 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	827		84.2	26.1	mg/Kg	4		10/28/16 19:10
Surrogates								
n-Triacontane-d62 (surr)	114		50-150		%	4		10/28/16 19:10

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK103
Analyst: CRA
Analytical Date/Time: 10/28/16 19:10
Container ID: 1166464003-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.271 g
Prep Extract Vol: 1 mL

J flagging is activated

Results of **02549-B2 S1**

Client Sample ID: **02549-B2 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464003
Lab Project ID: 1166464

Collection Date: 10/24/16 10:28
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):94.1
Location:

Results by **Volatile Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.736 J	1.65	0.496	mg/Kg	1		11/02/16 13:04
Surrogates							
4-Bromofluorobenzene (surr)	80.8	50-150		%	1		11/02/16 13:04

Batch Information

Analytical Batch: VFC13449
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/02/16 13:04
Container ID: 1166464003-B

Prep Batch: VXX29910
Prep Method: SW5035A
Prep Date/Time: 10/24/16 10:28
Prep Initial Wt./Vol.: 98.898 g
Prep Extract Vol: 30.7957 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B2 S1**

Client Sample ID: **02549-B2 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464003
Lab Project ID: 1166464

Collection Date: 10/24/16 10:28
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):94.1
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,1,1-Trichloroethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,1,2,2-Tetrachloroethane	4.13 U	8.27	2.58	ug/Kg	1		10/27/16 22:32
1,1,2-Trichloroethane	3.31 U	6.62	2.05	ug/Kg	1		10/27/16 22:32
1,1-Dichloroethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,1-Dichloroethene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,1-Dichloropropene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,2,3-Trichlorobenzene	16.6 U	33.1	9.92	ug/Kg	1		10/27/16 22:32
1,2,3-Trichloropropane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,2,4-Trichlorobenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,2,4-Trimethylbenzene	34.2	33.1	9.92	ug/Kg	1		10/27/16 22:32
1,2-Dibromo-3-chloropropane	33.1 U	66.2	20.5	ug/Kg	1		10/27/16 22:32
1,2-Dibromoethane	3.31 U	6.62	2.05	ug/Kg	1		10/27/16 22:32
1,2-Dichlorobenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,2-Dichloroethane	3.31 U	6.62	2.05	ug/Kg	1		10/27/16 22:32
1,2-Dichloropropane	3.31 U	6.62	2.05	ug/Kg	1		10/27/16 22:32
1,3,5-Trimethylbenzene	12.9 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,3-Dichlorobenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
1,3-Dichloropropane	3.31 U	6.62	2.05	ug/Kg	1		10/27/16 22:32
1,4-Dichlorobenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
2,2-Dichloropropane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
2-Butanone (MEK)	82.5 U	165	51.6	ug/Kg	1		10/27/16 22:32
2-Chlorotoluene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
2-Hexanone	82.5 U	165	51.6	ug/Kg	1		10/27/16 22:32
4-Chlorotoluene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
4-Isopropyltoluene	6.12 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
4-Methyl-2-pentanone (MIBK)	82.5 U	165	51.6	ug/Kg	1		10/27/16 22:32
Benzene	8.77	8.27	2.58	ug/Kg	1		10/27/16 22:32
Bromobenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Bromochloromethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Bromodichloromethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Bromoform	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Bromomethane	66.0 U	132	41.0	ug/Kg	1		10/27/16 22:32
Carbon disulfide	33.1 U	66.2	20.5	ug/Kg	1		10/27/16 22:32
Carbon tetrachloride	4.13 U	8.27	2.58	ug/Kg	1		10/27/16 22:32
Chlorobenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Chloroethane	66.0 U	132	41.0	ug/Kg	1		10/27/16 22:32

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Results of **02549-B2 S1**

Client Sample ID: **02549-B2 S1**	Collection Date: 10/24/16 10:28
Client Project ID: **02549 ARRC Sewer Ph4**	Received Date: 10/26/16 17:15
Lab Sample ID: 1166464003	Matrix: Soil/Solid (dry weight)
Lab Project ID: 1166464	Solids (%):94.1
	Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Chloromethane	6.12 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
cis-1,2-Dichloroethene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
cis-1,3-Dichloropropene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Dibromochloromethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Dibromomethane	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Dichlorodifluoromethane	16.6 U	33.1	9.92	ug/Kg	1		10/27/16 22:32
Ethylbenzene	8.93 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
Freon-113	33.1 U	66.2	20.5	ug/Kg	1		10/27/16 22:32
Hexachlorobutadiene	16.6 U	33.1	9.92	ug/Kg	1		10/27/16 22:32
Isopropylbenzene (Cumene)	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Methylene chloride	33.1 U	66.2	20.5	ug/Kg	1		10/27/16 22:32
Methyl-t-butyl ether	33.1 U	66.2	20.5	ug/Kg	1		10/27/16 22:32
Naphthalene	15.9 J	33.1	9.92	ug/Kg	1		10/27/16 22:32
n-Butylbenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
n-Propylbenzene	8.10 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
o-Xylene	14.9 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
P & M -Xylene	30.4 J	33.1	9.92	ug/Kg	1		10/27/16 22:32
sec-Butylbenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Styrene	7.61 J	16.5	5.16	ug/Kg	1		10/27/16 22:32
tert-Butylbenzene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Tetrachloroethene	10.6	8.27	2.58	ug/Kg	1		10/27/16 22:32
Toluene	32.4	16.5	5.16	ug/Kg	1		10/27/16 22:32
trans-1,2-Dichloroethene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
trans-1,3-Dichloropropene	8.25 U	16.5	5.16	ug/Kg	1		10/27/16 22:32
Trichloroethene	189	8.27	2.58	ug/Kg	1		10/27/16 22:32
Trichlorofluoromethane	16.6 U	33.1	9.92	ug/Kg	1		10/27/16 22:32
Vinyl acetate	33.1 U	66.2	20.5	ug/Kg	1		10/27/16 22:32
Vinyl chloride	3.31 U	6.62	2.05	ug/Kg	1		10/27/16 22:32
Xylenes (total)	45.3 J	49.6	15.1	ug/Kg	1		10/27/16 22:32
Surrogates							
1,2-Dichloroethane-D4 (surr)	122	71-136		%	1		10/27/16 22:32
4-Bromofluorobenzene (surr)	119	55-151		%	1		10/27/16 22:32
Toluene-d8 (surr)	101	85-116		%	1		10/27/16 22:32

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SGS

Results of **02549-B2 S1**

Client Sample ID: **02549-B2 S1**	Collection Date: 10/24/16 10:28
Client Project ID: **02549 ARRC Sewer Ph4**	Received Date: 10/26/16 17:15
Lab Sample ID: 1166464003	Matrix: Soil/Solid (dry weight)
Lab Project ID: 1166464	Solids (%):94.1
	Location:

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS16343	Prep Batch: VXX29862
Analytical Method: SW8260B	Prep Method: SW5035A
Analyst: S.P	Prep Date/Time: 10/24/16 10:28
Analytical Date/Time: 10/27/16 22:32	Prep Initial Wt./Vol.: 98.898 g
Container ID: 1166464003-B	Prep Extract Vol: 30.7957 mL

Results of **02549-B3 S1**

Client Sample ID: **02549-B3 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464005
Lab Project ID: 1166464

Collection Date: 10/25/16 13:43
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):88.7
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	76.7	22.3	6.92	mg/Kg	1		10/28/16 18:51
Surrogates							
5a Androstane (surr)	94.7	50-150		%	1		10/28/16 18:51

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK102
Analyst: CRA
Analytical Date/Time: 10/28/16 18:51
Container ID: 1166464005-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.297 g
Prep Extract Vol: 1 mL

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	384	22.3	6.92	mg/Kg	1		10/28/16 18:51
Surrogates							
n-Triacontane-d62 (surr)	87.6	50-150		%	1		10/28/16 18:51

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK103
Analyst: CRA
Analytical Date/Time: 10/28/16 18:51
Container ID: 1166464005-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.297 g
Prep Extract Vol: 1 mL

Results of **02549-B3 S1**

Client Sample ID: **02549-B3 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464005
Lab Project ID: 1166464

Collection Date: 10/25/16 13:43
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):88.7
Location:

Results by **Volatile Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.03 U	2.07	0.620	mg/Kg	1		11/02/16 13:23
Surrogates							
4-Bromofluorobenzene (surr)	93	50-150		%	1		11/02/16 13:23

Batch Information

Analytical Batch: VFC13449
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/02/16 13:23
Container ID: 1166464005-B

Prep Batch: VXX29910
Prep Method: SW5035A
Prep Date/Time: 10/25/16 13:43
Prep Initial Wt./Vol.: 98.599 g
Prep Extract Vol: 36.1508 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B3 S1**

Client Sample ID: **02549-B3 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464005
Lab Project ID: 1166464

Collection Date: 10/25/16 13:43
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):88.7
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,1,1-Trichloroethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,1,2,2-Tetrachloroethane	5.15 U	10.3	3.22	ug/Kg	1		10/27/16 22:48
1,1,2-Trichloroethane	4.13 U	8.27	2.56	ug/Kg	1		10/27/16 22:48
1,1-Dichloroethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,1-Dichloroethene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,1-Dichloropropene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,2,3-Trichlorobenzene	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
1,2,3-Trichloropropane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,2,4-Trichlorobenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,2,4-Trimethylbenzene	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
1,2-Dibromo-3-chloropropane	41.4 U	82.7	25.6	ug/Kg	1		10/27/16 22:48
1,2-Dibromoethane	4.13 U	8.27	2.56	ug/Kg	1		10/27/16 22:48
1,2-Dichlorobenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,2-Dichloroethane	4.13 U	8.27	2.56	ug/Kg	1		10/27/16 22:48
1,2-Dichloropropane	4.13 U	8.27	2.56	ug/Kg	1		10/27/16 22:48
1,3,5-Trimethylbenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,3-Dichlorobenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
1,3-Dichloropropane	4.13 U	8.27	2.56	ug/Kg	1		10/27/16 22:48
1,4-Dichlorobenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
2,2-Dichloropropane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
2-Butanone (MEK)	104 U	207	64.5	ug/Kg	1		10/27/16 22:48
2-Chlorotoluene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
2-Hexanone	104 U	207	64.5	ug/Kg	1		10/27/16 22:48
4-Chlorotoluene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
4-Isopropyltoluene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
4-Methyl-2-pentanone (MIBK)	104 U	207	64.5	ug/Kg	1		10/27/16 22:48
Benzene	5.15 U	10.3	3.22	ug/Kg	1		10/27/16 22:48
Bromobenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Bromochloromethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Bromodichloromethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Bromoform	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Bromomethane	82.5 U	165	51.3	ug/Kg	1		10/27/16 22:48
Carbon disulfide	41.4 U	82.7	25.6	ug/Kg	1		10/27/16 22:48
Carbon tetrachloride	5.15 U	10.3	3.22	ug/Kg	1		10/27/16 22:48
Chlorobenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Chloroethane	82.5 U	165	51.3	ug/Kg	1		10/27/16 22:48

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J flagging is activated

Results of **02549-B3 S1**

Client Sample ID: **02549-B3 S1**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464005
Lab Project ID: 1166464

Collection Date: 10/25/16 13:43
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):88.7
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Chloromethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
cis-1,2-Dichloroethene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
cis-1,3-Dichloropropene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Dibromochloromethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Dibromomethane	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Dichlorodifluoromethane	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
Ethylbenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Freon-113	41.4 U	82.7	25.6	ug/Kg	1		10/27/16 22:48
Hexachlorobutadiene	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
Isopropylbenzene (Cumene)	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Methylene chloride	41.4 U	82.7	25.6	ug/Kg	1		10/27/16 22:48
Methyl-t-butyl ether	41.4 U	82.7	25.6	ug/Kg	1		10/27/16 22:48
Naphthalene	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
n-Butylbenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
n-Propylbenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
o-Xylene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
P & M -Xylene	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
sec-Butylbenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Styrene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
tert-Butylbenzene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Tetrachloroethene	13.8	10.3	3.22	ug/Kg	1		10/27/16 22:48
Toluene	7.44 J	20.7	6.45	ug/Kg	1		10/27/16 22:48
trans-1,2-Dichloroethene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
trans-1,3-Dichloropropene	10.4 U	20.7	6.45	ug/Kg	1		10/27/16 22:48
Trichloroethene	7.85 J	10.3	3.22	ug/Kg	1		10/27/16 22:48
Trichlorofluoromethane	20.6 U	41.3	12.4	ug/Kg	1		10/27/16 22:48
Vinyl acetate	41.4 U	82.7	25.6	ug/Kg	1		10/27/16 22:48
Vinyl chloride	4.13 U	8.27	2.56	ug/Kg	1		10/27/16 22:48
Xylenes (total)	31.0 U	62.0	18.9	ug/Kg	1		10/27/16 22:48
Surrogates							
1,2-Dichloroethane-D4 (surr)	124	71-136		%	1		10/27/16 22:48
4-Bromofluorobenzene (surr)	129	55-151		%	1		10/27/16 22:48
Toluene-d8 (surr)	103	85-116		%	1		10/27/16 22:48

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J flagging is activated

Results of **02549-B3 S1**

Client Sample ID: **02549-B3 S1**	Collection Date: 10/25/16 13:43
Client Project ID: **02549 ARRC Sewer Ph4**	Received Date: 10/26/16 17:15
Lab Sample ID: 1166464005	Matrix: Soil/Solid (dry weight)
Lab Project ID: 1166464	Solids (%):88.7
	Location:

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS16343	Prep Batch: VXX29862
Analytical Method: SW8260B	Prep Method: SW5035A
Analyst: S.P	Prep Date/Time: 10/25/16 13:43
Analytical Date/Time: 10/27/16 22:48	Prep Initial Wt./Vol.: 98.599 g
Container ID: 1166464005-B	Prep Extract Vol: 36.1508 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B4 S5**

Client Sample ID: **02549-B4 S5**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464006
Lab Project ID: 1166464

Collection Date: 10/25/16 16:48
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):79.2
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	22.0 J	24.9	7.73	mg/Kg	1		10/28/16 19:29
Surrogates							
5a Androstane (surr)	83.4	50-150		%	1		10/28/16 19:29

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK102
Analyst: CRA
Analytical Date/Time: 10/28/16 19:29
Container ID: 1166464006-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.354 g
Prep Extract Vol: 1 mL

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	81.8	24.9	7.73	mg/Kg	1		10/28/16 19:29
Surrogates							
n-Triacontane-d62 (surr)	81.5	50-150		%	1		10/28/16 19:29

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK103
Analyst: CRA
Analytical Date/Time: 10/28/16 19:29
Container ID: 1166464006-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.354 g
Prep Extract Vol: 1 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B4 S5**

Client Sample ID: **02549-B4 S5**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464006
Lab Project ID: 1166464

Collection Date: 10/25/16 16:48
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):79.2
Location:

Results by **Volatile Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.45 U	2.90	0.870	mg/Kg	1		11/02/16 13:42
Surrogates							
4-Bromofluorobenzene (surr)	79.8	50-150		%	1		11/02/16 13:42

Batch Information

Analytical Batch: VFC13449
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/02/16 13:42
Container ID: 1166464006-B

Prep Batch: VXX29910
Prep Method: SW5035A
Prep Date/Time: 10/25/16 16:48
Prep Initial Wt./Vol.: 99.298 g
Prep Extract Vol: 45.6182 mL

Results of **02549-B4 S5**

Client Sample ID: **02549-B4 S5**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464006
Lab Project ID: 1166464

Collection Date: 10/25/16 16:48
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):79.2
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,1,1-Trichloroethane	15.4 J	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,1,2,2-Tetrachloroethane	7.25 U	14.5	4.52	ug/Kg	1		10/27/16 23:04
1,1,2-Trichloroethane	5.80 U	11.6	3.59	ug/Kg	1		10/27/16 23:04
1,1-Dichloroethane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,1-Dichloroethene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,1-Dichloropropene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,2,3-Trichlorobenzene	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
1,2,3-Trichloropropane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,2,4-Trichlorobenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,2,4-Trimethylbenzene	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
1,2-Dibromo-3-chloropropane	58.0 U	116	35.9	ug/Kg	1		10/27/16 23:04
1,2-Dibromoethane	5.80 U	11.6	3.59	ug/Kg	1		10/27/16 23:04
1,2-Dichlorobenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,2-Dichloroethane	5.80 U	11.6	3.59	ug/Kg	1		10/27/16 23:04
1,2-Dichloropropane	5.80 U	11.6	3.59	ug/Kg	1		10/27/16 23:04
1,3,5-Trimethylbenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,3-Dichlorobenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
1,3-Dichloropropane	5.80 U	11.6	3.59	ug/Kg	1		10/27/16 23:04
1,4-Dichlorobenzene	20.9 J	29.0	9.04	ug/Kg	1		10/27/16 23:04
2,2-Dichloropropane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
2-Butanone (MEK)	145 U	290	90.4	ug/Kg	1		10/27/16 23:04
2-Chlorotoluene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
2-Hexanone	145 U	290	90.4	ug/Kg	1		10/27/16 23:04
4-Chlorotoluene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
4-Isopropyltoluene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
4-Methyl-2-pentanone (MIBK)	145 U	290	90.4	ug/Kg	1		10/27/16 23:04
Benzene	8.41 J	14.5	4.52	ug/Kg	1		10/27/16 23:04
Bromobenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Bromochloromethane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Bromodichloromethane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Bromoform	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Bromomethane	116 U	232	71.9	ug/Kg	1		10/27/16 23:04
Carbon disulfide	58.0 U	116	35.9	ug/Kg	1		10/27/16 23:04
Carbon tetrachloride	7.25 U	14.5	4.52	ug/Kg	1		10/27/16 23:04
Chlorobenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Chloroethane	116 U	232	71.9	ug/Kg	1		10/27/16 23:04

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J flagging is activated

Results of **02549-B4 S5**

Client Sample ID: **02549-B4 S5**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464006
Lab Project ID: 1166464

Collection Date: 10/25/16 16:48
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):79.2
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Chloromethane	13.9 J	29.0	9.04	ug/Kg	1		10/27/16 23:04
cis-1,2-Dichloroethene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
cis-1,3-Dichloropropene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Dibromochloromethane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Dibromomethane	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Dichlorodifluoromethane	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
Ethylbenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Freon-113	58.0 U	116	35.9	ug/Kg	1		10/27/16 23:04
Hexachlorobutadiene	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
Isopropylbenzene (Cumene)	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Methylene chloride	58.0 U	116	35.9	ug/Kg	1		10/27/16 23:04
Methyl-t-butyl ether	58.0 U	116	35.9	ug/Kg	1		10/27/16 23:04
Naphthalene	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
n-Butylbenzene	13.0 J	29.0	9.04	ug/Kg	1		10/27/16 23:04
n-Propylbenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
o-Xylene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
P & M -Xylene	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
sec-Butylbenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Styrene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
tert-Butylbenzene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Tetrachloroethene	7.25 U	14.5	4.52	ug/Kg	1		10/27/16 23:04
Toluene	14.2 J	29.0	9.04	ug/Kg	1		10/27/16 23:04
trans-1,2-Dichloroethene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
trans-1,3-Dichloropropene	14.5 U	29.0	9.04	ug/Kg	1		10/27/16 23:04
Trichloroethene	25.5	14.5	4.52	ug/Kg	1		10/27/16 23:04
Trichlorofluoromethane	29.0 U	58.0	17.4	ug/Kg	1		10/27/16 23:04
Vinyl acetate	58.0 U	116	35.9	ug/Kg	1		10/27/16 23:04
Vinyl chloride	5.80 U	11.6	3.59	ug/Kg	1		10/27/16 23:04
Xylenes (total)	43.5 U	87.0	26.4	ug/Kg	1		10/27/16 23:04
Surrogates							
1,2-Dichloroethane-D4 (surr)	116	71-136		%	1		10/27/16 23:04
4-Bromofluorobenzene (surr)	128	55-151		%	1		10/27/16 23:04
Toluene-d8 (surr)	99.9	85-116		%	1		10/27/16 23:04

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B4 S5**

Client Sample ID: **02549-B4 S5**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464006
Lab Project ID: 1166464

Collection Date: 10/25/16 16:48
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):79.2
Location:

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS16343
Analytical Method: SW8260B
Analyst: S.P
Analytical Date/Time: 10/27/16 23:04
Container ID: 1166464006-B

Prep Batch: VXX29862
Prep Method: SW5035A
Prep Date/Time: 10/25/16 16:48
Prep Initial Wt./Vol.: 99.298 g
Prep Extract Vol: 45.6182 mL

Results of **02549-B4 S6B**

Client Sample ID: **02549-B4 S6B**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464007
Lab Project ID: 1166464

Collection Date: 10/25/16 17:00
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):89.4
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	12.9 J	22.1	6.84	mg/Kg	1		10/28/16 19:39
Surrogates							
5a Androstane (surr)	83	50-150		%	1		10/28/16 19:39

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK102
Analyst: CRA
Analytical Date/Time: 10/28/16 19:39
Container ID: 1166464007-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.402 g
Prep Extract Vol: 1 mL

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	11.1 U	22.1	6.84	mg/Kg	1		10/28/16 19:39
Surrogates							
n-Triacontane-d62 (surr)	88.5	50-150		%	1		10/28/16 19:39

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK103
Analyst: CRA
Analytical Date/Time: 10/28/16 19:39
Container ID: 1166464007-A

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/16 16:53
Prep Initial Wt./Vol.: 30.402 g
Prep Extract Vol: 1 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B4 S6B**

Client Sample ID: **02549-B4 S6B**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464007
Lab Project ID: 1166464

Collection Date: 10/25/16 17:00
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):89.4
Location:

Results by **Volatile Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.700 U	1.40	0.421	mg/Kg	1		11/02/16 14:01
Surrogates							
4-Bromofluorobenzene (surr)	93	50-150		%	1		11/02/16 14:01

Batch Information

Analytical Batch: VFC13449
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/02/16 14:01
Container ID: 1166464007-B

Prep Batch: VXX29910
Prep Method: SW5035A
Prep Date/Time: 10/25/16 17:00
Prep Initial Wt./Vol.: 172.264 g
Prep Extract Vol: 43.2508 mL

Results of **02549-B4 S6B**

Client Sample ID: **02549-B4 S6B**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464007
Lab Project ID: 1166464

Collection Date: 10/25/16 17:00
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):89.4
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,1,1-Trichloroethane	16.8	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,1,2,2-Tetrachloroethane	3.51 U	7.02	2.19	ug/Kg	1		10/27/16 23:20
1,1,2-Trichloroethane	2.81 U	5.62	1.74	ug/Kg	1		10/27/16 23:20
1,1-Dichloroethane	22.2	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,1-Dichloroethene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,1-Dichloropropene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,2,3-Trichlorobenzene	14.1 U	28.1	8.42	ug/Kg	1		10/27/16 23:20
1,2,3-Trichloropropane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,2,4-Trichlorobenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,2,4-Trimethylbenzene	14.1 U	28.1	8.42	ug/Kg	1		10/27/16 23:20
1,2-Dibromo-3-chloropropane	28.1 U	56.2	17.4	ug/Kg	1		10/27/16 23:20
1,2-Dibromoethane	2.81 U	5.62	1.74	ug/Kg	1		10/27/16 23:20
1,2-Dichlorobenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,2-Dichloroethane	15.0	5.62	1.74	ug/Kg	1		10/27/16 23:20
1,2-Dichloropropane	2.81 U	5.62	1.74	ug/Kg	1		10/27/16 23:20
1,3,5-Trimethylbenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,3-Dichlorobenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
1,3-Dichloropropane	2.81 U	5.62	1.74	ug/Kg	1		10/27/16 23:20
1,4-Dichlorobenzene	4.91 J	14.0	4.38	ug/Kg	1		10/27/16 23:20
2,2-Dichloropropane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
2-Butanone (MEK)	70.0 U	140	43.8	ug/Kg	1		10/27/16 23:20
2-Chlorotoluene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
2-Hexanone	70.0 U	140	43.8	ug/Kg	1		10/27/16 23:20
4-Chlorotoluene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
4-Isopropyltoluene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
4-Methyl-2-pentanone (MIBK)	70.0 U	140	43.8	ug/Kg	1		10/27/16 23:20
Benzene	5.90 J	7.02	2.19	ug/Kg	1		10/27/16 23:20
Bromobenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Bromochloromethane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Bromodichloromethane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Bromoform	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Bromomethane	56.0 U	112	34.8	ug/Kg	1		10/27/16 23:20
Carbon disulfide	28.1 U	56.2	17.4	ug/Kg	1		10/27/16 23:20
Carbon tetrachloride	3.51 U	7.02	2.19	ug/Kg	1		10/27/16 23:20
Chlorobenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Chloroethane	56.0 U	112	34.8	ug/Kg	1		10/27/16 23:20

J flagging is activated

Results of **02549-B4 S6B**

Client Sample ID: **02549-B4 S6B**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464007
Lab Project ID: 1166464

Collection Date: 10/25/16 17:00
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):89.4
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Chloromethane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
cis-1,2-Dichloroethene	36.4	14.0	4.38	ug/Kg	1		10/27/16 23:20
cis-1,3-Dichloropropene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Dibromochloromethane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Dibromomethane	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Dichlorodifluoromethane	14.1 U	28.1	8.42	ug/Kg	1		10/27/16 23:20
Ethylbenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Freon-113	28.1 U	56.2	17.4	ug/Kg	1		10/27/16 23:20
Hexachlorobutadiene	14.1 U	28.1	8.42	ug/Kg	1		10/27/16 23:20
Isopropylbenzene (Cumene)	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Methylene chloride	28.1 U	56.2	17.4	ug/Kg	1		10/27/16 23:20
Methyl-t-butyl ether	28.1 U	56.2	17.4	ug/Kg	1		10/27/16 23:20
Naphthalene	14.1 U	28.1	8.42	ug/Kg	1		10/27/16 23:20
n-Butylbenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
n-Propylbenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
o-Xylene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
P & M -Xylene	13.3 J	28.1	8.42	ug/Kg	1		10/27/16 23:20
sec-Butylbenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Styrene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
tert-Butylbenzene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Tetrachloroethene	3.51 U	7.02	2.19	ug/Kg	1		10/27/16 23:20
Toluene	6.46 J	14.0	4.38	ug/Kg	1		10/27/16 23:20
trans-1,2-Dichloroethene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
trans-1,3-Dichloropropene	7.00 U	14.0	4.38	ug/Kg	1		10/27/16 23:20
Trichloroethene	15.2	7.02	2.19	ug/Kg	1		10/27/16 23:20
Trichlorofluoromethane	14.1 U	28.1	8.42	ug/Kg	1		10/27/16 23:20
Vinyl acetate	28.1 U	56.2	17.4	ug/Kg	1		10/27/16 23:20
Vinyl chloride	11.7	5.62	1.74	ug/Kg	1		10/27/16 23:20
Xylenes (total)	13.3 J	42.1	12.8	ug/Kg	1		10/27/16 23:20
Surrogates							
1,2-Dichloroethane-D4 (surr)	118	71-136		%	1		10/27/16 23:20
4-Bromofluorobenzene (surr)	137	55-151		%	1		10/27/16 23:20
Toluene-d8 (surr)	102	85-116		%	1		10/27/16 23:20

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-B4 S6B**

Client Sample ID: **02549-B4 S6B**	Collection Date: 10/25/16 17:00
Client Project ID: **02549 ARRC Sewer Ph4**	Received Date: 10/26/16 17:15
Lab Sample ID: 1166464007	Matrix: Soil/Solid (dry weight)
Lab Project ID: 1166464	Solids (%):89.4
	Location:

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS16343	Prep Batch: VXX29862
Analytical Method: SW8260B	Prep Method: SW5035A
Analyst: S.P	Prep Date/Time: 10/25/16 17:00
Analytical Date/Time: 10/27/16 23:20	Prep Initial Wt./Vol.: 172.264 g
Container ID: 1166464007-B	Prep Extract Vol: 43.2508 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-STB**

Client Sample ID: **02549-STB**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464008
Lab Project ID: 1166464

Collection Date: 10/24/16 10:28
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):
Location:

Results by **Volatile Fuels**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.25 U	2.50	0.751	mg/Kg	1		11/02/16 12:07
Surrogates							
4-Bromofluorobenzene (surr)	82.3	50-150		%	1		11/02/16 12:07

Batch Information

Analytical Batch: VFC13449
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/02/16 12:07
Container ID: 1166464008-A

Prep Batch: VXX29910
Prep Method: SW5035A
Prep Date/Time: 10/24/16 10:28
Prep Initial Wt./Vol.: 49.929 g
Prep Extract Vol: 25 mL

Print Date: 11/04/2016 10:30:29AM

J flagging is activated

Results of **02549-STB**

Client Sample ID: **02549-STB**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464008
Lab Project ID: 1166464

Collection Date: 10/24/16 10:28
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):
Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,1,1-Trichloroethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,1,2,2-Tetrachloroethane	6.25 U	12.5	3.91	ug/Kg	1		10/27/16 19:21
1,1,2-Trichloroethane	5.00 U	10.0	3.10	ug/Kg	1		10/27/16 19:21
1,1-Dichloroethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,1-Dichloroethene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,1-Dichloropropene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,2,3-Trichlorobenzene	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
1,2,3-Trichloropropane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,2,4-Trichlorobenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,2,4-Trimethylbenzene	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
1,2-Dibromo-3-chloropropane	50.0 U	100	31.0	ug/Kg	1		10/27/16 19:21
1,2-Dibromoethane	5.00 U	10.0	3.10	ug/Kg	1		10/27/16 19:21
1,2-Dichlorobenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,2-Dichloroethane	5.00 U	10.0	3.10	ug/Kg	1		10/27/16 19:21
1,2-Dichloropropane	5.00 U	10.0	3.10	ug/Kg	1		10/27/16 19:21
1,3,5-Trimethylbenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,3-Dichlorobenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
1,3-Dichloropropane	5.00 U	10.0	3.10	ug/Kg	1		10/27/16 19:21
1,4-Dichlorobenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
2,2-Dichloropropane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
2-Butanone (MEK)	125 U	250	78.1	ug/Kg	1		10/27/16 19:21
2-Chlorotoluene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
2-Hexanone	125 U	250	78.1	ug/Kg	1		10/27/16 19:21
4-Chlorotoluene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
4-Isopropyltoluene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
4-Methyl-2-pentanone (MIBK)	125 U	250	78.1	ug/Kg	1		10/27/16 19:21
Benzene	6.25 U	12.5	3.91	ug/Kg	1		10/27/16 19:21
Bromobenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Bromochloromethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Bromodichloromethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Bromoform	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Bromomethane	100 U	200	62.1	ug/Kg	1		10/27/16 19:21
Carbon disulfide	50.0 U	100	31.0	ug/Kg	1		10/27/16 19:21
Carbon tetrachloride	6.25 U	12.5	3.91	ug/Kg	1		10/27/16 19:21
Chlorobenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Chloroethane	100 U	200	62.1	ug/Kg	1		10/27/16 19:21

Results of **02549-STB**

Client Sample ID: **02549-STB**	Collection Date: 10/24/16 10:28
Client Project ID: **02549 ARRC Sewer Ph4**	Received Date: 10/26/16 17:15
Lab Sample ID: 1166464008	Matrix: Soil/Solid (dry weight)
Lab Project ID: 1166464	Solids (%):
	Location:

Results by **Volatile GC/MS**

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Chloromethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
cis-1,2-Dichloroethene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
cis-1,3-Dichloropropene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Dibromochloromethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Dibromomethane	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Dichlorodifluoromethane	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
Ethylbenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Freon-113	50.0 U	100	31.0	ug/Kg	1		10/27/16 19:21
Hexachlorobutadiene	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
Isopropylbenzene (Cumene)	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Methylene chloride	50.0 U	100	31.0	ug/Kg	1		10/27/16 19:21
Methyl-t-butyl ether	50.0 U	100	31.0	ug/Kg	1		10/27/16 19:21
Naphthalene	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
n-Butylbenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
n-Propylbenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
o-Xylene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
P & M -Xylene	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
sec-Butylbenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Styrene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
tert-Butylbenzene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Tetrachloroethene	6.25 U	12.5	3.91	ug/Kg	1		10/27/16 19:21
Toluene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
trans-1,2-Dichloroethene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
trans-1,3-Dichloropropene	12.5 U	25.0	7.81	ug/Kg	1		10/27/16 19:21
Trichloroethene	6.25 U	12.5	3.91	ug/Kg	1		10/27/16 19:21
Trichlorofluoromethane	25.1 U	50.1	15.0	ug/Kg	1		10/27/16 19:21
Vinyl acetate	50.0 U	100	31.0	ug/Kg	1		10/27/16 19:21
Vinyl chloride	5.00 U	10.0	3.10	ug/Kg	1		10/27/16 19:21
Xylenes (total)	37.5 U	75.1	22.8	ug/Kg	1		10/27/16 19:21
Surrogates							
1,2-Dichloroethane-D4 (surr)	113	71-136		%	1		10/27/16 19:21
4-Bromofluorobenzene (surr)	116	55-151		%	1		10/27/16 19:21
Toluene-d8 (surr)	98.8	85-116		%	1		10/27/16 19:21

Results of **02549-STB**

Client Sample ID: **02549-STB**
Client Project ID: **02549 ARRC Sewer Ph4**
Lab Sample ID: 1166464008
Lab Project ID: 1166464

Collection Date: 10/24/16 10:28
Received Date: 10/26/16 17:15
Matrix: Soil/Solid (dry weight)
Solids (%):
Location:

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS16343
Analytical Method: SW8260B
Analyst: S.P
Analytical Date/Time: 10/27/16 19:21
Container ID: 1166464008-A

Prep Batch: VXX29862
Prep Method: SW5035A
Prep Date/Time: 10/24/16 10:28
Prep Initial Wt./Vol.: 49.929 g
Prep Extract Vol: 25 mL

J flagging is activated

Method Blank

Blank ID: MB for HBN 1747027 [SPT/10033]
Blank Lab ID: 1362204

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007

Results by **SM21 2540G**

Parameter	Results	LOQ/CL	DL	Units
Total Solids	100			%

Batch Information

Analytical Batch: SPT10033
Analytical Method: SM21 2540G
Instrument:
Analyst: RJA
Analytical Date/Time: 10/27/2016 6:07:00PM

Print Date: 11/04/2016 10:30:32AM

Duplicate Sample Summary

Original Sample ID: 1165992045
Duplicate Sample ID: 1362205

Analysis Date: 10/27/2016 18:07
Matrix: Soil/Solid (dry weight)

QC for Samples:

1166464001

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	96.4	96.4	%	0.02	(< 15)

Batch Information

Analytical Batch: SPT10033
Analytical Method: SM21 2540G
Instrument:
Analyst: RJA

Print Date: 11/04/2016 10:30:34AM

Duplicate Sample Summary

Original Sample ID: 1166464001
Duplicate Sample ID: 1362206

Analysis Date: 10/27/2016 18:07
Matrix: Soil/Solid (dry weight)

QC for Samples:

1166464001, 1166464003, 1166464005, 1166464006, 1166464007

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	85.0	85.3	%	0.28	(< 15)

Batch Information

Analytical Batch: SPT10033
Analytical Method: SM21 2540G
Instrument:
Analyst: RJA

Print Date: 11/04/2016 10:30:34AM

Duplicate Sample Summary

Original Sample ID: 1166476005
Duplicate Sample ID: 1362217

Analysis Date: 10/27/2016 18:07
Matrix: Soil/Solid (dry weight)

QC for Samples:

1166464003, 1166464005, 1166464006, 1166464007

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	95.2	95.1	%	0.06	(< 15)

Batch Information

Analytical Batch: SPT10033
Analytical Method: SM21 2540G
Instrument:
Analyst: RJA

Print Date: 11/04/2016 10:30:34AM

Method Blank

Blank ID: MB for HBN 1747028 [VXX/29862]
Blank Lab ID: 1362208

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

Parameter	Results	LOQ/CL	DL	Units
1,1,1,2-Tetrachloroethane	12.5U	25.0	7.80	ug/Kg
1,1,1-Trichloroethane	12.5U	25.0	7.80	ug/Kg
1,1,2,2-Tetrachloroethane	6.25U	12.5	3.90	ug/Kg
1,1,2-Trichloroethane	5.00U	10.0	3.10	ug/Kg
1,1-Dichloroethane	12.5U	25.0	7.80	ug/Kg
1,1-Dichloroethene	12.5U	25.0	7.80	ug/Kg
1,1-Dichloropropene	12.3J	25.0	7.80	ug/Kg
1,2,3-Trichlorobenzene	25.0U	50.0	15.0	ug/Kg
1,2,3-Trichloropropane	12.5U	25.0	7.80	ug/Kg
1,2,4-Trichlorobenzene	12.5U	25.0	7.80	ug/Kg
1,2,4-Trimethylbenzene	25.0U	50.0	15.0	ug/Kg
1,2-Dibromo-3-chloropropane	50.0U	100	31.0	ug/Kg
1,2-Dibromoethane	5.00U	10.0	3.10	ug/Kg
1,2-Dichlorobenzene	12.5U	25.0	7.80	ug/Kg
1,2-Dichloroethane	5.00U	10.0	3.10	ug/Kg
1,2-Dichloropropane	5.00U	10.0	3.10	ug/Kg
1,3,5-Trimethylbenzene	11.3J	25.0	7.80	ug/Kg
1,3-Dichlorobenzene	12.5U	25.0	7.80	ug/Kg
1,3-Dichloropropane	5.00U	10.0	3.10	ug/Kg
1,4-Dichlorobenzene	12.5U	25.0	7.80	ug/Kg
2,2-Dichloropropane	12.5U	25.0	7.80	ug/Kg
2-Butanone (MEK)	125U	250	78.0	ug/Kg
2-Chlorotoluene	12.5U	25.0	7.80	ug/Kg
2-Hexanone	125U	250	78.0	ug/Kg
4-Chlorotoluene	12.5U	25.0	7.80	ug/Kg
4-Isopropyltoluene	12.0J	25.0	7.80	ug/Kg
4-Methyl-2-pentanone (MIBK)	125U	250	78.0	ug/Kg
Benzene	6.25U	12.5	3.90	ug/Kg
Bromobenzene	12.5U	25.0	7.80	ug/Kg
Bromochloromethane	12.5U	25.0	7.80	ug/Kg
Bromodichloromethane	12.5U	25.0	7.80	ug/Kg
Bromoform	12.5U	25.0	7.80	ug/Kg
Bromomethane	100U	200	62.0	ug/Kg
Carbon disulfide	50.0U	100	31.0	ug/Kg
Carbon tetrachloride	6.25U	12.5	3.90	ug/Kg
Chlorobenzene	12.5U	25.0	7.80	ug/Kg
Chloroethane	100U	200	62.0	ug/Kg
Chloroform	12.5U	25.0	7.80	ug/Kg

Print Date: 11/04/2016 10:30:36AM

Method Blank

Blank ID: MB for HBN 1747028 [VXX/29862]
Blank Lab ID: 1362208

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

Parameter	Results	LOQ/CL	DL	Units
Chloromethane	12.5U	25.0	7.80	ug/Kg
cis-1,2-Dichloroethene	12.5U	25.0	7.80	ug/Kg
cis-1,3-Dichloropropene	12.5U	25.0	7.80	ug/Kg
Dibromochloromethane	12.5U	25.0	7.80	ug/Kg
Dibromomethane	12.5U	25.0	7.80	ug/Kg
Dichlorodifluoromethane	25.0U	50.0	15.0	ug/Kg
Ethylbenzene	12.5U	25.0	7.80	ug/Kg
Freon-113	50.0U	100	31.0	ug/Kg
Hexachlorobutadiene	25.0U	50.0	15.0	ug/Kg
Isopropylbenzene (Cumene)	12.5U	25.0	7.80	ug/Kg
Methylene chloride	50.0U	100	31.0	ug/Kg
Methyl-t-butyl ether	50.0U	100	31.0	ug/Kg
Naphthalene	25.0U	50.0	15.0	ug/Kg
n-Butylbenzene	12.5J	25.0	7.80	ug/Kg
n-Propylbenzene	12.0J	25.0	7.80	ug/Kg
o-Xylene	12.5U	25.0	7.80	ug/Kg
P & M -Xylene	25.0U	50.0	15.0	ug/Kg
sec-Butylbenzene	12.0J	25.0	7.80	ug/Kg
Styrene	12.5U	25.0	7.80	ug/Kg
tert-Butylbenzene	12.0J	25.0	7.80	ug/Kg
Tetrachloroethene	6.25U	12.5	3.90	ug/Kg
Toluene	12.5U	25.0	7.80	ug/Kg
trans-1,2-Dichloroethene	12.5U	25.0	7.80	ug/Kg
trans-1,3-Dichloropropene	12.5U	25.0	7.80	ug/Kg
Trichloroethene	6.25U	12.5	3.90	ug/Kg
Trichlorofluoromethane	25.0U	50.0	15.0	ug/Kg
Vinyl acetate	50.0U	100	31.0	ug/Kg
Vinyl chloride	5.00U	10.0	3.10	ug/Kg
Xylenes (total)	37.5U	75.0	22.8	ug/Kg
Surrogates				
1,2-Dichloroethane-D4 (surr)	118	71-136		%
4-Bromofluorobenzene (surr)	114	55-151		%
Toluene-d8 (surr)	97.7	85-116		%

Print Date: 11/04/2016 10:30:36AM

Method Blank

Blank ID: MB for HBN 1747028 [VXX/29862]
Blank Lab ID: 1362208

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

Parameter	Results	LOQ/CL	DL	Units

Batch Information

Analytical Batch: VMS16343
Analytical Method: SW8260B
Instrument: Agilent 7890-75MS
Analyst: S.P
Analytical Date/Time: 10/27/2016 4:57:00PM

Prep Batch: VXX29862
Prep Method: SW5035A
Prep Date/Time: 10/27/2016 3:00:00AM
Prep Initial Wt./Vol.: 50 g
Prep Extract Vol: 25 mL

Print Date: 11/04/2016 10:30:36AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1166464 [VXX29862]
Blank Spike Lab ID: 1362209
Date Analyzed: 10/27/2016 17:13

Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)	CL
1,1,1,2-Tetrachloroethane	750	796	106	(78-125)
1,1,1-Trichloroethane	750	820	109	(73-130)
1,1,2,2-Tetrachloroethane	750	784	104	(70-124)
1,1,2-Trichloroethane	750	795	106	(78-121)
1,1-Dichloroethane	750	840	112	(76-125)
1,1-Dichloroethene	750	827	110	(70-131)
1,1-Dichloropropene	750	829	111	(76-125)
1,2,3-Trichlorobenzene	750	670	89	(66-130)
1,2,3-Trichloropropane	750	847	113	(73-125)
1,2,4-Trichlorobenzene	750	719	96	(67-129)
1,2,4-Trimethylbenzene	750	796	106	(75-123)
1,2-Dibromo-3-chloropropane	750	733	98	(61-132)
1,2-Dibromoethane	750	793	106	(78-122)
1,2-Dichlorobenzene	750	849	113	(78-121)
1,2-Dichloroethane	750	837	112	(73-128)
1,2-Dichloropropane	750	798	106	(76-123)
1,3,5-Trimethylbenzene	750	789	105	(73-124)
1,3-Dichlorobenzene	750	791	105	(77-121)
1,3-Dichloropropane	750	788	105	(77-121)
1,4-Dichlorobenzene	750	788	105	(75-120)
2,2-Dichloropropane	750	837	112	(67-133)
2-Butanone (MEK)	2250	2310	102	(51-148)
2-Chlorotoluene	750	780	104	(75-122)
2-Hexanone	2250	2270	101	(53-145)
4-Chlorotoluene	750	794	106	(72-124)
4-Isopropyltoluene	750	803	107	(73-127)
4-Methyl-2-pentanone (MIBK)	2250	2370	105	(65-135)
Benzene	750	789	105	(77-121)
Bromobenzene	750	786	105	(78-121)
Bromochloromethane	750	833	111	(78-125)
Bromodichloromethane	750	799	107	(75-127)
Bromoform	750	788	105	(67-132)
Bromomethane	750	845	113	(53-143)
Carbon disulfide	1130	1160	103	(63-132)

Print Date: 11/04/2016 10:30:39AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1166464 [VXX29862]
Blank Spike Lab ID: 1362209
Date Analyzed: 10/27/2016 17:13

Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

	Blank Spike (ug/Kg)			
Parameter	Spike	Result	Rec (%)	CL
Carbon tetrachloride	750	821	109	(70-135)
Chlorobenzene	750	792	106	(79-120)
Chloroethane	750	895	119	(59-139)
Chloroform	750	786	105	(78-123)
Chloromethane	750	806	107	(50-136)
cis-1,2-Dichloroethene	750	862	115	(77-123)
cis-1,3-Dichloropropene	750	794	106	(74-126)
Dibromochloromethane	750	785	105	(74-126)
Dibromomethane	750	871	116	(78-125)
Dichlorodifluoromethane	750	896	120	(29-149)
Ethylbenzene	750	800	107	(76-122)
Freon-113	1130	1260	112	(66-136)
Hexachlorobutadiene	750	721	96	(61-135)
Isopropylbenzene (Cumene)	750	805	107	(68-134)
Methylene chloride	750	755	101	(70-128)
Methyl-t-butyl ether	1130	1280	114	(73-125)
Naphthalene	750	708	94	(62-129)
n-Butylbenzene	750	812	108	(70-128)
n-Propylbenzene	750	803	107	(73-125)
o-Xylene	750	792	106	(77-123)
P & M -Xylene	1500	1580	105	(77-124)
sec-Butylbenzene	750	791	105	(73-126)
Styrene	750	782	104	(76-124)
tert-Butylbenzene	750	800	107	(73-125)
Tetrachloroethene	750	822	110	(73-128)
Toluene	750	798	106	(77-121)
trans-1,2-Dichloroethene	750	801	107	(74-125)
trans-1,3-Dichloropropene	750	785	105	(71-130)
Trichloroethene	750	826	110	(77-123)
Trichlorofluoromethane	750	970	129	(62-140)
Vinyl acetate	750	790	105	(50-151)
Vinyl chloride	750	868	116	(56-135)
Xylenes (total)	2250	2370	105	(78-124)

Print Date: 11/04/2016 10:30:39AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1166464 [VXX29862]
Blank Spike Lab ID: 1362209
Date Analyzed: 10/27/2016 17:13

Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

	Blank Spike (%)			
Parameter	Spike	Result	Rec (%)	CL
Surrogates				
1,2-Dichloroethane-D4 (surr)	750	101	101	(71-136)
4-Bromofluorobenzene (surr)	750	110	110	(55-151)
Toluene-d8 (surr)	750	99.6	100	(85-116)

Batch Information

Analytical Batch: **VMS16343**
Analytical Method: **SW8260B**
Instrument: **Agilent 7890-75MS**
Analyst: **S.P**

Prep Batch: **VXX29862**
Prep Method: **SW5035A**
Prep Date/Time: **10/27/2016 03:00**
Spike Init Wt./Vol.: 750 ug/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 11/04/2016 10:30:39AM

Matrix Spike Summary

Original Sample ID: 1166458001
MS Sample ID: 1362210 MS
MSD Sample ID: 1362211 MSD

Analysis Date: 10/27/2016 19:37
Analysis Date: 10/27/2016 17:46
Analysis Date: 10/27/2016 18:02
Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **SW8260B**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Benzene	4.76U	444	486	110	444	474	107	77-121	2.70	(< 20)
Ethylbenzene	9.50U	444	489	110	444	469	106	76-122	4.20	(< 20)
o-Xylene	9.50U	444	484	109	444	456	103	77-123	6.00	(< 20)
P & M -Xylene	19.1U	888	962	108	888	908	102	77-124	5.80	(< 20)
Toluene	9.50U	444	480	108	444	470	106	77-121	2.40	(< 20)
Surrogates										
1,2-Dichloroethane-D4 (surr)		444	456	103	444	453	102	71-136	0.65	
4-Bromofluorobenzene (surr)		1182	1247	105	1182	1193	101	55-151	4.30	
Toluene-d8 (surr)		444	460	103	444	448	101	85-116	2.60	

Batch Information

Analytical Batch: VMS16343
Analytical Method: SW8260B
Instrument: Agilent 7890-75MS
Analyst: S.P
Analytical Date/Time: 10/27/2016 5:46:00PM

Prep Batch: VXX29862
Prep Method: Vol. Extraction SW8260 Field Extracted L
Prep Date/Time: 10/27/2016 3:00:00AM
Prep Initial Wt./Vol.: 91.58g
Prep Extract Vol: 25.00mL

Print Date: 11/04/2016 10:30:40AM

Method Blank

Blank ID: MB for HBN 1747532 [VXX/29910]
Blank Lab ID: 1363298

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **AK101**

Parameter	Results	LOQ/CL	DL	Units
Gasoline Range Organics	1.25U	2.50	0.750	mg/Kg
Surrogates				
4-Bromofluorobenzene (surr)	81.2	50-150		%

Batch Information

Analytical Batch: VFC13449	Prep Batch: VXX29910
Analytical Method: AK101	Prep Method: SW5035A
Instrument: Agilent 7890 PID/FID	Prep Date/Time: 11/2/2016 12:30:00AM
Analyst: ST	Prep Initial Wt./Vol.: 50 g
Analytical Date/Time: 11/2/2016 11:10:00AM	Prep Extract Vol: 25 mL

Print Date: 11/04/2016 10:30:41AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1166464 [VXX29910]
Blank Spike Lab ID: 1363299
Date Analyzed: 11/02/2016 11:29

Spike Duplicate ID: LCSD for HBN 1166464 [VXX29910]
Spike Duplicate Lab ID: 1363300
Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007, 1166464008

Results by **AK101**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Gasoline Range Organics	12.5	12.9	103	12.5	12.5	100	(60-120)	3.80	(< 20)
Surrogates									
4-Bromofluorobenzene (surr)	1.25	88	88	1.25	87.2	87	(50-150)	0.91	

Batch Information

Analytical Batch: **VFC13449**
Analytical Method: **AK101**
Instrument: **Agilent 7890 PID/FID**
Analyst: **ST**

Prep Batch: **VXX29910**
Prep Method: **SW5035A**
Prep Date/Time: **11/02/2016 00:30**
Spike Init Wt./Vol.: 12.5 mg/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: 12.5 mg/Kg Extract Vol: 25 mL

Method Blank

Blank ID: MB for HBN 1747011 [XXX/36605]
Blank Lab ID: 1362146

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007

Results by **AK102**

Parameter	Results	LOQ/CL	DL	Units
Diesel Range Organics	10.0U	20.0	6.20	mg/Kg
Surrogates				
5a Androstane (surr)	88.9	60-120		%

Batch Information

Analytical Batch: XFC13019
Analytical Method: AK102
Instrument: Agilent 7890B F
Analyst: CRA
Analytical Date/Time: 10/28/2016 5:24:00PM

Prep Batch: XXX36605
Prep Method: SW3550C
Prep Date/Time: 10/27/2016 4:53:07PM
Prep Initial Wt./Vol.: 30 g
Prep Extract Vol: 1 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1166464 [XXX36605]
Blank Spike Lab ID: 1362147
Date Analyzed: 10/28/2016 17:33

Spike Duplicate ID: LCSD for HBN 1166464 [XXX36605]
Spike Duplicate Lab ID: 1362148
Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007

Results by **AK102**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Diesel Range Organics	167	150	90	167	147	88	(75-125)	2.10	(< 20)
Surrogates									
5a Androstane (surr)	3.33	96.1	96	3.33	93.9	94	(60-120)	2.30	

Batch Information

Analytical Batch: **XFC13019**
Analytical Method: **AK102**
Instrument: **Agilent 7890B F**
Analyst: **CRA**

Prep Batch: **XXX36605**
Prep Method: **SW3550C**
Prep Date/Time: **10/27/2016 16:53**
Spike Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL
Dupe Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL

Method Blank

Blank ID: MB for HBN 1747011 [XXX/36605]
Blank Lab ID: 1362146

Matrix: Soil/Solid (dry weight)

QC for Samples:
1166464001, 1166464003, 1166464005, 1166464006, 1166464007

Results by **AK103**

Parameter	Results	LOQ/CL	DL	Units
Residual Range Organics	10.0U	20.0	6.20	mg/Kg
Surrogates				
n-Triacontane-d62 (surr)	91.8	60-120		%

Batch Information

Analytical Batch: XFC13019	Prep Batch: XXX36605
Analytical Method: AK103	Prep Method: SW3550C
Instrument: Agilent 7890B F	Prep Date/Time: 10/27/2016 4:53:07PM
Analyst: CRA	Prep Initial Wt./Vol.: 30 g
Analytical Date/Time: 10/28/2016 5:24:00PM	Prep Extract Vol: 1 mL

Print Date: 11/04/2016 10:30:50AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1166464 [XXX36605]
Blank Spike Lab ID: 1362147
Date Analyzed: 10/28/2016 17:33

Spike Duplicate ID: LCSD for HBN 1166464 [XXX36605]
Spike Duplicate Lab ID: 1362148
Matrix: Soil/Solid (dry weight)

QC for Samples: 1166464001, 1166464003, 1166464005, 1166464006, 1166464007

Results by **AK103**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Residual Range Organics	167	154	93	167	146	88	(60-120)	5.20	(< 20)
Surrogates									
n-Triacontane-d62 (surr)	3.33	100	100	3.33	91.6	92	(60-120)	8.80	

Batch Information

Analytical Batch: **XFC13019**
Analytical Method: **AK103**
Instrument: **Agilent 7890B F**
Analyst: **CRA**

Prep Batch: **XXX36605**
Prep Method: **SW3550C**
Prep Date/Time: **10/27/2016 16:53**
Spike Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL
Dupe Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL

1166464

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CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Laboratory SGS

Attn: Tori

Analysis Parameters/Sample Container Description
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Comp.	Grab	DRO/RRO 102/103	GRO/VOCs 101/8260					Total Number of Containers	Remarks/Matrix
02549- B1 S1	① AB	11:55	10/24/16		X	X	X					2	Soil Samples
- B1 S4	② AB	12:35	10/24/16		X	HOLD						↓	↓
- B2 S1	③ AB	10:28	10/24/16		X	X	X						
- B2 S2	④ AB	10:45	10/24/16		X	HOLD							
- B3 S1	⑤ AB	13:43	10/25/16		X	X	X						
- B4 S5	⑥ AB	16:48	10/25/16		X	X	X						
- B4 S6B	⑦ A-B	17:00	10/25/16		X	X	X					↓	↓
STB	⑧ A						X					1	Lab Supplied Blank

Project Information

Project Number: 02549
Project Name: ARRC Sewer Ph.4
Contact: Russell Hepner
Ongoing Project? Yes ☒ No ☐
Sampler: Russell Hepner

Sample Receipt

Total Number of Containers
COC Seals/Intact? Y/N/[✓ NA]
Received Good Cond./Cold 4.2
Delivery Method: Hand Delivered #D20
(attach shipping bill, if any)

Instructions

Requested Turnaround Time: Standard
Special Instructions: Level II Deliverables
Please send preliminary results so we can
decide what to do with held samples.

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - Job File

Relinquished By: 1.

Signature:
Time: 17:15
Printed Name: Russell Hepner
Date: 10/26/16
Company: S+W

Relinquished By: 2.

Signature:
Time:
Printed Name:
Date:
Company:

Relinquished By: 3.

Signature:
Time:
Printed Name:
Date:
Company:

Received By: 1.

Signature:
Time:
Printed Name:
Date:
Company:

Received By: 2.

Signature:
Time:
Printed Name:
Date:
Company:

Received By: 3.

Signature:
Time: 17:15
Printed Name: Nicholas Wells
Date: 10/26/16
Company: SGS

F-19-91/UR

include chromatograms.

No. 30912

e-SAMPLE RECEIPT FORM

1166464

Review Criteria	**Y/N (yes/no)**	**Exceptions Noted below**
		☐ exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	Y	Absent
COC accompanied samples?	Y	
☐ **exemption permitted if chilled & collected <8hrs ago or chlling not required (i.e., waste, oil)		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Y	Cooler ID: 1 @ 4.2 °C Therm ID: D20
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
	Y	Cooler ID: @ °C Therm ID:
*If >6°C, were samples collected <8 hours ago?	Y	
If <0°C, were sample containers ice free?	Y	
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
		Note: Refer to form F-083 "Sample Guide" for hold times.
Were samples received within hold time?	Y	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Y	
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous?	Y	
		☐ ***Exemption permitted for metals (e.g,200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Y	
IF APPLICABLE		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	Y	
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	Y	
Were all soil VOAs field extracted with MeOH+BFB?	Y	

Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1166464001-A	No Preservative Required	OK			
1166464001-B	Methanol field pres. 4 C	OK			
1166464002-A	No Preservative Required	OK			
1166464002-B	Methanol field pres. 4 C	OK			
1166464003-A	No Preservative Required	OK			
1166464003-B	Methanol field pres. 4 C	OK			
1166464004-A	No Preservative Required	OK			
1166464004-B	Methanol field pres. 4 C	OK			
1166464005-A	No Preservative Required	OK			
1166464005-B	Methanol field pres. 4 C	OK			
1166464006-A	No Preservative Required	OK			
1166464006-B	Methanol field pres. 4 C	OK			
1166464007-A	No Preservative Required	OK			
1166464007-B	Methanol field pres. 4 C	OK			
1166464008-A	Methanol field pres. 4 C	OK			

Container Condition Glossary

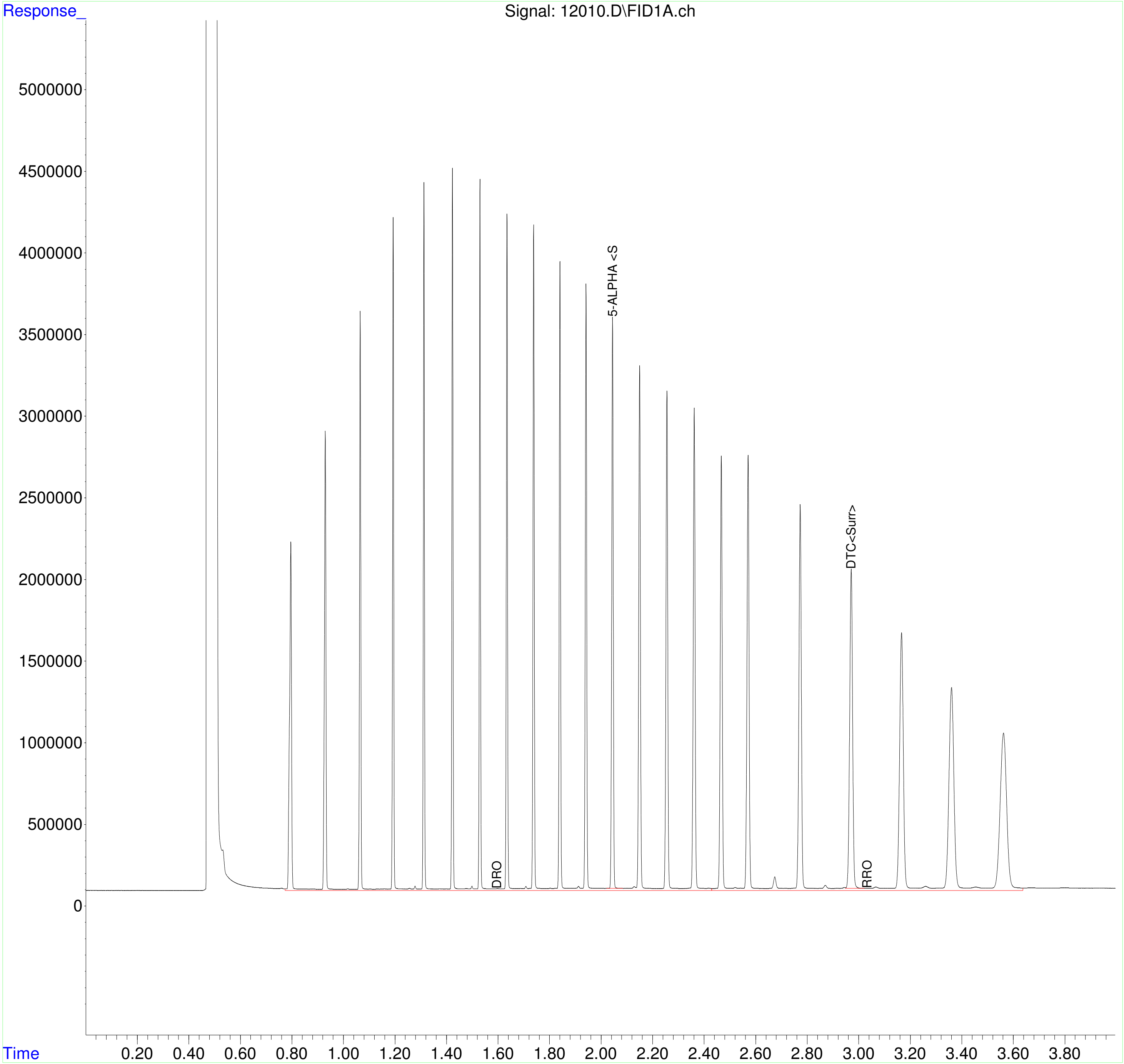
Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM- The container was received damaged.
FR- The container was received frozen and not usable for Bacteria or BOD analyses.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

CHROMATOGRAMS

Quantitation Report   (QT Reviewed)

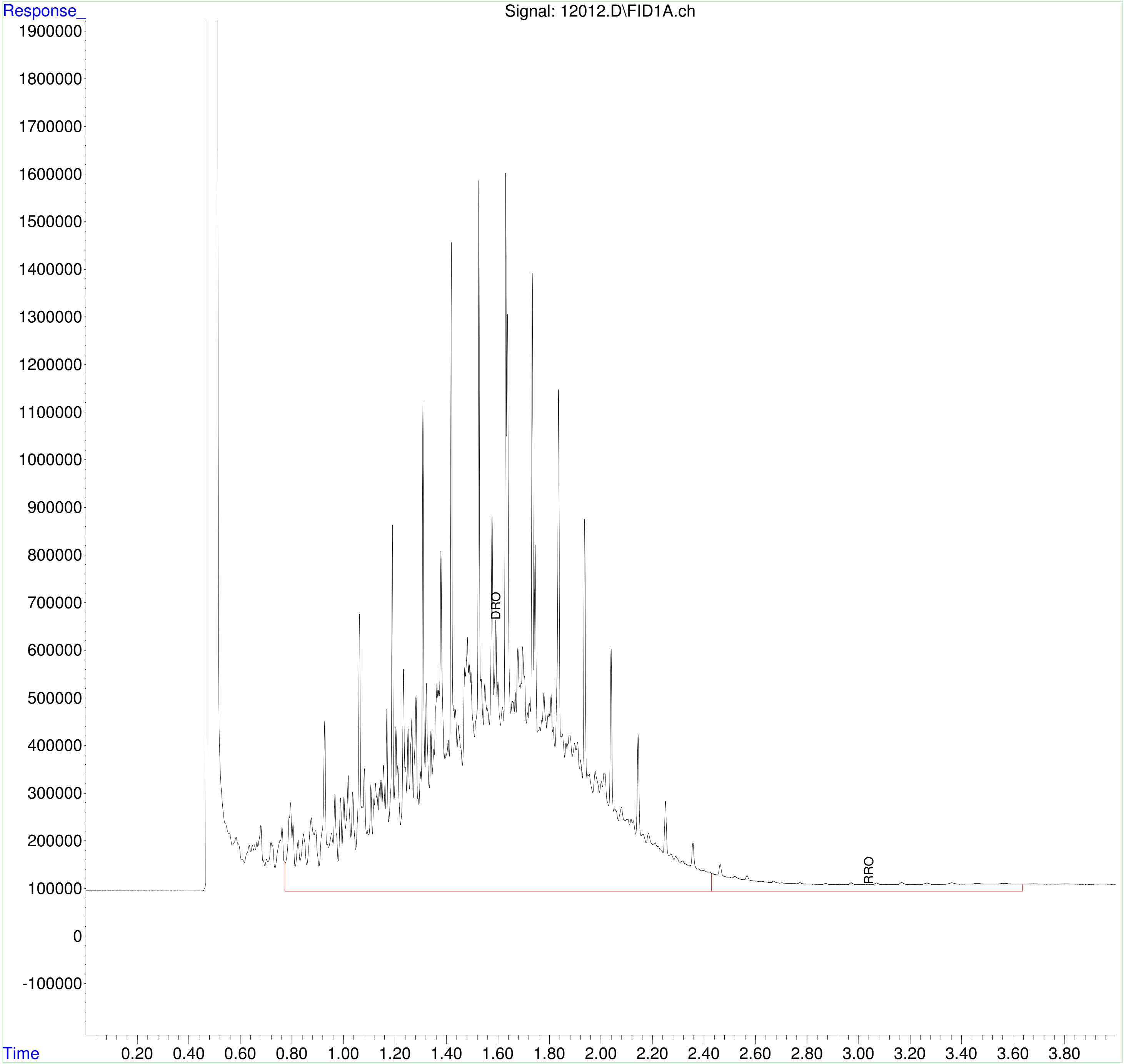
```
Data Path : Z:\10\SF\DATA\101216F\
Data File : 12010.D
Signal(s) : FID1A.ch
Acq On    : 12 Oct 2016   6:05 pm
Operator  : CRA
Sample    : NAS
Misc      :
ALS Vial  : 2   Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Oct 12 19:22:11 2016
Quant Method : Z:\10\SF\Method\SFF2016-100616D.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Thu Oct 06 20:54:27 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```



Quantitation Report (QT Reviewed)

```
Data Path : Z:\10\SF\DATA\101216F\
Data File : 12012.D
Signal(s) : FID1A.ch
Acq On    : 12 Oct 2016   6:15 pm
Operator  : CRA
Sample    : CCVB
Misc      :
ALS Vial  : 3   Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Oct 13 12:04:48 2016
Quant Method : Z:\10\SF\Method\SFF2016-100616D.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Thu Oct 06 20:54:27 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```

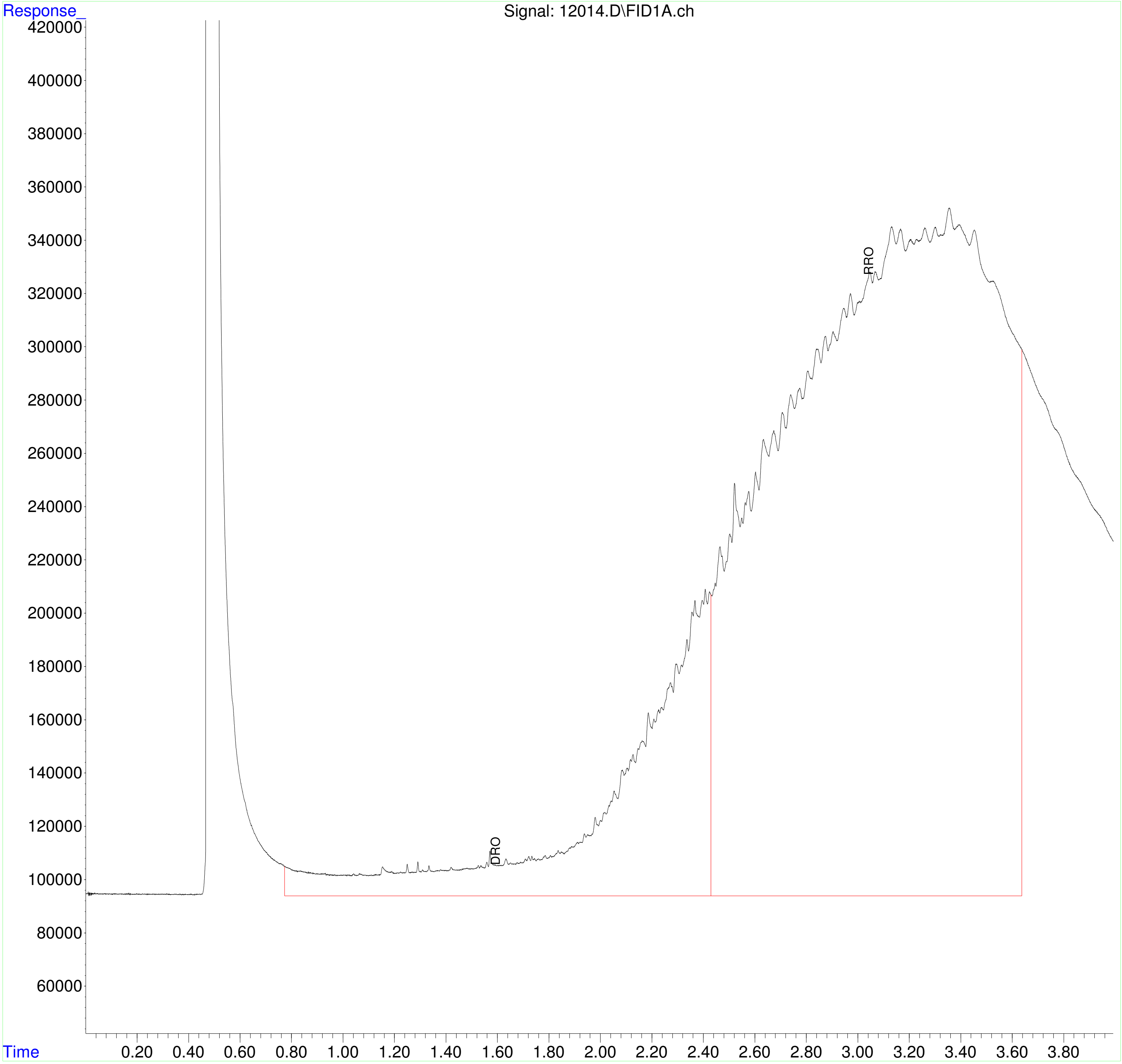
DRO Standard



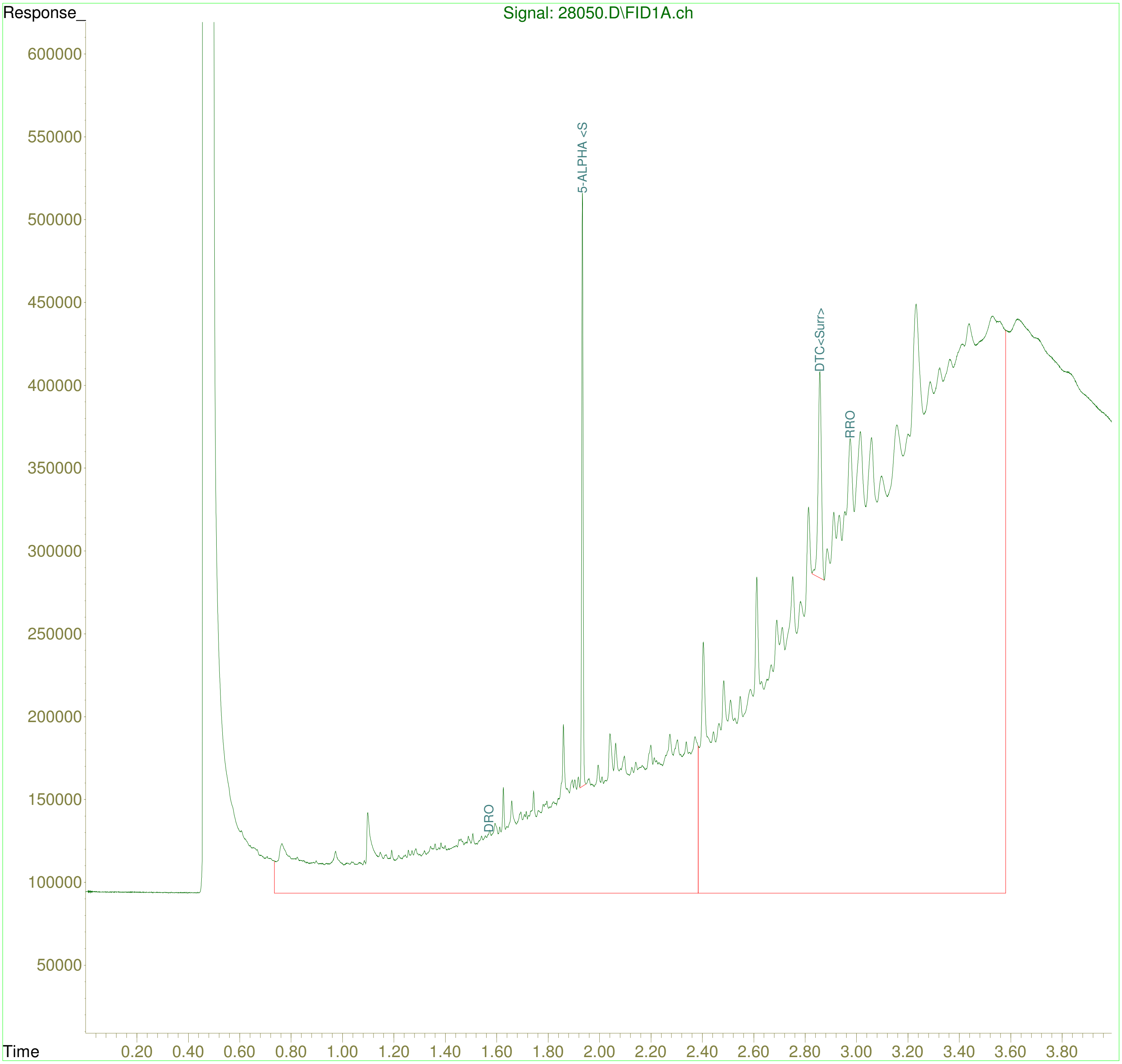
Quantitation Report   (QT Reviewed)

```
Data Path : Z:\10\SF\DATA\101216F\
Data File : 12014.D
Signal(s) : FID1A.ch
Acq On    : 12 Oct 2016   6:25 pm
Operator  : CRA
Sample    : CCVR
Misc      :
ALS Vial  : 4   Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Oct 13 12:06:20 2016
Quant Method : Z:\10\SF\Method\SFF2016-100616D.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Thu Oct 06 20:54:27 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```

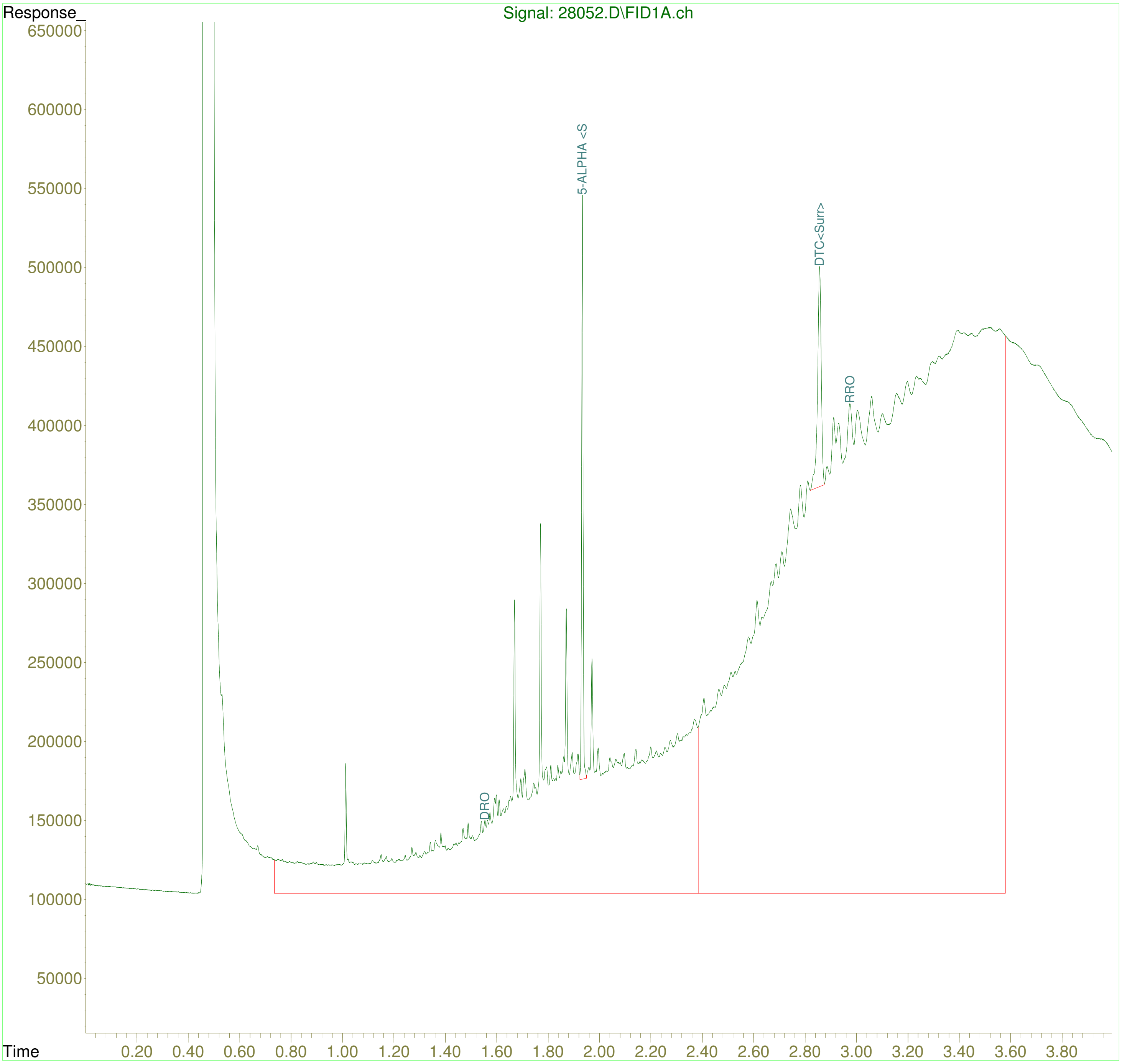
RRO Standard



```
Data Path : Z:\10\SF\DATA\102816\
Data File : 28050.D
Signal(s) : FID1A.ch
Acq On    : 28 Oct 2016   7:00 pm
Operator  : CRA
Sample    : 1166464001 4X
Misc      :
ALS Vial  : 91   Sample Multiplier: 4

Integration File: autoint1.e
Quant Time: Oct 31 10:08:06 2016
Quant Method : Z:\10\SF\Method\SFF2016-1027.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Fri Oct 28 09:38:22 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```

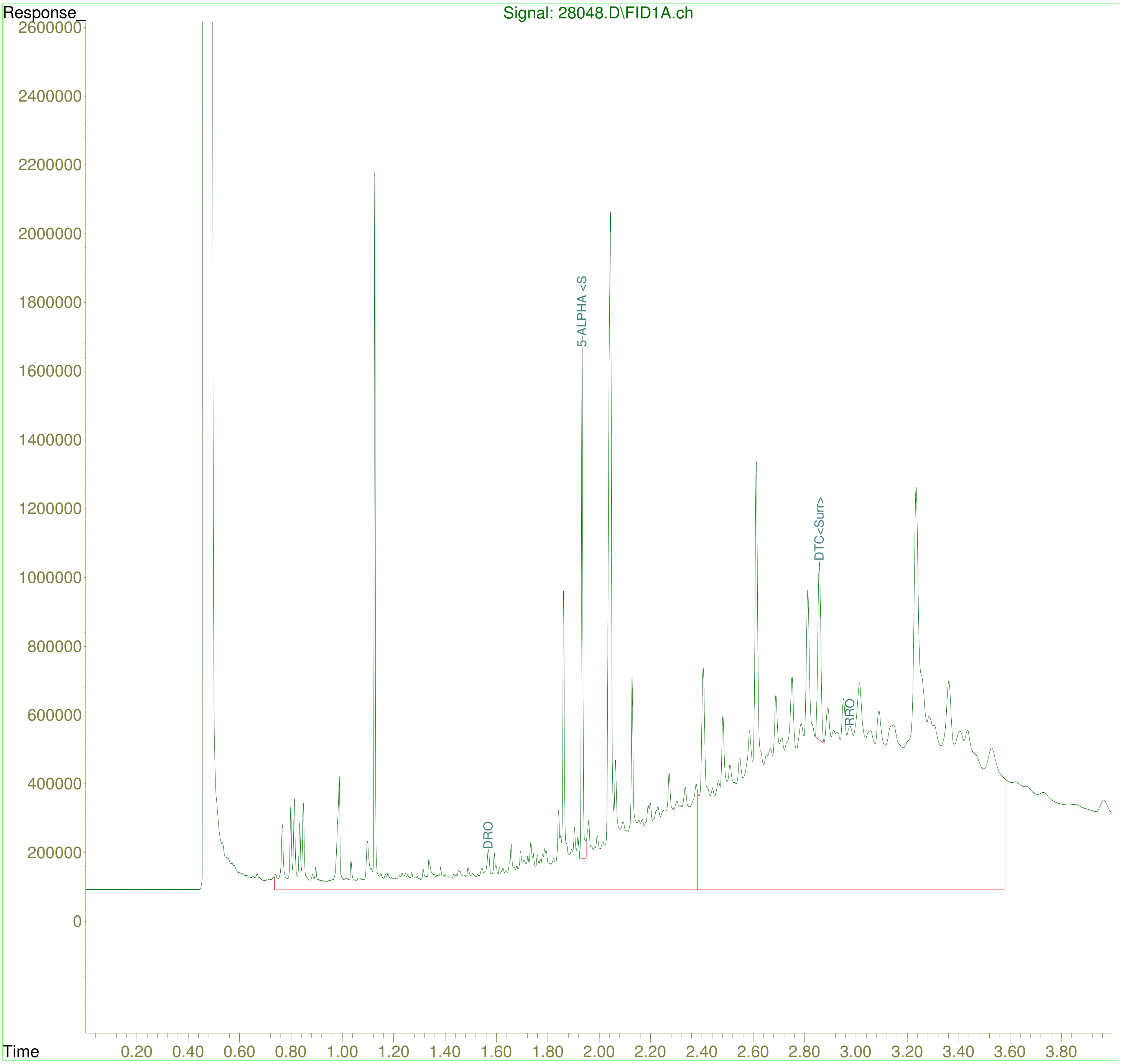


```
Data Path : Z:\10\SF\DATA\102816\
Data File : 28052.D
Signal(s) : FID1A.ch
Acq On    : 28 Oct 2016   7:10 pm
Operator  : CRA
Sample    : 1166464003 4X
Misc      :
ALS Vial  : 92   Sample Multiplier: 4

Integration File: autoint1.e
Quant Time: Oct 31 10:09:52 2016
Quant Method : Z:\10\SF\Method\SFF2016-1027.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Fri Oct 28 09:38:22 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```



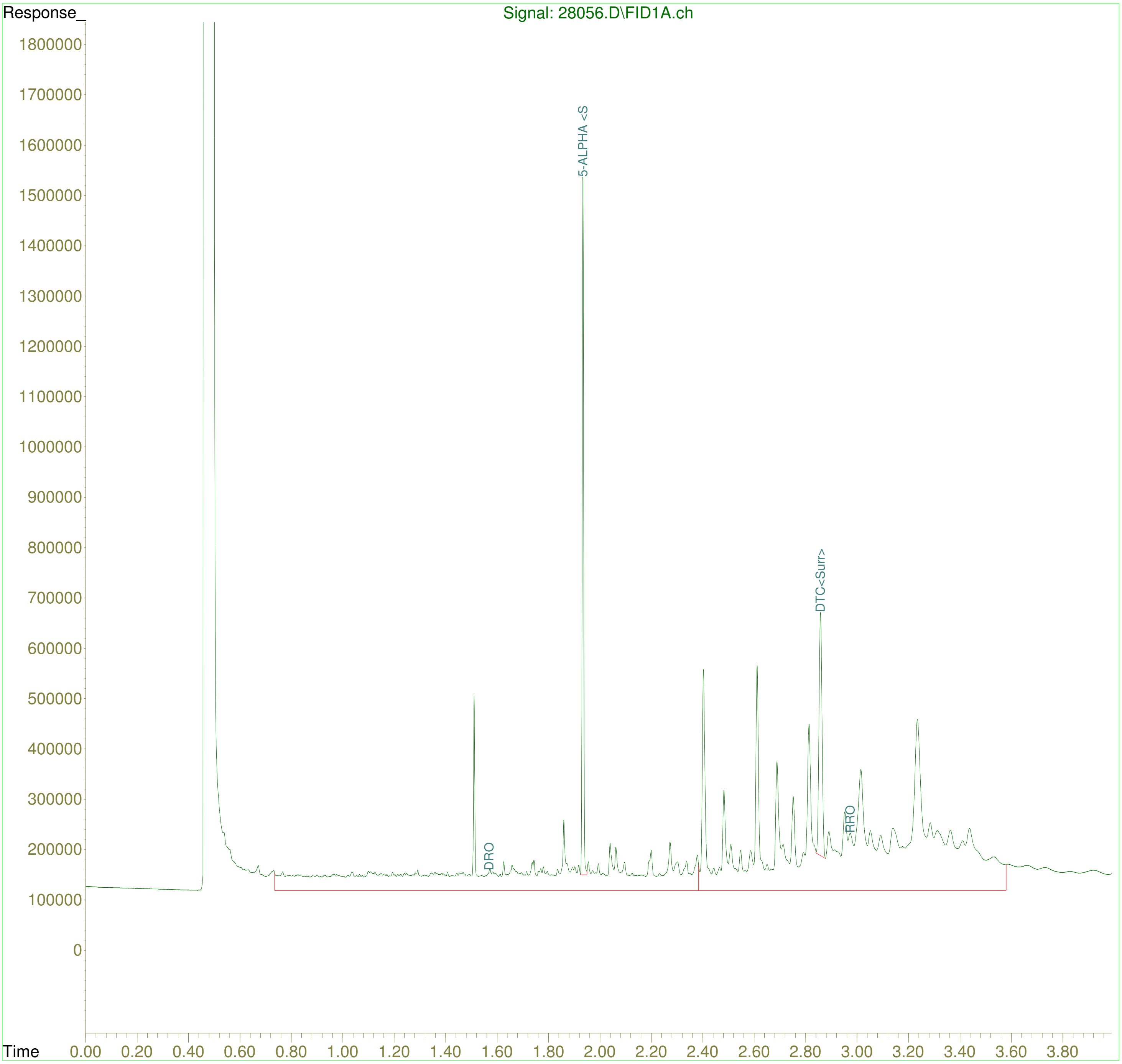
Quantitation Report (QT Reviewed)

```
Data Path : Z:\10\SF\DATA\102816\
Data File : 28048.D
Signal(s) : FID1A.ch
Acq On    : 28 Oct 2016   6:51 pm
Operator  : CRA
Sample    : 1166464005
Misc      :
ALS Vial  : 90   Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Oct 31 10:06:52 2016
Quant Method : Z:\10\SF\Method\SFF2016-1027.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Fri Oct 28 09:38:22 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```

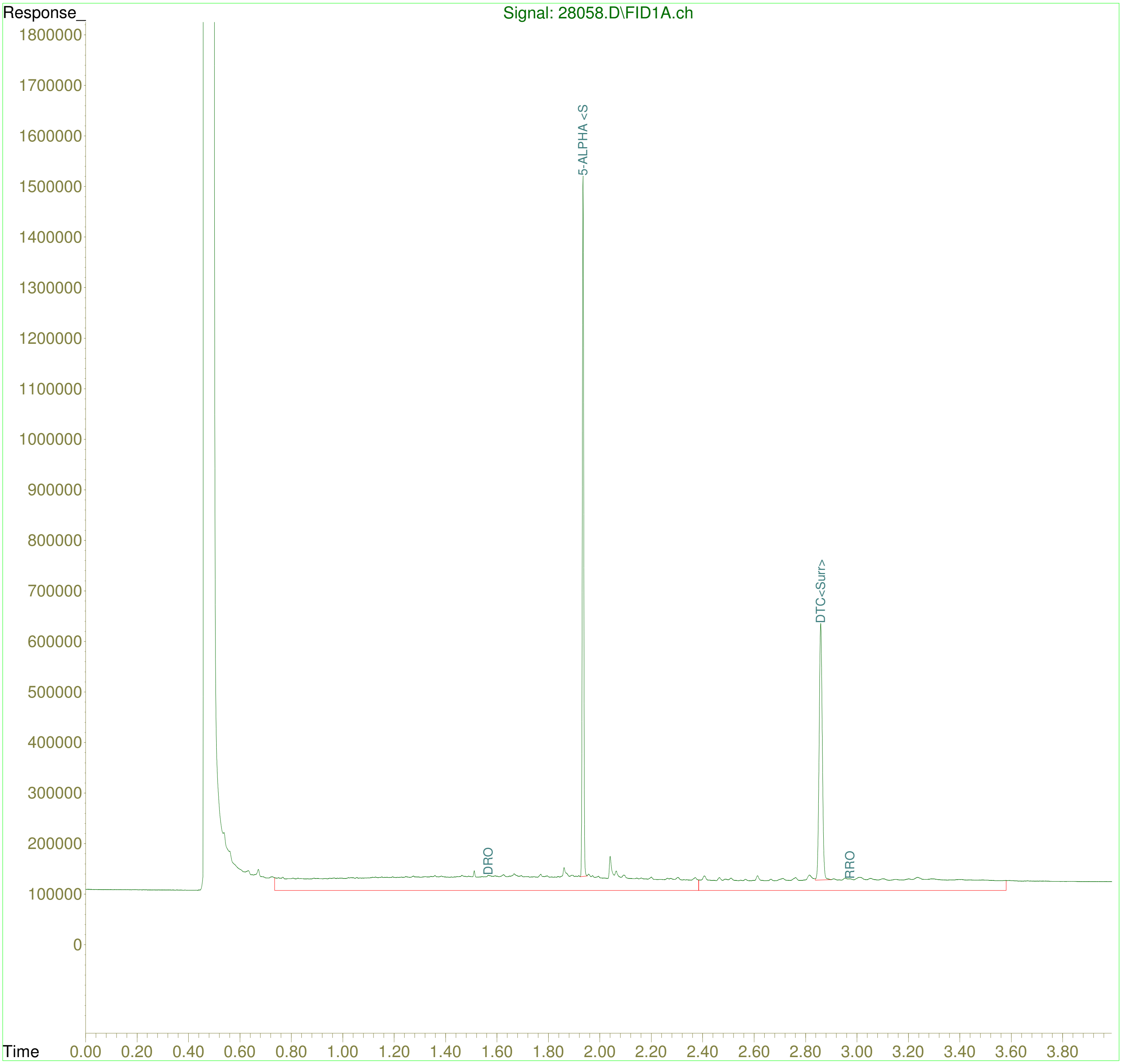


Quantitation Report (QT Reviewed)

```
Data Path : Z:\10\SF\DATA\102816\
Data File : 28056.D
Signal(s) : FID1A.ch
Acq On    : 28 Oct 2016   7:29 pm
Operator  : CRA
Sample    : 1166464006
Misc      :
ALS Vial  : 93   Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Oct 31 10:19:28 2016
Quant Method : Z:\10\SF\Method\SFF2016-1027.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Fri Oct 28 09:38:22 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```



```
Data Path : Z:\10\SF\DATA\102816\
Data File : 28058.D
Signal(s) : FID1A.ch
Acq On    : 28 Oct 2016   7:39 pm
Operator  : CRA
Sample    : 1166464007
Misc      :
ALS Vial  : 94   Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Oct 31 10:20:23 2016
Quant Method : Z:\10\SF\Method\SFF2016-1027.M
Quant Title  : DRO/RRO by Method AK 102/103
QLast Update : Fri Oct 28 09:38:22 2016
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj.  :
Signal Phase :
Signal Info  :
```



APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to 32-1-02549

Date: December 2016
To: HDR Alaska, Inc.
Re: ARRC Sewer Line Extension – Phase IV
Anchorage, Alaska

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors, which were considered in the development of the report, have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland