

21-07042-01
April 22, 2016

Mr. Mark A. Young, Executive Director
Lowell Regional Wastewater Utility
451 First Avenue Boulevard (Route 110)
Lowell, Massachusetts 01850

Re: **Read-West Pump and Storage Project
Geo-environmental Evaluation**

Dear Mr. Young:

Tighe & Bond is pleased to present this geotechnical and environmental (geo-environmental) evaluation for the proposed diversion and gate structures at the Read Street Station in Lowell, Massachusetts. A Site Locus is presented as Figure 1 of Appendix A. This evaluation was completed in accordance with the scope of services presented to the City of Lowell on November 25, 2015. The elevations referenced in this report are based on the North American Vertical Datum of 1988 (NAVD88).

Executive Summary

In general, subsurface conditions observed in the explorations consisted of approximately 6.5 to 17.5 feet of granular fill overlying 4 to 10 feet of natural sands, overlying natural glacial till, which was penetrated up to 14.5 feet before the explorations were terminated. It is recommended that the proposed structures be supported on spread footings bearing on compacted Crushed Stone wrapped in a non-woven geotextile separation fabric placed on undisturbed glacial till or bedrock after over excavation of existing fill.

It appears that excavation of bedrock may be required within the vicinity of the proposed gate structure. The bedrock should be over excavated by a minimum of 1 foot below the bottom of structure to allow for placement of compacted Crushed Stone which will also facilitate dewatering and provide a stable working platform. The recommended net allowable bearing pressure is 3 tons per square foot (3 tsf) bearing on Crushed Stone placed over glacial till or bedrock.

Due to the anticipated depth of excavation required to construct the proposed structures, an excavation support system (ESS) is likely needed. Potential ESSs include continuous steel sheet piles, grouted secant or tangent piles, or steel soldier piles and wood lagging. We anticipate that continuous steel sheet piles would be appropriate for this project due to the limited number of potential subsurface obstructions and utilities and groundwater cutoff capabilities. It should be noted, however, that a boulder was encountered at boring location B-5 at an elevation of approximately 51.5 feet. Additionally, as groundwater is likely to be encountered, a dewatering program will likely be required to facilitate the construction of the two structures.

The identification of elevated lead at the site has triggered a 120-day Reporting Condition to the Massachusetts Department of Environmental Protection (MassDEP) and requires additional evaluation. Based on the analytical results collected to date, it appears that the elevated lead concentrations are likely attributable to the anthropogenic fill identified at the site and could not be entirely attributed to sources of lead that may be exempt from reporting in accordance with the Massachusetts Contingency Plan (MCP). Pending the findings of additional assessment, future soils management will likely only pertain to soils



excavated during construction. Soils meet the reuse levels for disposal at a Massachusetts lined landfill as described in Reuse and Disposal of Contaminated Soil at Massachusetts Landfills (Policy #Comm-97-001) prepared by the Massachusetts Department of Environmental Protection in 1997.

Site Conditions

Existing – The existing site consists of a relatively level parking lot and dog park located to the south of the VFW Highway. A concrete diversion structure is located on the north side of the site. There is an approximately 10-foot high slope to the south of the parking lot that slopes down to a paved bike trail, which traverses along the north bank of the Merrimack River. A 96-inch diameter reinforced concrete (RC) sewer interceptor pipe is located beneath the bike trail. The diversion structure discharges to a 60-inch RC outfall pipe and a 30-inch PVC pipe, which traverses to the south to the Merrimack River and the sewer interceptor, respectively. Grades at the parking lot and dog park vary from approximately elevation 70 feet to 72 feet, the bike path is approximately at elevation 59 feet, and the Merrimack River is approximately at elevation 50 feet.

Proposed – The structures for this phase include an interceptor structure, constructed at the existing 96-inch RC interceptor, and a gate structure that is anticipated to be connected into a future phase of this project. The proposed gate and interceptor structures are to be constructed below grade at an approximate elevation of 45 feet and will likely extend up to ground surface with access to inside the structures via manholes.

Subsurface Conditions

The generalized subsurface conditions described in the text below summarize trends observed in the explorations. The boundaries between soil strata are approximate, and are based on interpretations of widely spaced explorations and samples. Actual conditions could be more variable.

Test Borings – Four geotechnical test borings (B-1 thru B-4) were previously performed for Tighe & Bond on April 27, 28, and 29, 2015 as part of a preliminary geotechnical evaluation. For more information on borings B-1 thru B-4, please reference the preliminary geotechnical evaluation, previously submitted by Tighe & Bond, dated June 4, 2015.

Two geotechnical test borings (B-5 and B-6) were advanced by Technical Drilling Services (TDS) of Sterling, Massachusetts on February 16, 2016. Test borings B-5 and B-6 were advanced with 4.25-inch inner diameter hollow-stem augers to depths of 24.5 feet and 28 feet, respectively, below the existing ground surface. Split-spoon sampling and Standard Penetration Tests (SPTs) were conducted at maximum 5 foot intervals. Test borings B-5 and B-6 were terminated at refusal of the hollow-stem auger.

Borings were backfilled upon completion with cuttings. Boring locations are shown on Figure 2, of Appendix A. Test boring logs are included in Appendix B.

Summary of Subsurface Conditions – In general, subsurface conditions observed in the explorations consisted of approximately 6.5 to 17.5 feet of granular fill overlying 4 to 10 feet of natural sands, overlying natural glacial till, which was penetrated up to 14.5 feet before the explorations were terminated. Table 1 below presents the general stratigraphy encountered during the subsurface exploration program in descending depth from the ground surface.

Table 1
Description of Subsurface Conditions Encountered

Strata (In Descending Depth)	General Description
GRANULAR FILL	Very loose to medium dense, black to brown, fine to coarse SAND, trace to some Gravel, trace to more brick, trace to some Silt
SAND	Very loose to medium dense, black to tan, fine to medium SAND, trace to little Gravel, trace to little Silt
GLACIAL TILL	Medium dense to very dense, tan to gray, fine to coarse SAND, trace to some Gravel, trace to some Silt; varying to very dense, light brown, fine to coarse SAND and Clayey SILT, some Gravel

Definition of Soil Description Terms: "trace" = 0-10%, "little" = 10-20%, "some" = 20-35%, "and" = 35-50%, by weight

Groundwater was encountered in borings B-5 and B-6 approximately 20 feet and 10 feet, respectively, below the existing ground surface corresponding to approximate elevation 50 feet. Water levels were recorded during or immediately after drilling and may not reflect stabilized conditions. Water levels can fluctuate with season, precipitation, and nearby construction or other below grade activities, such as excavation, dewatering, wells, infiltration basins, etc.

Analytical Results Summary – Laboratory tests were performed on soil samples from the fill material and native soils at the site to aid in soil classifications, analytical analysis, and pre-characterization. Three mechanical Particle Size Analysis tests (ASTM D422) were performed on samples taken during the explorations by Thielsch Engineering of Cranston, Rhode Island and the laboratory test results are included in Appendix C.

Additional samples were sent to ESS Laboratory (ESS) of Cranston, Rhode Island and analyzed for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), RCRA 8 Metals and additional hazardous waste characterization parameters. A complete analytical summary table is included as Table 1 in Appendix C along with a copy of the laboratory analytical data reports. Laboratory analytical results were compared to the Reportable Concentration in Soils for soil category RCS-1 because the site is within 500 feet of occupied residential properties. Soil samples from an identified interval of apparent anthropogenic fill were collected from two locations at the site;

- B-5 (12'-14') from the top of slope (Elevation 69')
- B-6 (6'-8') from the base of slope (Elevation 60')

Additionally, soil samples were collected from B-5 and B-6 and from native soils underlying the fill to assess naturally-occurring metals concentrations that may be present. Laboratory analytical data from B-5 and B-6 are summarized below.

Soil Boring B-5

- Exceedances of RCS-1 Standards were identified in fill material in B-5 (12-14')
 - Benzo(a)pyrene was detected at 5.99 mg/kg exceeding the RCS-1 concentration of 2 mg/kg.
 - Total Petroleum Hydrocarbons (TPH) was detected at 1,160 mg/kg exceeding the RCS-1 concentration of 1,000 mg/kg.
 - Lead was detected at 1,110 mg/kg exceeding the RCS-1 concentration of 200 mg/kg
- RCRA 8 metal concentrations were below RCS-1 concentrations in native soils, B-5 (16'-18')

Based on the exceedance of the applicable RCS-1 standards in B-5 (12'-14') for Lead, Benzo(a)pyrene, and TPH, additional laboratory analysis was requested. Sample B-5 (12'-14') was submitted for EPH range analysis and TCLP Lead analysis. Additionally, the sample was submitted for Polarized Light Microscopy and Scanning Electron Microscopy Analysis (PLM/SEM) to determine if Coal or Coal Ash were present in anthropogenic fill at the site. Laboratory results indicate:

- The exceedance of the TPH limit is superseded by the EPH fraction results, which were below the RCS-1 concentrations, thus the exceedance of RCS-1 for TPH does not require MassDEP notification.
- TCLP Lead was reported at 3.38 milligrams per liter (mg/L), which is below the TCLP limit of 5 mg/L. The TCLP analysis is used to characterize whether the soil would be classified as hazardous waste once generated based on leachability in accordance with state and federal regulations. A result under 5 mg/L indicates that the sampled soil would likely not be classified as a hazardous waste once generated. It should be noted however that significant variability can result in soil with respect to total and TCLP results.
- Coal and Coal Ash were identified by PLM/SEM analysis
 - Coal was detected at moderate concentrations
 - Coal ash was detected at light concentrations

Soil Boring B-6

- No exceedance of the RCS-1 Standards were identified in fill material in sample B-6 (6'-8') or native soils in sample B-6 (15'-17')

Analytical Data Evaluation and Recommendations

Based on the analytical data collected to date, total lead and benzo(a)pyrene concentrations were identified at concentrations exceeding the RCS-1 Reportable Concentrations. An exceedance of an RCS-1 concentration triggers a 120-day reporting condition to MassDEP.

Fill material identified at the site was confirmed to contain coal and coal ash through PLM and SEM analysis. The MassDEP has published a guidance document entitled "*Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil*" to assess and manage the presence of coal and coal ash in fill material across sites in Massachusetts. This document includes elevated background concentrations for select PAHs and metals in fill material containing coal and coal ash. See table below:

Summary of RCS-1 Exceedances (all concentrations in mg/kg)			
Compound	Result in B-5 (12-14')	RCS-1	Background for fill material with coal and coal ash
Benzo(a)pyrene	5.99	2	7
Lead	1,110	200	600

As shown in the above table, benzo(a)pyrene is below the published background concentration for soil containing fill materials. The detection of benzo(a)pyrene therefore has been attributed to the observed presence of coal/ash materials. In accordance with the MCP, contaminants associated with coal/ash are exempt from notification to MassDEP.

The elevated lead concentration exceeds the published background level in fill soils. Based on the limited data set for total lead for the site, the lead detection cannot be solely attributed to the presence of coal/ash in the soil as other lead sources in the soil may exist. Therefore, it is Tighe & Bond’s recommendation that the total lead is currently reportable and requires additional evaluation.

Tighe & Bond recommends the following approach to managing the elevated lead concentrations identified in site soils.

- Report the elevated lead concentration to MassDEP prior to the expiration of the 120-day reporting deadline. Once reported, the next regulatory deadline for MassDEP is one year from the reporting date.
- Additional assessment of the elevated lead can be completed prior to construction at the site. Once the anticipated start date and logistics for construction has been established, the sequencing for additional lead assessment can be determined. Tighe & Bond recommends one day of geoprobing or boring in fill soils across the site to visually characterize fill at the parcel extents and to collect additional soil samples for lead analysis.
- With the additional soil characterization information, soil disposal arrangements can be made and regulatory requirements satisfied before bid documents are issued, thereby minimizing costs for Lowell.
- Anticipated MassDEP Reporting
 - File a Release Notification Form (RNF) for the 120-day reporting condition
 - Prepare a Release Abatement Measure (RAM) plan for submittal to MassDEP to document the proposed excavation and soil management plan. The RAM Plan would only address how soils that are disturbed as part the proposed construction project will be handled.
 - File a Permanent Solution Statement (PSS) with “Conditions” at the Site
 1. Per the MCP, the Condition would document the presence of Anthropogenic Fill at the site contributing to the elevated lead and PAHs at the site.



2. No additional management or remediation of the anthropogenic fill soils beyond the management of soil necessary for construction is required based on the data collected to date.

Geo-environmental Evaluation and Recommendations

The analyses and recommendations submitted in this evaluation are based upon the data obtained from the relatively widely spaced subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If significant variations from these descriptions appear during construction, it will be necessary to re-evaluate these recommendations.

Geotechnical Design Recommendations

Foundation and Slab Design – The proposed gate and interceptor structures are to be constructed below grade at an approximate elevation of 45 feet and will likely extend up to ground surface with access to inside the structures via manholes. At this elevation, it is anticipated that the bottom of the interceptor structure would be in glacial till while the gate structure is likely to be in loose sands, which are not considered suitable for foundation support. Due to the loose nature of the sands encountered, it is recommended that the sand be removed to the top of the natural glacial till, or a minimum of one foot of over excavation below the bottom of the structure, which is deeper to allow for placement of compacted Crushed Stone wrapped in a non-woven geotextile separation fabric placed on undisturbed glacial till. Additionally, the placement of the Crushed Stone will facilitate dewatering and provide a stable working platform. A net allowable bearing pressure of 3 tons per square foot (3 tsf) is recommended for footings bearing on placed and compacted Crushed Stone.

It is possible that bedrock could be encountered during excavation. If encountered, bedrock should be over excavated by a minimum of one foot below the bottom of structure to allow for placement of compacted Crushed Stone wrapped in a non-woven geotextile separation fabric. The placement of compacted Crushed Stone will help limit differential settlement or concrete cracking that may occur due to bearing on dissimilar materials (bedrock versus soil/crushed stone).

Subgrades and required granular fill to achieve proposed grade should be prepared, placed, and compacted as recommended later in this letter.

The net allowable bearing pressure applies to footings having a minimum lateral dimension of at least 3 feet. For smaller footings, the recommended allowable bearing pressure must be reduced by the ratio of actual minimum footing size to 3 feet. At the recommended bearing pressure, total and differential settlements are anticipated to be less than 1 inch and ½ inch, respectively. Most settlement will occur during construction as dead load is applied.

Per the Massachusetts State Building Code, footings should bear a minimum of 4 feet below adjacent ground surface exposed to freezing temperatures for frost protection. Interior footings not exposed to freezing temperatures should bear a minimum of 1.5 feet below the slab.

Foundation and Underslab Drainage – Due to the depth of these structures, foundation and underslab drainage would be impractical. The proposed structures should be designed to resist hydrostatic forces based on a design ground water elevation of 47 feet and should

be designed to resist uplift with a factor of safety of 1.5. Additionally, waterproofing of the structures should be provided since they extend below the water table.

Lateral loads – It is understood that both structures will have unbalanced soil pressures below grade. It is recommended that the structures be designed for the following lateral loads:

- Static: 59 psf/ft as an equivalent fluid pressure
- Surcharge: 0.5 times the vertical surcharge load uniformly distributed over the height of the wall. The minimum vertical surcharge should be equivalent to an H-20 vehicular load, if vehicles (including construction equipment) will be allowed above the structures within a distance of the 1.5 times the wall height.
- Seismic: $6.0H^2$ distributed as an inverse triangle over the height of the wall

These design values were calculated using Rankine Theory with a soil unit weight of 125 pounds per cubic foot (pcf) and a friction angle of 30 degrees. The design values above do not include hydrostatic loads. The design groundwater level is approximate elevation of 47 feet. It has been assumed that foundation and underslab drainage for the structures will be impractical. Therefore, hydrostatic loads should be included. Where the calculated lateral earth pressure is less than 200 pounds per square foot (psf), it should be increased to 200 psf to account for compaction induced stresses.

The recommended minimum factors of safety against sliding and overturning are 1.5 and 2.0 respectively. A coefficient of friction equal to 0.35 ($\delta = 19$ degrees) should be used for concrete on granular soils or crushed stone.

Modulus of Subgrade Reaction - The recommended modulus of subgrade reaction, k_1 , is 200 pounds per cubic inch for structures bearing on the placed and compacted Crushed Stone. This value was determined based upon the available SPT data collected during the subsurface exploration program, and is not based upon a plate load test, or other type of direct test.

Seismic Design - Based on data from the borings, the site is assigned to Site Class D, according to the Massachusetts State Building Code. The design spectral response accelerations at short periods (S_{DS}) and at 1-second periods (S_{D1}) are 0.32 and 0.117 respectively. These values were calculated based on mapped spectral response accelerations and the appropriate magnification factors for Site Class D. The Seismic Design Category should be determined by the structural engineer based upon the seismic use groups presented in the building code.

Based on standard penetration test N-values, groundwater levels measured at the site, gradation of the soils observed in the explorations, and the liquefaction susceptibility charts included in the MSBC, soils encountered in the borings are not considered susceptible to liquefaction.

Geo-environmental Construction Recommendations

This section provides comments related to foundation construction, earthwork, and other geo-environmental aspects of the project that will aid those responsible for preparing construction specifications.

Excavation and Fill – Conventional heavy construction equipment should be suitable for excavation in existing soil materials. Excavation should conform to OSHA excavation regulations contained in 29 CFR Part 1926, latest edition. Subgrades should be excavated in such a way to minimize disturbance, such as using a smooth faced bucket. If bedrock is encountered, it should be excavated a minimum of one foot below the bottom of the structure. Fill needed below the structure should consist of compacted Crushed Stone wrapped in a non-woven geotextile separation fabric, which will facilitate dewatering and provide a stable working platform.

Due to the anticipated depth of excavation required to construct the proposed structures, an excavation support system (ESS) is likely needed. Potential ESSs include continuous steel sheet piles, grouted secant or tangent piles, or steel soldier piles and wood lagging. We anticipate that continuous steel sheet piles would be appropriate for this project due to the limited number of subsurface obstructions and utilities and their good groundwater cutoff capabilities. It should be noted, however, that a boulder was encountered at boring location B-5 at an elevation of approximately 51.5 feet. The contractor should submit their proposed ESS design, and should also be required to protect existing structures and utilities from damage. The ESS design should include supporting calculations and be stamped by a Massachusetts Professional Engineer.

Table 2 presents the required gradations for imported materials.

Table 2
Gradation Requirements for Borrow Materials

Sieve Size	Percent Finer by Weight			
	Granular Fill	Gravel Borrow	Gravel Subbase	1-1/2" Crushed Stone
2/3 rd lift thickness	100			
6 inch	--		100	
2 inch	--	100	--	100
1½ inch	--	--	--	95-100
1 inch	--	--	--	35-70
¾ inch	--	--	--	0-25
½ inch	--	50-85	50-85	--
No. 4	--	40-75	40-75	--
No. 10	30-95	--	--	--
No. 40	10-70	--	10-35	--
No. 50	--	8-28	--	--
No. 200	0-15	0-10	0-8	--

All granular backfill should be placed in 12-inch maximum lifts and should be compacted to 95 percent of the maximum dry density as determined by the Modified Proctor laboratory test (ASTM D1557). Thinner lifts may be needed depending on the material placed and the type of compactor used. Crushed Stone should be placed in loose lift thicknesses of less than 12 inches and be compacted with heavy compaction equipment to achieve an unyielding subgrade.



Dewatering – Groundwater will likely be encountered during excavation for the structures. Based upon the anticipated depths of the foundations below the water table and the soils encountered, dewatering may be accomplished by pumping from properly filtered sumps, however, more extensive dewatering will likely be necessary. The use of sheet piles for ESS could be an issue for seepage protection if bedrock is encountered and significant dewatering, such as well points or large diameter wells, may be needed outside of the excavation.

A series groundwater management options are typically available, including on-site recharge or off-site discharge (i.e., storm drain or surface discharge), which would be based on the contractor's approach to excavation and groundwater management. These management options may require pre-treatment prior to discharge and include typical dewatering controls, including sedimentation tanks and bag filters. The project can likely be managed under the EPA's Construction General Permit (CGP) for activities related management of non-impacted groundwater, including a Stormwater Pollution Prevention Plan (SWPPP) if site disturbances are anticipated to be greater than 1 acre.

The groundwater level should be temporarily lowered at least two feet below excavations to limit potential "boils", loss of fines, or softening of the ground. Surface water entering the construction area should be diverted away from excavations.

Bearing Surface Preparation – Excavated granular subgrades above the water table should be proof compacted with either 10 passes of a 10-ton vibratory drum roller for open excavations or 6 passes of a large, reversible, walk behind vibratory compactor capable of exerting a minimum force of 2,000 lbs in trench or pit excavations. Any subgrades that are soft or yielding under proof compaction efforts should be removed below the footprint of the structure as well as in the footing bearing zone which is defined by a 1H:1V plane extending downward and outward from one foot beyond the edge of footing and replaced with compacted Crushed Stone wrapped in a non-woven geotextile. If proof compaction will prove detrimental to the surface due to the presence of groundwater, static rolling may be allowed at the discretion of the Engineer.

For excavated granular subgrades below the groundwater table, a smooth faced excavator bucket should be used to limit disturbance for the last six inches of the excavation. Over-excavate any soft or weak spots and replace with Crushed Stone wrapped in a non-woven geotextile.

Time between final excavation and placement of footings should be minimized to limit disturbance and groundwater induced softening of the subgrade. Soil bearing surfaces should be protected against freezing and the elements before and after concrete placement. If construction is performed during freezing weather, footings and foundation walls should be backfilled as soon as possible after they are constructed. Alternatively, insulating blankets or other means may be used for protection against freezing.

Bedrock bearing surfaces should be cleared of any ponded water, loose rock, or soil prior to foundation construction.

Reuse and Off-Site Disposal Options for Site Soils – Existing subsurface materials, excluding topsoil, may be re-used as Granular Fill, regardless of its gradation, provided it is free of organics, debris, stones greater than two thirds the lift thickness in diameter, or other unsuitable material, and they are placed to the required degree of compaction. It should be noted that some of the existing site soils have a relatively high fine grained content, which could make them difficult to place and compact to the required degree of compaction when excessively wet.

Existing site soils may not be re-used as Gravel Borrow, Gravel Subbase, or Crushed Stone unless it meets the gradation requirements presented above, which is unlikely. Existing topsoil/subsoil may be reused in landscaped areas but should be tested for pH, percent organics, and nutrient content and modified as needed to support vegetative growth.

Excavated materials should be reused to the extent possible on site to limit the generation of excess material that would require off-site disposal. If excess material is generated from the site, it must be appropriately managed in accordance with state and federal regulations. Based on the analytical results collected to date, the anthropogenic fill material meets the Reuse Levels for soil disposal at a Massachusetts lined landfill as described in Reuse and Disposal of Contaminated Soil at Massachusetts Landfills (Policy #Comm-97-001) prepared by the MassDEP in 1997. The Reuse levels are presented in Table 1 in Appendix C.

The fill material will likely be shipped under a properly executed Bill of Lading (BOL), subject to facility approval. Each individual landfill will likely have facility specific acceptance criteria forms and analytical criteria that may differ from sampling conducted to date. During excavation, fill soils should be segregated from deeper naturally occurring soils. Naturally occurring soils should be preferentially removed from the site first before the removal of anthropogenic fill soils to help reduce off-site disposal premiums.

Closing

The preceding recommendations provided herein are for specific application to the proposed gate and interceptor structures in Lowell, Massachusetts, in accordance with generally accepted soil, foundation, and environmental engineering practices. No warranty, expressed or implied, is made. In the event that any changes in the design or location of the proposed structure are made, the conclusions and recommendations in this report should not be considered valid unless verified in writing.

Thank you for the opportunity to provide these services. Please contact Tiffany Labrie at 413-572-3248 if you should have any questions, comments, or require additional information.

Very truly yours,

TIGHE & BOND, INC.



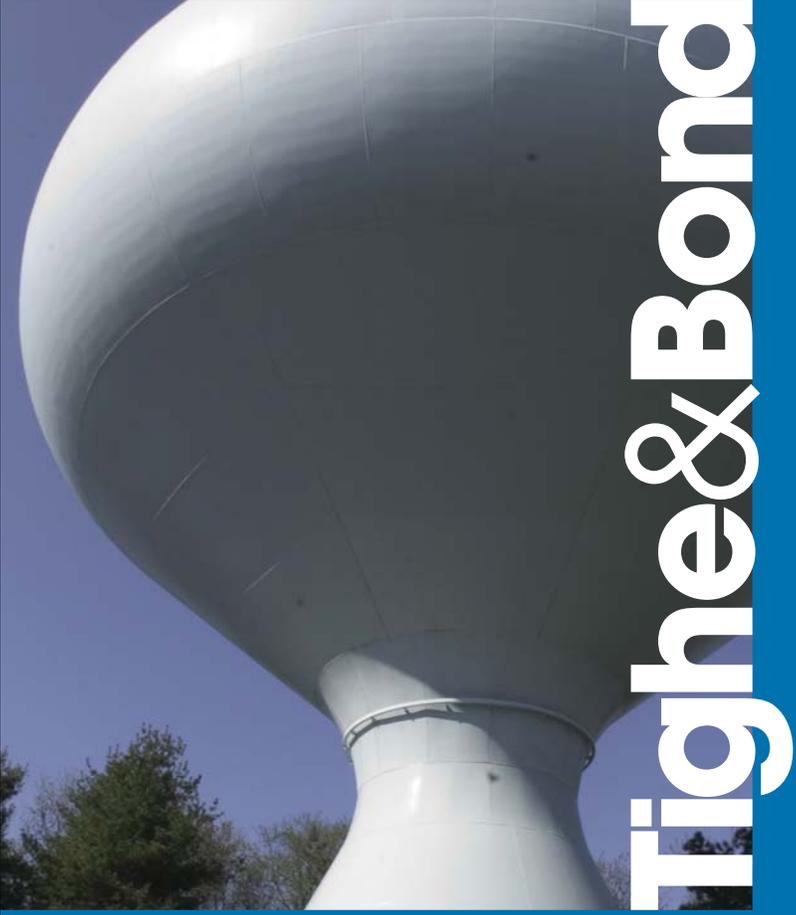
Christopher D. Haker, P.E.
Principal Engineer



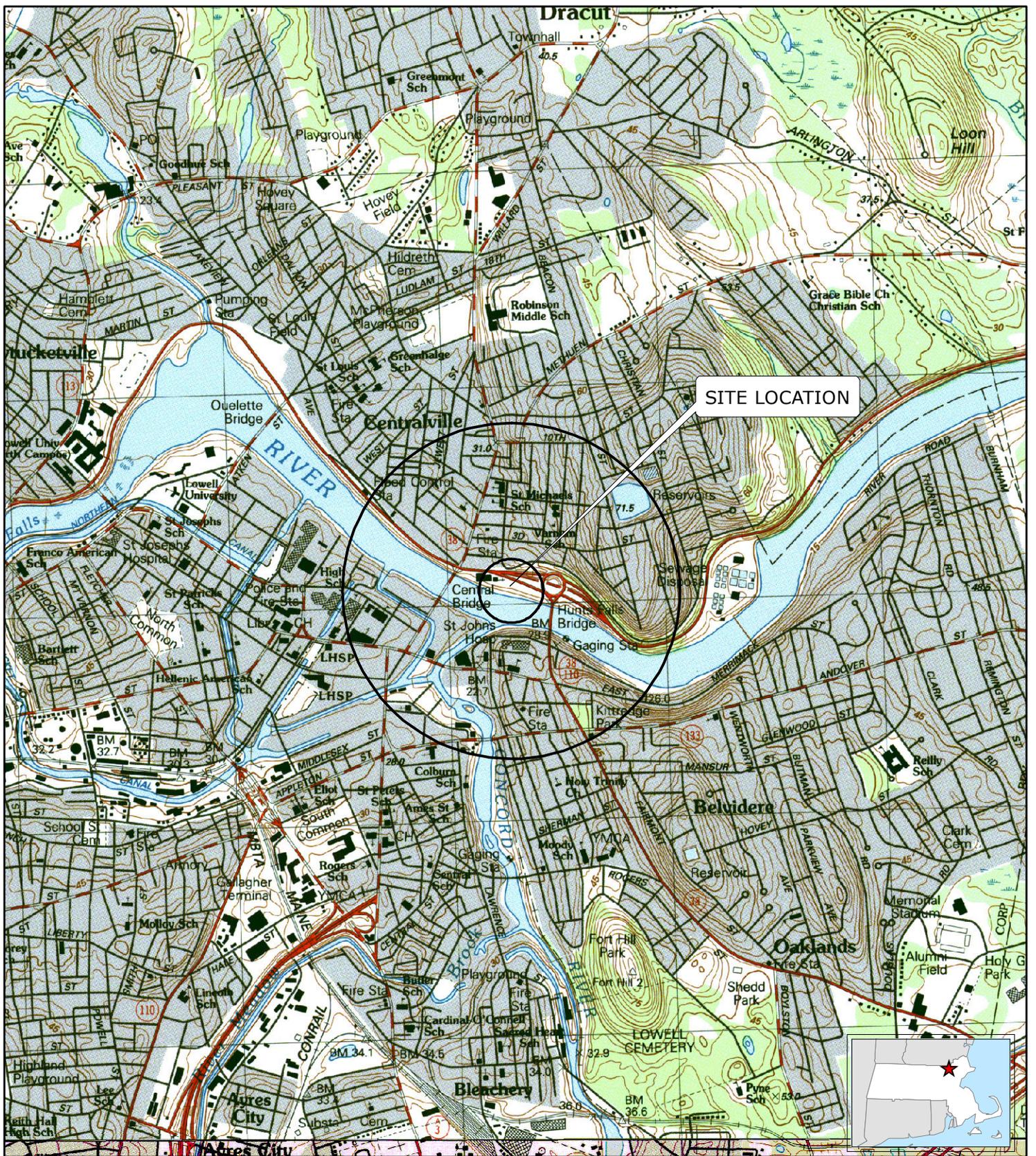
Marc J. Richards, P.E., LSP
Vice President

Attachments: Appendix A – Figures
Appendix B – Test Boring Logs
Appendix C – Laboratory Test Results

J:\L\0704 Lowell LTCP Phase 1A\ReadWest
Design\Geoenvironmental\Report\LowellReadWest_GeoenvironmentalReport final.doc



Tighe & Bond



SITE LOCATION

FIGURE 1

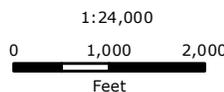
SITE LOCUS

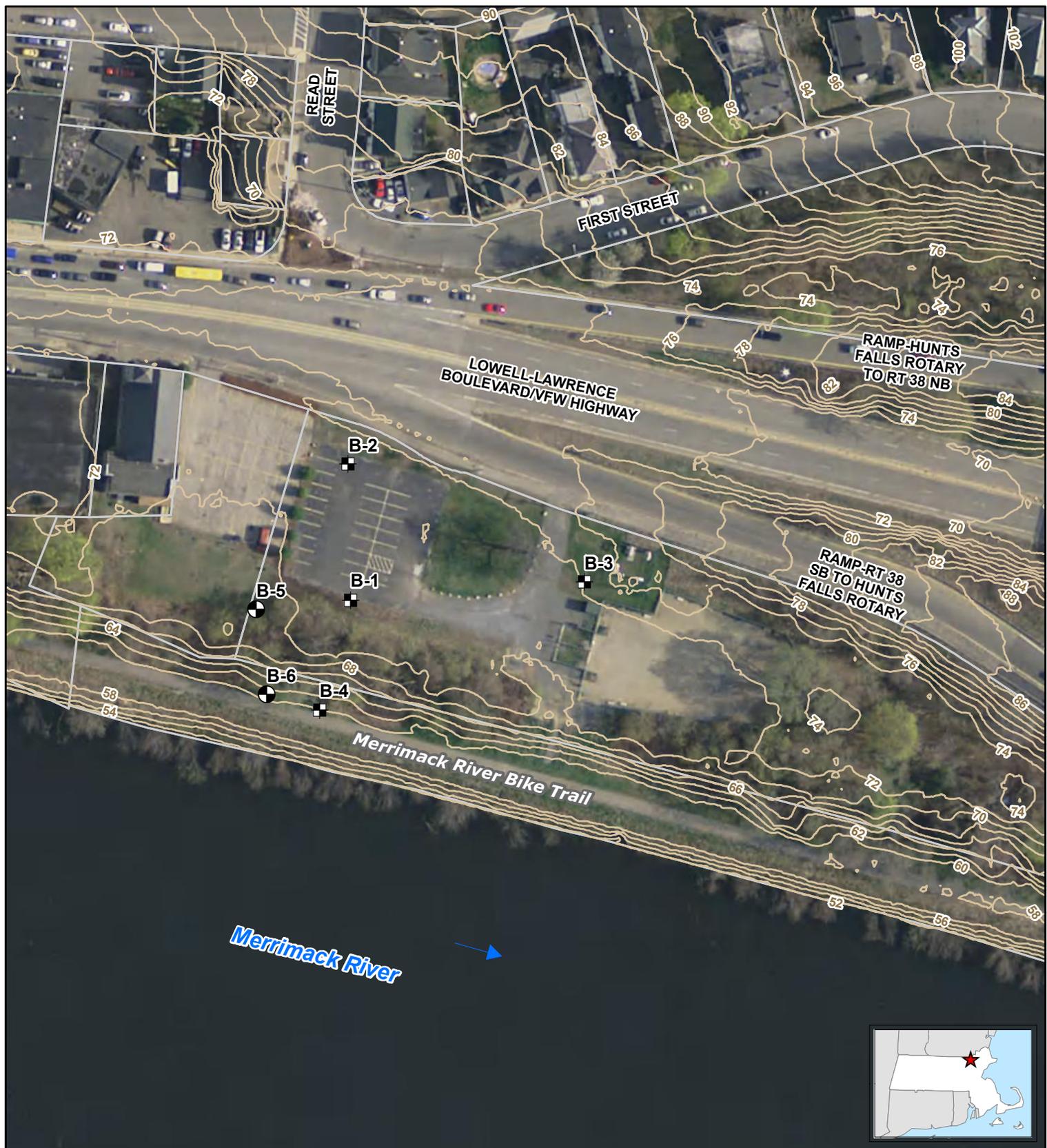
Lowell Regional Wastewater Utility
 Read Street Site
 Lowell, Massachusetts

March 2016



Based on USGS Topographic Map for Lowell, Revised in 1987. 3-Meter Contour Interval. Circles indicate 500-foot and half-mile radii





Legend

-  Boring Performed on April 27-29, 2015
-  Boring Performed on February 16, 2016
-  2 Foot Contours (LiDAR)
-  Parcel Boundary



Based on MassGIS Color Orthophotography (April 2013-2014)
 Borings Performed by Technical Drilling Services of Sterling, Ma



**FIGURE 2
 ORTHOPHOTOGRAPH**

Lowell Regional Wastewater Utility
 Read Street Boring Location Plan
 Lowell, Massachusetts

March, 2016



Tighe & Bond

Project: Read-West Pump and Storage Project
Location: Lowell Dog Park, Read St., Lowell, MA
Client: City of Lowell

Boring No. B-5
Page 1 of 1
File No. L-0704
Checked by: C. Miller/C. Haker

Drilling Co.: Technical Drilling Services
Foreman: Gary Cauette
T&B Rep.: Trevor Poole
Date Start: 02/16/16 End: 02/16/16
Location: See Exploration Location Plan
GS. Elev. 69' Datum: NAVD88

Casing	Sampler
HSA	Split Spoon
4"/4-1/2"	1-3/8"/2"
	140#
	30"
HSA 0-24.5'	Autohammer

Date	Time	Depth	Casing	Sta. Time
2/16/2016				See Note 1

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction	
5		S-1/13	0-2	2-3	Loose, moist, brown to black, fine to coarse SAND, little Organics, trace Silt (TOPSOIL)	FILL	1	No well installed	
				3-4					
		S-2/11	2-4	3-3	Loose, moist, black to brown, fine to coarse SAND, little Gravel, trace Silt, trace broken brick and asphalt (FILL)				
				5-5					
		S-3/9	4-6	3-3	Loose, moist, brown to black, fine to coarse SAND, little Gravel, little Silt, trace asphalt (FILL)				
			2-1						
	S-4/8	6-8	1-2	Very loose, brown to black, moist, fine to coarse SAND, little Silt, trace asphalt (FILL)					
			2-1						
10		S-5/7	8-10	1-1	Very loose, tan to black, moist, fine to coarse SAND, little Silt, trace brick and asphalt (FILL)				
				1-1					
		S-6/8	10-12	1-1	Very loose, tan to black, moist, fine to coarse SAND and Broken Brick, little Silt (FILL)				
			1-1						
15		S-7/10.5	12-14	1-1	Loose, grey to black, moist, fine to coarse SAND, little Silt, trace broken gravel, trace broken brick (FILL)				14'
				9-9					SAND
		S-8/21	14-16	3-3	Loose, grey to black, moist, fine to coarse SAND, little Silt, trace broken Gravel	17.5'			
			5-4	18.5'		BOULDER			
20					Encountered boulder @ ~17.5', cored				
		S-9/15	20-22	2-5	Loose, tan to brown, wet, fine to coarse SAND, little Silt, trace broken gravel				
			4-4	SAND					
25					Refusal of Hollow Stem Auger at 24.5'; End of exploration				
30									

Notes:
1) Groundwater was observed at approximately 20' BSG

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Project: Read-West Pump and Storage Project
Location: Lowell Dog Park, Read St., Lowell, MA
Client: City of Lowell

Boring No. B-6
Page 1 of 1
File No. L-0704
Checked by: C. Miller/C. Haker

Drilling Co.: Technical Drilling Services
Foreman: Gary Cauette
T&B Rep.: Trevor Poole
Date Start: 02/16/16 End: 02/16/16
Location: See Exploration Location Plan
GS. Elev. 60' Datum: NAVD88

Casing	Sampler
HSA	Split Spoon
4"/4-1/2"	1-3/8"/2"
	140#
	30"
HSA 0'-28'	Autohammer

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
2/16/2016				See Note 1

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
5		S-1/16	0-2	5-4	Loose, moist, brown to tan fine to coarse SAND, little Organics, trace Silt (TOPSOIL)	FILL	1	No well installed
				5-3				
		S-2/12	2-4	9-9	Medium Dense, black to brown, fine to coarse SAND, little Gravel, trace Silt, trace broken brick and asphalt (FILL)			
				18-18				
		S-3/NR	4-6	14-9	No Recovery			
10				8-7		6.5'		
		S-4/3	6-6.5	8-5	Brown to tan, moist, fine to coarse SAND, little Silt, trace asphalt (FILL)			
		S-5/17	6.5-8	4-3	Loose, brown to tan, moist, fine to coarse SAND, little Silt			
		S-6/17	8-10	1-1	Very loose, tan to black, moist, fine to coarse SAND, little Silt			
				3-1				
15				6-10	Medium dense, grey to black, wet, fine to coarse SAND, little broken Gravel, little Silt	13.5'		
				16-19				
		S-8/16	15-17	54-100	Very Dense, wet, grey, fine to coarse SAND, some Silt, trace Gravel (GLACIAL TILL)			
				refusal				
20						GLACIAL TILL		
		S-9/13	20-22	5-7	Medium dense, tan, wet, fine to coarse SAND, little broken Gravel, little Silt (GLACIAL TILL)			
				9-12				
25								
		S-10/14	25-27	16-18	Very dense, wet, grey, fine to coarse SAND, some broken Gravel, little Silt (GLACIAL TILL)			
				100/refusal				
30					Refusal of Hollow Stem Auger at 28'; End of Exploration			

Notes:
1) Groundwater was observed at approximately 10' BSG via the recovery of wet soils in the splitspoon

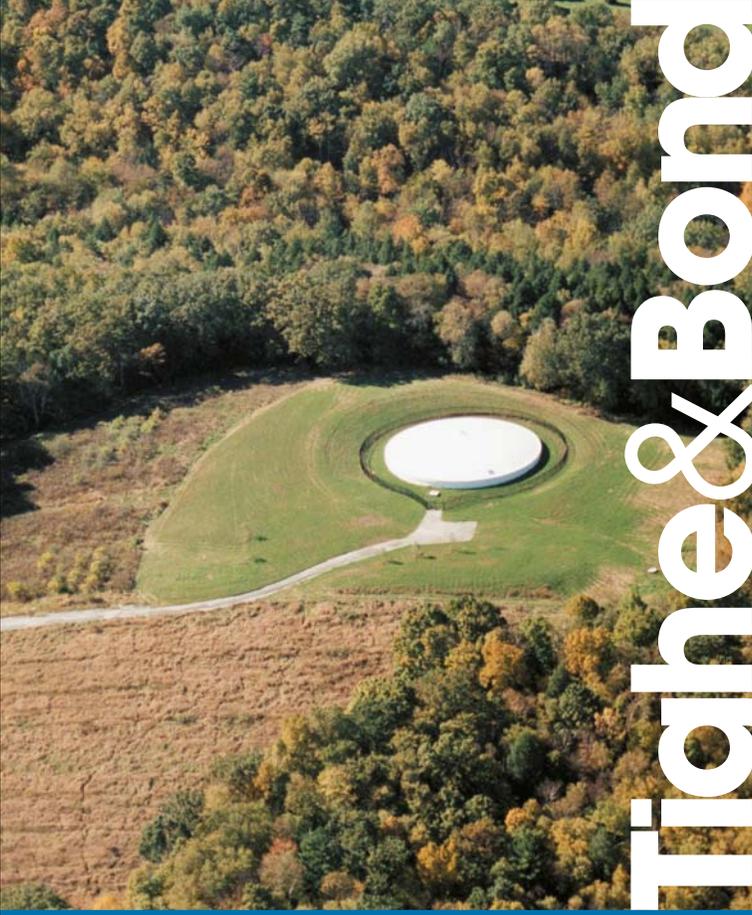
Proportions Used	
TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency			
VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

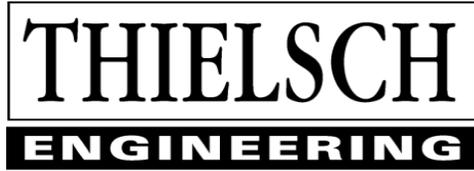
Table1
Soil Analytical Results
Reed Street, Lowell

Sample Designation Sample Date Sample Depth (feet)	B-5 12ft-14ft 02/16/2016 12-14	B-5 16ft-18ft 02/16/2016 16-18	B-6 6ft-8ft 02/16/2016 6-8	B-6 15ft-17ft 02/16/2016 15-17	Reportable Concentrations RCS-1	Comm 97 Landfill Reuse Levels Lined Unlined	
Volatile Organic Compounds (VOCs)							
VOCs	< CS	NA	< CS	NA	CS	-	-
Total VOCs	ND	NA	ND	NA	NA	10	4
Semi-Volatile Organic Compounds (SVOCs)							
Acenaphthene	0.46	NA	< 0.394	NA	4	-	-
Acenaphthylene	0.63	NA	< 0.394	NA	1	-	-
Anthracene	1.56	NA	< 0.394	NA	1000	-	-
Benzo(a)anthracene	5.39	NA	1.10	NA	7	-	-
Benzo(a)pyrene	5.99	NA	0.99	NA	2	-	-
Benzo(b)fluoranthene	5.88	NA	0.87	NA	7	-	-
Benzo(g,h,i)perylene	1.25	NA	0.47	NA	1000	-	-
Benzo(k)fluoranthene	3.88	NA	< 0.394	NA	70	-	-
Chrysene	5.23	NA	0.95	NA	70	-	-
Dibenzo(a,h)Anthracene	0.64	NA	< 0.197	NA	0.7	-	-
Fluoranthene	11.70	NA	1.77	NA	1000	-	-
Fluorene	0.64	NA	< 0.394	NA	1000	-	-
Indeno(1,2,3-cd)Pyrene	1.26	NA	0.46	NA	7	-	-
Naphthalene	0.73	NA	< 0.394	NA	4	-	-
Phenanthrene	4.01	NA	0.92	NA	10	-	-
Pyrene	8.48	NA	1.47	NA	1000	-	-
Other VOCs	<CS	NA	<CS	NA	CS	-	-
Total SVOCs	57.72	NA	8.99	NA	NA	100	100
Total Petroleum Hydrocarbons (TPH)							
TPH	1160	NA	121	NA	1000	5,000	2,500
Extractable Petroleum Hydrocarbons (EPH)							
C9-C18 Aliphatics	< 42.1	NA	NA	NA	1000	-	-
C19-C36 Aliphatics	196	NA	NA	NA	3000	-	-
C11-C22 Aromatics	271	NA	NA	NA	1000	-	-
Metals							
Arsenic	18.40	4.25	6.66	5.42	20	40	40
Barium	213.00	32.8	44.0	31.5	1000	-	-
Cadmium	1.37	< 0.45	< 0.47	< 0.5	70	80	30
Chromium	20.80	11.8	16.3	38.3	100	1,000	1,000
Lead	1,110	21.8	69.0	5.16	200	2,000	1,000
TCLP Lead* (µg/L)	3.38	NA	NA	NA	NE	-	-
Mercury	2.34	0.069	0.288	< 0.035	20	10	10
Selenium	< 2.7	< 0.54	< 0.56	< 0.6	400	-	-
Silver	0.68	< 0.45	< 0.47	< 0.5	100	-	-
Polarized Light Microscopy and Scanning Electron Microscopy							
Coal and Coal Ash	Present	NA	NA	NA	NA	-	-
PCBs							
Total PCBs	< 0.0656	NA	< 0.0583	NA	1	<2	<2
Classical Chemistry							
Corrosivity (pH) (S.U.)	7.45	NA	7.66	NA	NE	-	-
Flashpoint (°F)	> 200	NA	> 200	NA	NE	-	-
Reactive Cyanide	< 2	NA	< 2	NA	NE	-	-
Reactive Sulfide	< 2	NA	< 2	NA	NE	-	-
Conductivity (umhos/cm)	410	NA	169	NA	NE	8,000	4,000
Eh (ORP) (mv)	321	NA	328	NA	NE	-	-

Results reported in milligrams-per-kilogram (mg/kg) unless otherwise noted
 < XX = analyte was not detected at the noted detection limit
 NE = not established
 TCLP Lead* = the TCLP limit for lead is 5 µg/L
 NA = Not Analyzed



Tighe & Bond



195 Frances Avenue
 Cranston RI, 02910
 Phone: (401)-467-6454
 Fax: (401)-467-2398
<http://www.thielsch.com>

Client Information:
Tighe & Bond
 Worcester, MA
PM: Tiffany Labrie
 Assigned By: Chris Miller
Project: L0704

Laboratory Information
 Project Name:
Lowell Read West Pump and Storage
Lowell, MA
 TEI Project Number: 74-16-0002.104
 Report Date: 2/25/2016

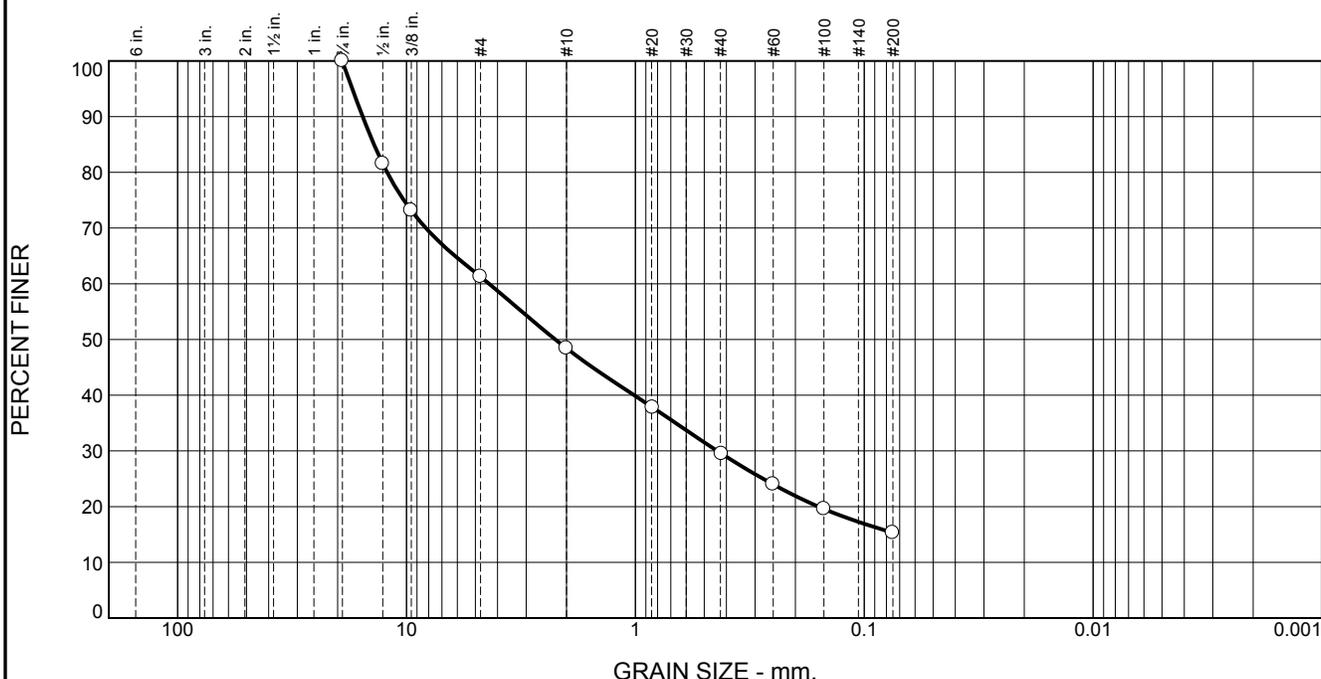
LABORATORY TESTING DATA SHEET

Boring ID	Sample No.	Depth (ft)	Lab No.	Identification Tests							pH	Resistivity			Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %		Dry unit wt. pcf	Saturated Water Content %	Saturated Resistance (ohm.m)	
B-5	S-6	10-12	16-S-174				38.7	46.0	15.3						Dark brown silty sand with gravel (SM)
B-5	S-9	20-22	16-S-175				0	87.9	12.1						Dark gray silty sand (SM)
B-6	S-9	20-22	16-S-176				13.2	72.1	14.7						Gray silty sand (SM)

Reviewed By Matthew Pyle

2/22/2016

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	38.6	12.9	18.8	14.3	15.3	

TEST RESULTS (D422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
.5"	81.6		
.375"	73.2		
#4	61.3		
#10	48.4		
#20	37.8		
#40	29.5		
#60	24.0		
#100	19.6		
#200	15.3		

* (no specification provided)

Material Description

Dark brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-1-a

Coefficients

D₉₀= 15.5315 D₈₅= 13.8646 D₆₀= 4.3576
D₅₀= 2.2374 D₃₀= 0.4387 D₁₅=
D₁₀= C_u= C_c=

Remarks

Sample contains coal and coal ash

Date Received: 2/23/16 Date Tested: 2/25/16
Tested By: AS/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

Source of Sample: B-5 Depth: 10-12'
Sample Number: S-6

Date Sampled:

Thielsch Engineering Inc.

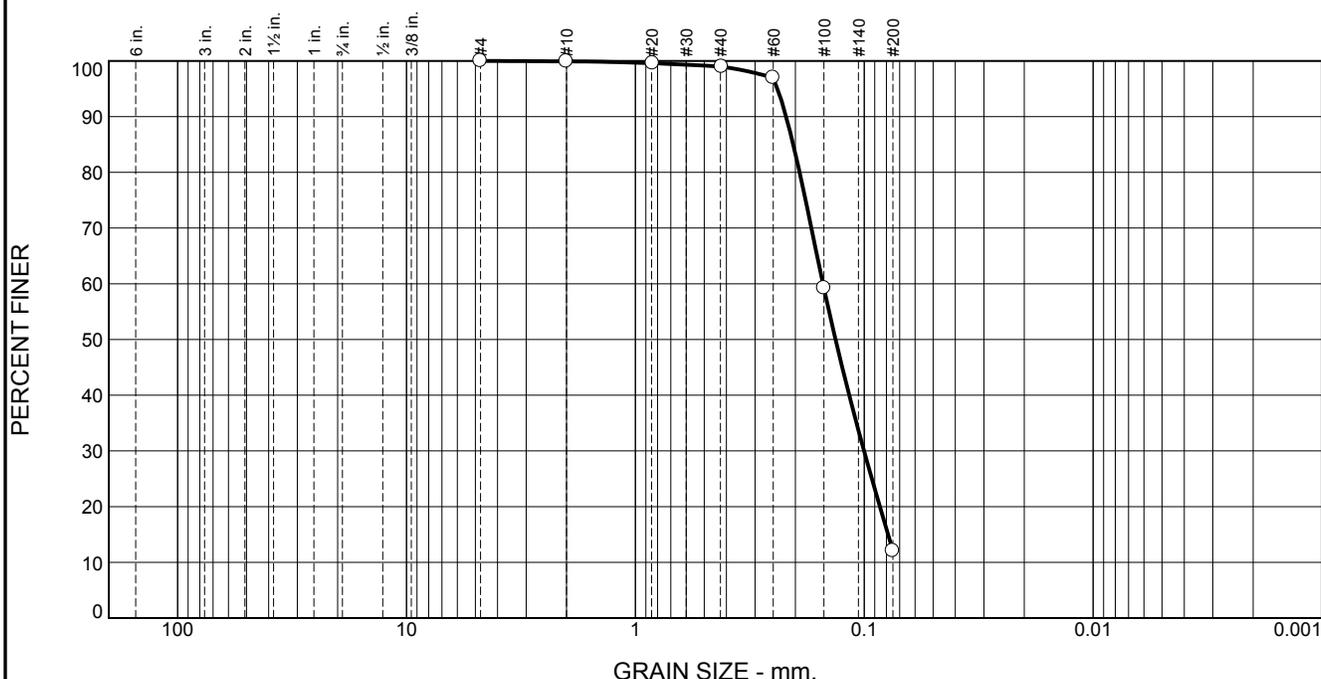
Cranston, RI

Client: Tighe & Bond
Project: Lowell Read West Pump and Storage Project
Lowell, MA

Project No: L0704

Figure 16-S-174

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.9	86.9	12.1	

TEST RESULTS (D422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.6		
#40	99.0		
#60	97.0		
#100	59.2		
#200	12.1		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 0.2193 D₈₅= 0.2043 D₆₀= 0.1514
D₅₀= 0.1335 D₃₀= 0.1002 D₁₅= 0.0787
D₁₀= C_u= C_c=

Remarks

Date Received: 2/23/16 Date Tested: 2/25/16
Tested By: AS/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

Source of Sample: B-5 Depth: 20-22'
Sample Number: S-9

Date Sampled:

Thielsch Engineering Inc.

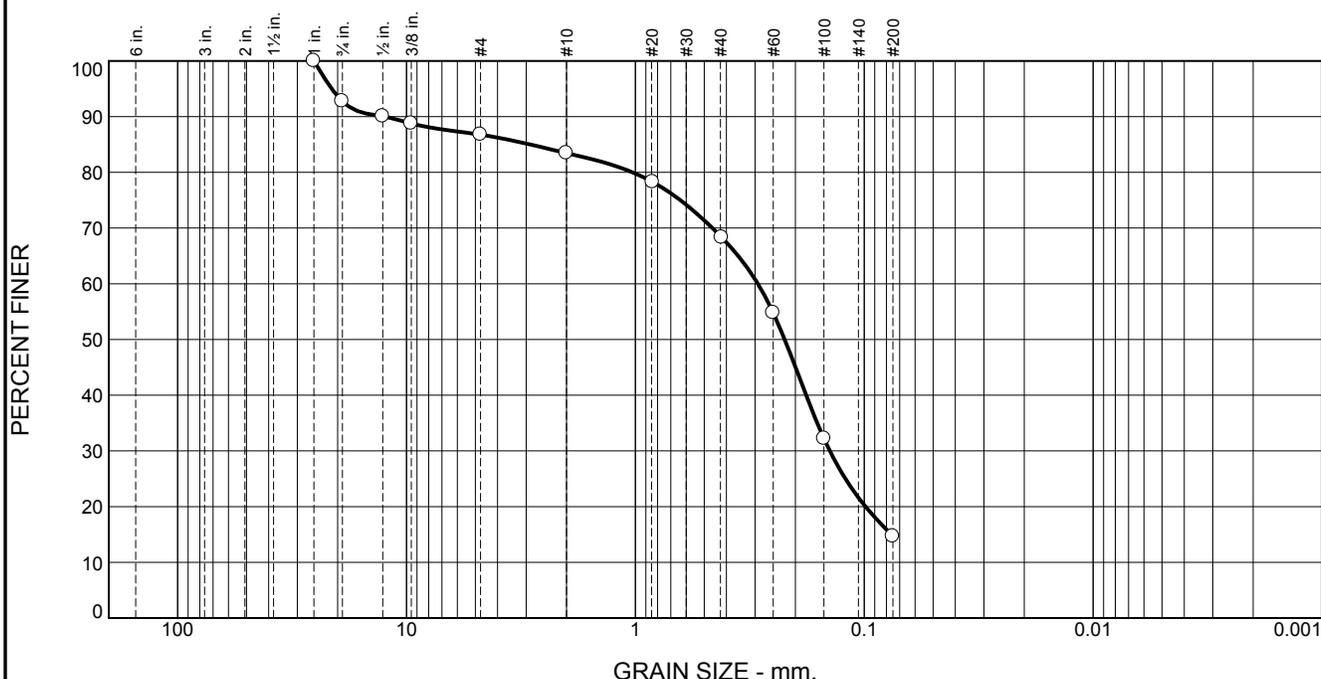
Client: Tighe & Bond
Project: Lowell Read West Pump and Storage Project
Lowell, MA

Cranston, RI

Project No: L0704

Figure 16-S-175

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.3	5.9	3.3	15.0	53.8	14.7	

TEST RESULTS (D422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	92.8		
.5"	90.1		
.375"	88.8		
#4	86.8		
#10	83.5		
#20	78.3		
#40	68.3		
#60	54.8		
#100	32.2		
#200	14.7		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D₉₀= 12.4454 D₈₅= 2.8846 D₆₀= 0.2916
D₅₀= 0.2227 D₃₀= 0.1414 D₁₅= 0.0763
D₁₀= C_u= C_c=

Remarks

Date Received: 2/23/16 Date Tested: 2/25/16
Tested By: AS/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

Source of Sample: B-6 Depth: 20-22'
Sample Number: S-9

Date Sampled:

Thielsch Engineering Inc.

Cranston, RI

Client: Tighe & Bond
Project: Lowell Read West Pump and Storage Project
Lowell, MA

Project No: L0704

Figure 16-S-176



CERTIFICATE OF ANALYSIS

Matt Abraham
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Reed Street Lowell (L-0704-02)
ESS Laboratory Work Order Number: 1602379

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoussard
Laboratory Director

REVIEWED
By mpagliarini at 4:18 pm, Mar 02, 2016

Analytical Summary

The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with NELAC Standards, A2LA and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

SAMPLE RECEIPT

The following samples were received on February 17, 2016 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has performed and reviewed all QA/QC Requirements and Performance Standards listed in each method. Holding times and preservation have also been reviewed. All CAM requirements have been achieved unless noted in the project narrative.

Each method has been set-up in the laboratory to reach required MCP standards. The methods for aqueous VOA and Soil Methanol VOA have known limitations for certain analytes. The regulatory standards may not be achieved due to these limitations. In addition, for all methods, matrix interferences, dilutions, and %Solids may elevate method reporting limits above regulatory standards. ESS Laboratory can provide, upon request, a Data Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Question I: All samples for Metals and EPH were analyzed for a subset of the required MCP list per the client's request.

Lab Number	Sample Name	Matrix	Analysis
1602379-01	B-5 12ft-14ft	Soil	1010, 2580, 6010C, 7.3.3.2, 7.3.4.1, 7010, 7471B, 8082A, 8100M, 8260B, 8270D, 9045, 9050A
1602379-02	B-5 16ft-18ft	Soil	6010C, 6020A, 7471B
1602379-03	B-6 6ft-8ft	Soil	1010, 2580, 6010C, 6020A, 7.3.3.2, 7.3.4.1, 7471B, 8082A, 8100M, 8260B, 8270D, 9045, 9050A
1602379-04	B-6 15ft-17ft	Soil	6010C, 6020A, 7471B



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

PROJECT NARRATIVE

5035/8260B Volatile Organic Compounds / Methanol

CB61939-BSD1 Relative percent difference for duplicate is outside of criteria (D+).

1,1,2,2-Tetrachloroethane (27% @ 25%), 1,2,3-Trichloropropane (36% @ 25%), 1,3,5-Trimethylbenzene (30% @ 25%), 2-Chlorotoluene (30% @ 25%), 4-Chlorotoluene (29% @ 25%), Isopropylbenzene (26% @ 25%), n-Propylbenzene (32% @ 25%)

8270D Semi-Volatile Organic Compounds

CZB0245-CCV1 Continuing Calibration %Diff/Drift is above control limit (CD+).

2,4-Dinitrophenol (29% @ 20%), Pentachlorophenol (23% @ 20%)

CZB0285-CCV1 Continuing Calibration %Diff/Drift is above control limit (CD+).

2,4-Dinitrophenol (38% @ 20%)

CZB0325-CCV1 Continuing Calibration %Diff/Drift is above control limit (CD+).

2,4-Dinitrophenol (21% @ 20%)

Classical Chemistry

1602379-01 Estimated value. Sample hold times were exceeded (H).

Corrosivity (pH) , Corrosivity (pH) Sample Temp , Eh (ORP)

1602379-03 Estimated value. Sample hold times were exceeded (H).

Corrosivity (pH) , Corrosivity (pH) Sample Temp , Eh (ORP)

Total Metals

CB62202-BSD1 Relative percent difference for duplicate is outside of criteria (D+).

Barium (29% @ 20%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

[Definitions of Quality Control Parameters](#)

[Semivolatile Organics Internal Standard Information](#)

[Semivolatile Organics Surrogate Information](#)

[Volatile Organics Internal Standard Information](#)

[Volatile Organics Surrogate Information](#)

[EPH and VPH Alkane Lists](#)



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

- 1010A - Flashpoint
- 6010C - ICP
- 6020A - ICP MS
- 7010 - Graphite Furnace
- 7196A - Hexavalent Chromium
- 7470A - Aqueous Mercury
- 7471B - Solid Mercury
- 8011 - EDB/DBCP/TCP
- 8015D - GRO/DRO
- 8081B - Pesticides
- 8082A - PCB
- 8100M - TPH
- 8151A - Herbicides
- 8260B - VOA
- 8270D - SVOA
- 8270D SIM - SVOA Low Level
- 9014 - Cyanide
- 9038 - Sulfate
- 9040C - Aqueous pH
- 9045D - Solid pH (Corrosivity)
- 9050A - Specific Conductance
- 9056A - Anions (IC)
- 9060A - TOC
- 9095B - Paint Filter
- MADEP 04-1.1 - EPH / VPH

Prep Methods

- 3005A - Aqueous ICP Digestion
- 3020A - Aqueous Graphite Furnace / ICP MS Digestion
- 3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
- 3060A - Solid Hexavalent Chromium Digestion
- 3510C - Separatory Funnel Extraction
- 3520C - Liquid / Liquid Extraction
- 3540C - Manual Soxhlet Extraction
- 3541 - Automated Soxhlet Extraction
- 3546 - Microwave Extraction
- 3580A - Waste Dilution
- 5030B - Aqueous Purge and Trap
- 5030C - Aqueous Purge and Trap
- 5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1602379-01 through 1602379-04**

Matrices: () Ground Water/Surface Water (X) Soil/Sediment () Drinking Water () Air () Other: _____

CAM Protocol (check all that apply below):

- | | | | | | |
|------------------------------|-------------------------------|-----------------------------|------------------------------------|--|-----------------------------|
| (X) 8260 VOC
CAM II A | (X) 7470/7471 Hg
CAM III B | () MassDEP VPH
CAM IV A | () 8081 Pesticides
CAM V B | () 7196 Hex Cr
CAM VI B | () MassDEP APH
CAM IX A |
| (X) 8270 SVOC
CAM II B | () 7010 Metals
CAM III C | (X) MassDEP EPH
CAM IV B | () 8151 Herbicides
CAM V C | () 8330 Explosives
CAM VIII A | () TO-15 VOC
CAM IX B |
| (X) 6010 Metals
CAM III A | (X) 6020 Metals
CAM III D | (X) 8082 PCB
CAM V A | () 6860 Perchlorate
CAM VIII B | () 9014 Total Cyanide/PAC
CAM VI A | |

Affirmative responses to questions A through F are required for Presumptive Certainty's status

- A Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times? Yes (X) No ()
- B Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed? Yes (X) No ()
- C Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances? Yes (X) No ()
- D Does the laboratory report comply with all the reporting requirements specified in the CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? Yes (X) No ()
- E a. VPH, EPH, APH and TO-15 only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications). Yes (X) No ()
b. APH and TO-15 Methods only: Was the complete analyte list reported for each method? Yes () No ()
- F Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)? Yes (X) No ()

Responses to Questions G, H and I below are required for Presumptive Certainty's status

- G Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocols(s)? Yes (X) No ()*
- Data User Note: Data that achieve Presumptive Certainty's status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.**
- H Were all QC performance standards specified in the CAM protocol(s) achieved? Yes () No (X)*
- I Were results reported for the complete analyte list specified in the selected CAM protocol(s)? Yes () No (X)*

*All negative responses must be addressed in an attached laboratory narrative.

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Signature: _____
Printed Name: Lauren Stouffer

Date: March 02, 2016
Position: Laboratory Director



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12ft-14ft
Date Sampled: 02/16/16 10:30
Percent Solids: 78

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>I/V</u>	<u>F/V</u>	<u>Batch</u>
Arsenic	18.4 (2.70)		6010C		1	BJV	02/23/16 3:55	2.37	100	CB62202
Barium	213 (2.70)		6010C		1	BJV	02/23/16 3:55	2.37	100	CB62202
Cadmium	1.37 (0.54)		6010C		1	BJV	02/23/16 3:55	2.37	100	CB62202
Chromium	20.8 (1.08)		6010C		1	BJV	02/23/16 3:55	2.37	100	CB62202
Lead	1110 (5.40)		6010C		1	BJV	02/23/16 3:55	2.37	100	CB62202
Mercury	2.34 (0.402)		7471B		10	PJP	02/23/16 15:56	0.63	40	CB62205
Selenium	ND (2.70)		7010		5	KJK	02/25/16 15:21	2.37	100	CB62202
Silver	0.68 (0.54)		6010C		1	BJV	02/23/16 3:55	2.37	100	CB62202



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12ft-14ft
Date Sampled: 02/16/16 10:30
Percent Solids: 78
Initial Volume: 15.2
Final Volume: 15
Extraction Method: 5035

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
1,1,1,2-Tetrachloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,1,1-Trichloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,1,2,2-Tetrachloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,1,2-Trichloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,1-Dichloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,1-Dichloroethene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,1-Dichloropropene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2,3-Trichlorobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2,3-Trichloropropane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2,4-Trichlorobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2,4-Trimethylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2-Dibromo-3-Chloropropane	ND (1.54)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2-Dibromoethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2-Dichlorobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2-Dichloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,2-Dichloropropane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,3,5-Trimethylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,3-Dichlorobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,3-Dichloropropane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,4-Dichlorobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
1,4-Dioxane - Screen	ND (61.6)		8260B		1	02/20/16 3:02	CZB0284	CB61939
2,2-Dichloropropane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
2-Butanone	ND (1.54)		8260B		1	02/20/16 3:02	CZB0284	CB61939
2-Chlorotoluene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
2-Hexanone	ND (1.54)		8260B		1	02/20/16 3:02	CZB0284	CB61939
4-Chlorotoluene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
4-Isopropyltoluene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
4-Methyl-2-Pentanone	ND (1.54)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Acetone	ND (1.54)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Benzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Bromobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-5 12ft-14ft
 Date Sampled: 02/16/16 10:30
 Percent Solids: 78
 Initial Volume: 15.2
 Final Volume: 15
 Extraction Method: 5035

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-01
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Bromochloromethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Bromodichloromethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Bromoform	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Bromomethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Carbon Disulfide	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Carbon Tetrachloride	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Chlorobenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Chloroethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Chloroform	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Chloromethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
cis-1,2-Dichloroethene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
cis-1,3-Dichloropropene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Dibromochloromethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Dibromomethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Dichlorodifluoromethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Diethyl Ether	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Di-isopropyl ether	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Ethyl tertiary-butyl ether	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Ethylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Hexachlorobutadiene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Isopropylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Methyl tert-Butyl Ether	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Methylene Chloride	ND (0.616)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Naphthalene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
n-Butylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
n-Propylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
sec-Butylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Styrene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
tert-Butylbenzene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Tertiary-amyl methyl ether	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Tetrachloroethene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-5 12ft-14ft
 Date Sampled: 02/16/16 10:30
 Percent Solids: 78
 Initial Volume: 15.2
 Final Volume: 15
 Extraction Method: 5035

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-01
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Tetrahydrofuran	ND (1.54)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Toluene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
trans-1,2-Dichloroethene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
trans-1,3-Dichloropropene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Trichloroethene	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Trichlorofluoromethane	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Vinyl Chloride	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Xylene O	ND (0.308)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Xylene P,M	ND (0.616)		8260B		1	02/20/16 3:02	CZB0284	CB61939
Xylenes (Total)	ND (0.482)		8260B		2	02/20/16 3:02		[CALC]

	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>
<i>Surrogate: 1,2-Dichloroethane-d4</i>	122 %		70-130
<i>Surrogate: 4-Bromofluorobenzene</i>	119 %		70-130
<i>Surrogate: Dibromofluoromethane</i>	121 %		70-130
<i>Surrogate: Toluene-d8</i>	125 %		70-130



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12ft-14ft
Date Sampled: 02/16/16 10:30
Percent Solids: 78
Initial Volume: 19.5
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 2/18/16 17:30
Cleanup Method: 3665A

8082A Polychlorinated Biphenyls (PCB)

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Aroclor 1016	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1221	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1232	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1242	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1248	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1254	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1260	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1262	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327
Aroclor 1268	ND (0.0656)		8082A		1	02/22/16 22:14		CB62327

	<u>%Recovery</u>	<u>Qualifier</u>	<u>Limits</u>
<i>Surrogate: Decachlorobiphenyl</i>	64 %		30-150
<i>Surrogate: Decachlorobiphenyl [2C]</i>	60 %		30-150
<i>Surrogate: Tetrachloro-m-xylene</i>	76 %		30-150
<i>Surrogate: Tetrachloro-m-xylene [2C]</i>	57 %		30-150



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-5 12ft-14ft
 Date Sampled: 02/16/16 10:30
 Percent Solids: 78
 Initial Volume: 20.9
 Final Volume: 1
 Extraction Method: 3546

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-01
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: DPS
 Prepared: 2/18/16 10:20

8100M Total Petroleum Hydrocarbons

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Total Petroleum Hydrocarbons	1160 (12.2)		8100M		1	02/19/16 2:27	CZB0257	CB61712
		<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				
<i>Surrogate: O-Terphenyl</i>		97 %		40-140				



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12ft-14ft
Date Sampled: 02/16/16 10:30
Percent Solids: 78
Initial Volume: 14.7
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: ML
Prepared: 2/18/16 10:47

8270D Semi-Volatile Organic Compounds

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
1,2,4-Trichlorobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
1,2-Dichlorobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
1,3-Dichlorobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
1,4-Dichlorobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,4,5-Trichlorophenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,4,6-Trichlorophenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,4-Dichlorophenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,4-Dimethylphenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,4-Dinitrophenol	ND (2.18)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,4-Dinitrotoluene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2,6-Dinitrotoluene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2-Chloronaphthalene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2-Chlorophenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2-Methylnaphthalene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2-Methylphenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
2-Nitrophenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
3,3'-Dichlorobenzidine	ND (0.870)		8270D		1	02/20/16 8:11	CZB0285	CB61714
3+4-Methylphenol	ND (0.870)		8270D		1	02/20/16 8:11	CZB0285	CB61714
4-Bromophenyl-phenylether	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
4-Chloroaniline	ND (0.870)		8270D		1	02/20/16 8:11	CZB0285	CB61714
4-Nitrophenol	ND (2.18)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Acenaphthene	0.458 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Acenaphthylene	0.631 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Acetophenone	ND (0.870)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Aniline	ND (2.18)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Anthracene	1.56 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Azobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Benzo(a)anthracene	5.39 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Benzo(a)pyrene	5.99 (0.218)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Benzo(b)fluoranthene	5.88 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Benzo(g,h,i)perylene	1.25 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-5 12ft-14ft
 Date Sampled: 02/16/16 10:30
 Percent Solids: 78
 Initial Volume: 14.7
 Final Volume: 0.5
 Extraction Method: 3546

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-01
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: ML
 Prepared: 2/18/16 10:47

8270D Semi-Volatile Organic Compounds

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Benzo(k)fluoranthene	3.88 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
bis(2-Chloroethoxy)methane	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
bis(2-Chloroethyl)ether	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
bis(2-chloroisopropyl)Ether	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
bis(2-Ethylhexyl)phthalate	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Butylbenzylphthalate	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Chrysene	5.23 (0.218)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Dibenzo(a,h)Anthracene	0.638 (0.218)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Dibenzofuran	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Diethylphthalate	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Dimethylphthalate	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Di-n-butylphthalate	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Di-n-octylphthalate	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Fluoranthene	11.7 (2.17)		8270D		5	02/25/16 15:12	CZB0285	CB61714
Fluorene	0.638 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Hexachlorobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Hexachlorobutadiene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Hexachloroethane	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Indeno(1,2,3-cd)Pyrene	1.26 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Isophorone	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Naphthalene	0.725 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Nitrobenzene	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
N-Nitrosodimethylamine	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Pentachlorophenol	ND (2.18)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Phenanthrene	4.01 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Phenol	ND (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714
Pyrene	8.48 (0.435)		8270D		1	02/20/16 8:11	CZB0285	CB61714



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12ft-14ft
Date Sampled: 02/16/16 10:30
Percent Solids: 78
Initial Volume: 14.7
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: ML
Prepared: 2/18/16 10:47

8270D Semi-Volatile Organic Compounds

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
		<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				
<i>Surrogate: 1,2-Dichlorobenzene-d4</i>		80 %		30-130				
<i>Surrogate: 2,4,6-Tribromophenol</i>		85 %		30-130				
<i>Surrogate: 2-Chlorophenol-d4</i>		83 %		30-130				
<i>Surrogate: 2-Fluorobiphenyl</i>		85 %		30-130				
<i>Surrogate: 2-Fluorophenol</i>		81 %		30-130				
<i>Surrogate: Nitrobenzene-d5</i>		93 %		30-130				
<i>Surrogate: Phenol-d6</i>		85 %		30-130				
<i>Surrogate: p-Terphenyl-d14</i>		77 %		30-130				



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-5 12ft-14ft
 Date Sampled: 02/16/16 10:30
 Percent Solids: 78

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-01
 Sample Matrix: Soil

Classical Chemistry

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>Units</u>	<u>Batch</u>
Conductivity	WL 410 (5)		9050A		1	MJV	02/18/16 9:30	umhos/cm	CB61804
Corrosivity (pH)	H 7.45 (N/A)		9045		1	JLK	02/17/16 21:33	S.U.	CB61746
Corrosivity (pH) Sample Temp	Soil pH measured in water at 19.6 °C.								
Eh (ORP)	H, WL 321 (N/A)		2580		1	JLK	02/17/16 21:33	mv	CB61747
Flashpoint	> 200 (N/A)		1010		1	EEM	02/19/16 15:45	°F	CB61914
Reactive Cyanide	ND (2.0)		7.3.3.2		1	JLK	02/19/16 12:00	mg/kg	CB61916
Reactive Sulfide	ND (2.0)		7.3.4.1		1	JLK	02/19/16 12:00	mg/kg	CB61916



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 16ft-18ft
Date Sampled: 02/16/16 10:45
Percent Solids: 86

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>I/V</u>	<u>F/V</u>	<u>Batch</u>
Arsenic	4.25 (2.26)		6010C		1	BJV	02/23/16 4:15	2.56	100	CB62202
Barium	32.8 (2.26)		6010C		1	BJV	02/23/16 4:15	2.56	100	CB62202
Cadmium	ND (0.45)		6010C		1	BJV	02/23/16 4:15	2.56	100	CB62202
Chromium	11.8 (0.90)		6010C		1	BJV	02/23/16 4:15	2.56	100	CB62202
Lead	21.8 (4.52)		6010C		1	BJV	02/23/16 4:15	2.56	100	CB62202
Mercury	0.069 (0.036)		7471B		1	PJP	02/23/16 12:47	0.63	40	CB62205
Selenium	ND (0.54)		6020A		50	NAR	02/23/16 22:03	2.56	100	CB62202
Silver	ND (0.45)		6010C		1	BJV	02/23/16 4:15	2.56	100	CB62202



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-6 6ft-8ft
Date Sampled: 02/16/16 13:00
Percent Solids: 89

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>I/V</u>	<u>F/V</u>	<u>Batch</u>
Arsenic	6.66 (2.33)		6010C		1	BJV	02/23/16 4:19	2.4	100	CB62202
Barium	44.0 (2.33)		6010C		1	BJV	02/23/16 4:19	2.4	100	CB62202
Cadmium	ND (0.47)		6010C		1	BJV	02/23/16 4:19	2.4	100	CB62202
Chromium	16.3 (0.93)		6010C		1	BJV	02/23/16 4:19	2.4	100	CB62202
Lead	69.0 (4.66)		6010C		1	BJV	02/23/16 4:19	2.4	100	CB62202
Mercury	0.288 (0.035)		7471B		1	PJP	02/23/16 12:53	0.64	40	CB62205
Selenium	ND (0.56)		6020A		50	NAR	02/23/16 22:10	2.4	100	CB62202
Silver	ND (0.47)		6010C		1	BJV	02/23/16 4:19	2.4	100	CB62202



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-6 6ft-8ft
Date Sampled: 02/16/16 13:00
Percent Solids: 89
Initial Volume: 18.8
Final Volume: 15
Extraction Method: 5035

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
1,1,1,2-Tetrachloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,1,1-Trichloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,1,2,2-Tetrachloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,1,2-Trichloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,1-Dichloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,1-Dichloroethene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,1-Dichloropropene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2,3-Trichlorobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2,3-Trichloropropane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2,4-Trichlorobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2,4-Trimethylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2-Dibromo-3-Chloropropane	ND (1.01)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2-Dibromoethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2-Dichlorobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2-Dichloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,2-Dichloropropane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,3,5-Trimethylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,3-Dichlorobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,3-Dichloropropane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,4-Dichlorobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
1,4-Dioxane - Screen	ND (40.5)		8260B		1	02/20/16 3:34	CZB0284	CB61939
2,2-Dichloropropane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
2-Butanone	ND (1.01)		8260B		1	02/20/16 3:34	CZB0284	CB61939
2-Chlorotoluene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
2-Hexanone	ND (1.01)		8260B		1	02/20/16 3:34	CZB0284	CB61939
4-Chlorotoluene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
4-Isopropyltoluene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
4-Methyl-2-Pentanone	ND (1.01)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Acetone	ND (1.01)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Benzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Bromobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-6 6ft-8ft
 Date Sampled: 02/16/16 13:00
 Percent Solids: 89
 Initial Volume: 18.8
 Final Volume: 15
 Extraction Method: 5035

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-03
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Bromochloromethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Bromodichloromethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Bromoform	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Bromomethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Carbon Disulfide	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Carbon Tetrachloride	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Chlorobenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Chloroethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Chloroform	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Chloromethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
cis-1,2-Dichloroethene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
cis-1,3-Dichloropropene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Dibromochloromethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Dibromomethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Dichlorodifluoromethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Diethyl Ether	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Di-isopropyl ether	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Ethyl tertiary-butyl ether	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Ethylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Hexachlorobutadiene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Isopropylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Methyl tert-Butyl Ether	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Methylene Chloride	ND (0.405)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Naphthalene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
n-Butylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
n-Propylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
sec-Butylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Styrene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
tert-Butylbenzene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Tertiary-amyl methyl ether	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Tetrachloroethene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-6 6ft-8ft
 Date Sampled: 02/16/16 13:00
 Percent Solids: 89
 Initial Volume: 18.8
 Final Volume: 15
 Extraction Method: 5035

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-03
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: MD

5035/8260B Volatile Organic Compounds / Methanol

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Tetrahydrofuran	ND (1.01)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Toluene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
trans-1,2-Dichloroethene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
trans-1,3-Dichloropropene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Trichloroethene	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Trichlorofluoromethane	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Vinyl Chloride	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Xylene O	ND (0.202)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Xylene P,M	ND (0.405)		8260B		1	02/20/16 3:34	CZB0284	CB61939
Xylenes (Total)	ND (0.362)		8260B		2	02/20/16 3:34		[CALC]

	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>
<i>Surrogate: 1,2-Dichloroethane-d4</i>	103 %		70-130
<i>Surrogate: 4-Bromofluorobenzene</i>	115 %		70-130
<i>Surrogate: Dibromofluoromethane</i>	115 %		70-130
<i>Surrogate: Toluene-d8</i>	120 %		70-130



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-6 6ft-8ft
 Date Sampled: 02/16/16 13:00
 Percent Solids: 89
 Initial Volume: 19.2
 Final Volume: 10
 Extraction Method: 3540C

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-03
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: TJ
 Prepared: 2/18/16 17:30
 Cleanup Method: 3665A

8082A Polychlorinated Biphenyls (PCB)

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Aroclor 1016	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1221	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1232	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1242	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1248	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1254	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1260	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1262	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809
Aroclor 1268	ND (0.0583)		8082A		1	02/19/16 19:22		CB61809

	<u>%Recovery</u>	<u>Qualifier</u>	<u>Limits</u>
Surrogate: Decachlorobiphenyl	60 %		30-150
Surrogate: Decachlorobiphenyl [2C]	60 %		30-150
Surrogate: Tetrachloro-m-xylene	64 %		30-150
Surrogate: Tetrachloro-m-xylene [2C]	55 %		30-150



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-6 6ft-8ft
 Date Sampled: 02/16/16 13:00
 Percent Solids: 89
 Initial Volume: 20.7
 Final Volume: 1
 Extraction Method: 3546

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-03
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: DPS
 Prepared: 2/18/16 10:20

8100M Total Petroleum Hydrocarbons

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Total Petroleum Hydrocarbons	121 (10.8)		8100M		1	02/19/16 3:06	CZB0257	CB61712
		<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				
<i>Surrogate: O-Terphenyl</i>		103 %		40-140				



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
 Client Project ID: Reed Street Lowell
 Client Sample ID: B-6 6ft-8ft
 Date Sampled: 02/16/16 13:00
 Percent Solids: 89
 Initial Volume: 14.2
 Final Volume: 0.5
 Extraction Method: 3546

ESS Laboratory Work Order: 1602379
 ESS Laboratory Sample ID: 1602379-03
 Sample Matrix: Soil
 Units: mg/kg dry
 Analyst: ML
 Prepared: 2/18/16 10:47

8270D Semi-Volatile Organic Compounds

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
1,2,4-Trichlorobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
1,2-Dichlorobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
1,3-Dichlorobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
1,4-Dichlorobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,4,5-Trichlorophenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,4,6-Trichlorophenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,4-Dichlorophenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,4-Dimethylphenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,4-Dinitrophenol	ND (1.97)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,4-Dinitrotoluene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2,6-Dinitrotoluene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2-Chloronaphthalene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2-Chlorophenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2-Methylnaphthalene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2-Methylphenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
2-Nitrophenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
3,3'-Dichlorobenzidine	ND (0.789)		8270D		1	02/20/16 3:20	CZB0285	CB61714
3+4-Methylphenol	ND (0.789)		8270D		1	02/20/16 3:20	CZB0285	CB61714
4-Bromophenyl-phenylether	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
4-Chloroaniline	ND (0.789)		8270D		1	02/20/16 3:20	CZB0285	CB61714
4-Nitrophenol	ND (1.97)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Acenaphthene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Acenaphthylene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Acetophenone	ND (0.789)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Aniline	ND (1.97)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Anthracene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Azobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Benzo(a)anthracene	1.10 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Benzo(a)pyrene	0.986 (0.197)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Benzo(b)fluoranthene	0.867 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Benzo(g,h,i)perylene	0.471 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-6 6ft-8ft
Date Sampled: 02/16/16 13:00
Percent Solids: 89
Initial Volume: 14.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: ML
Prepared: 2/18/16 10:47

8270D Semi-Volatile Organic Compounds

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
Benzo(k)fluoranthene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
bis(2-Chloroethoxy)methane	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
bis(2-Chloroethyl)ether	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
bis(2-chloroisopropyl)Ether	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
bis(2-Ethylhexyl)phthalate	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Butylbenzylphthalate	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Chrysene	0.946 (0.197)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Dibenzo(a,h)Anthracene	ND (0.197)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Dibenzofuran	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Diethylphthalate	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Dimethylphthalate	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Di-n-butylphthalate	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Di-n-octylphthalate	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Fluoranthene	1.77 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Fluorene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Hexachlorobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Hexachlorobutadiene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Hexachloroethane	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Indeno(1,2,3-cd)Pyrene	0.464 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Isophorone	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Naphthalene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Nitrobenzene	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
N-Nitrosodimethylamine	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Pentachlorophenol	ND (1.97)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Phenanthrene	0.919 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Phenol	ND (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714
Pyrene	1.47 (0.394)		8270D		1	02/20/16 3:20	CZB0285	CB61714



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-6 6ft-8ft
Date Sampled: 02/16/16 13:00
Percent Solids: 89
Initial Volume: 14.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: ML
Prepared: 2/18/16 10:47

8270D Semi-Volatile Organic Compounds

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
		<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>				
<i>Surrogate: 1,2-Dichlorobenzene-d4</i>		85 %		30-130				
<i>Surrogate: 2,4,6-Tribromophenol</i>		88 %		30-130				
<i>Surrogate: 2-Chlorophenol-d4</i>		88 %		30-130				
<i>Surrogate: 2-Fluorobiphenyl</i>		91 %		30-130				
<i>Surrogate: 2-Fluorophenol</i>		87 %		30-130				
<i>Surrogate: Nitrobenzene-d5</i>		97 %		30-130				
<i>Surrogate: Phenol-d6</i>		91 %		30-130				
<i>Surrogate: p-Terphenyl-d14</i>		84 %		30-130				



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-6 6ft-8ft
Date Sampled: 02/16/16 13:00
Percent Solids: 89

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-03
Sample Matrix: Soil

Classical Chemistry

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>Units</u>	<u>Batch</u>
Conductivity	WL 169 (5)		9050A		1	MJV	02/18/16 9:30	umhos/cm	CB61804
Corrosivity (pH)	H 7.66 (N/A)		9045		1	JLK	02/17/16 21:33	S.U.	CB61746
Corrosivity (pH) Sample Temp	Soil pH measured in water at 19.2 °C.								
Eh (ORP)	H, WL 328 (N/A)		2580		1	JLK	02/17/16 21:33	mv	CB61747
Flashpoint	> 200 (N/A)		1010		1	EEM	02/19/16 15:45	°F	CB61914
Reactive Cyanide	ND (2.0)		7.3.3.2		1	JLK	02/19/16 12:00	mg/kg	CB61916
Reactive Sulfide	ND (2.0)		7.3.4.1		1	JLK	02/19/16 12:00	mg/kg	CB61916



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-6 15ft-17ft
Date Sampled: 02/16/16 13:20
Percent Solids: 88

ESS Laboratory Work Order: 1602379
ESS Laboratory Sample ID: 1602379-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>I/V</u>	<u>F/V</u>	<u>Batch</u>
Arsenic	5.42 (2.48)		6010C		1	BJV	02/23/16 4:36	2.29	100	CB62202
Barium	31.5 (2.48)		6010C		1	BJV	02/23/16 4:36	2.29	100	CB62202
Cadmium	ND (0.50)		6010C		1	BJV	02/23/16 4:36	2.29	100	CB62202
Chromium	38.3 (0.99)		6010C		1	BJV	02/23/16 4:36	2.29	100	CB62202
Lead	5.16 (4.96)		6010C		1	BJV	02/23/16 4:36	2.29	100	CB62202
Mercury	ND (0.035)		7471B		1	PJP	02/23/16 12:55	0.65	40	CB62205
Selenium	ND (0.60)		6020A		50	NAR	02/23/16 22:17	2.29	100	CB62202
Silver	ND (0.50)		6010C		1	BJV	02/23/16 4:36	2.29	100	CB62202



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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Total Metals

Batch CB62202 - 3050B

Blank

Arsenic	ND	2.50	mg/kg wet
Barium	ND	2.50	mg/kg wet
Cadmium	ND	0.50	mg/kg wet
Chromium	ND	1.00	mg/kg wet
Lead	ND	5.00	mg/kg wet
Selenium	ND	0.50	mg/kg wet
Selenium	ND	0.60	mg/kg wet
Silver	ND	0.50	mg/kg wet

LCS

Arsenic	156	8.06	mg/kg wet	161.0	97	80-120
Barium	277	8.06	mg/kg wet	351.0	79	74-126
Cadmium	165	1.61	mg/kg wet	190.0	87	80-120
Chromium	79.3	3.23	mg/kg wet	87.90	90	80-120
Lead	124	16.1	mg/kg wet	138.0	90	80-120
Selenium	270	1.94	mg/kg wet	305.0	89	80-120
Selenium	334	40.3	mg/kg wet	305.0	109	80-120
Silver	54.1	1.61	mg/kg wet	58.00	93	80-120

LCS Dup

Arsenic	167	8.33	mg/kg wet	161.0	104	80-120	7	20	
Barium	370	8.33	mg/kg wet	351.0	105	80-120	29	20	D+
Cadmium	178	1.67	mg/kg wet	190.0	94	80-120	8	20	
Chromium	85.4	3.33	mg/kg wet	87.90	97	80-120	7	20	
Lead	136	16.7	mg/kg wet	138.0	99	80-120	10	20	
Selenium	364	41.7	mg/kg wet	305.0	119	80-120	9	20	
Selenium	299	2.00	mg/kg wet	305.0	98	80-120	10	30	
Silver	58.1	1.67	mg/kg wet	58.00	100	80-120	7	20	

Batch CB62205 - 7471B

Blank

Mercury	ND	0.033	mg/kg wet
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LCS

Mercury	16.3	1.60	mg/kg wet	15.90	103	80-120
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LCS Dup

Mercury	15.9	1.48	mg/kg wet	15.90	100	80-120	3	20
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

Blank

1,1,1,2-Tetrachloroethane	ND	0.100	mg/kg wet
1,1,1-Trichloroethane	ND	0.100	mg/kg wet
1,1,2,2-Tetrachloroethane	ND	0.100	mg/kg wet
1,1,2-Trichloroethane	ND	0.100	mg/kg wet



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

1,1-Dichloroethane	ND	0.100	mg/kg wet							
1,1-Dichloroethene	ND	0.100	mg/kg wet							
1,1-Dichloropropene	ND	0.100	mg/kg wet							
1,2,3-Trichlorobenzene	ND	0.100	mg/kg wet							
1,2,3-Trichloropropane	ND	0.100	mg/kg wet							
1,2,4-Trichlorobenzene	ND	0.100	mg/kg wet							
1,2,4-Trimethylbenzene	ND	0.100	mg/kg wet							
1,2-Dibromo-3-Chloropropane	ND	0.500	mg/kg wet							
1,2-Dibromoethane	ND	0.100	mg/kg wet							
1,2-Dichlorobenzene	ND	0.100	mg/kg wet							
1,2-Dichloroethane	ND	0.100	mg/kg wet							
1,2-Dichloropropane	ND	0.100	mg/kg wet							
1,3,5-Trimethylbenzene	ND	0.100	mg/kg wet							
1,3-Dichlorobenzene	ND	0.100	mg/kg wet							
1,3-Dichloropropane	ND	0.100	mg/kg wet							
1,4-Dichlorobenzene	ND	0.100	mg/kg wet							
1,4-Dioxane - Screen	ND	20.0	mg/kg wet							
2,2-Dichloropropane	ND	0.100	mg/kg wet							
2-Butanone	ND	0.500	mg/kg wet							
2-Chlorotoluene	ND	0.100	mg/kg wet							
2-Hexanone	ND	0.500	mg/kg wet							
4-Chlorotoluene	ND	0.100	mg/kg wet							
4-Isopropyltoluene	ND	0.100	mg/kg wet							
4-Methyl-2-Pentanone	ND	0.500	mg/kg wet							
Acetone	ND	0.500	mg/kg wet							
Benzene	ND	0.100	mg/kg wet							
Bromobenzene	ND	0.100	mg/kg wet							
Bromochloromethane	ND	0.100	mg/kg wet							
Bromodichloromethane	ND	0.100	mg/kg wet							
Bromoform	ND	0.100	mg/kg wet							
Bromomethane	ND	0.100	mg/kg wet							
Carbon Disulfide	ND	0.100	mg/kg wet							
Carbon Tetrachloride	ND	0.100	mg/kg wet							
Chlorobenzene	ND	0.100	mg/kg wet							
Chloroethane	ND	0.100	mg/kg wet							
Chloroform	ND	0.100	mg/kg wet							
Chloromethane	ND	0.100	mg/kg wet							
cis-1,2-Dichloroethene	ND	0.100	mg/kg wet							
cis-1,3-Dichloropropene	ND	0.100	mg/kg wet							
Dibromochloromethane	ND	0.100	mg/kg wet							
Dibromomethane	ND	0.100	mg/kg wet							
Dichlorodifluoromethane	ND	0.100	mg/kg wet							
Diethyl Ether	ND	0.100	mg/kg wet							
Di-isopropyl ether	ND	0.100	mg/kg wet							



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

Ethyl tertiary-butyl ether	ND	0.100	mg/kg wet							
Ethylbenzene	ND	0.100	mg/kg wet							
Hexachlorobutadiene	ND	0.100	mg/kg wet							
Isopropylbenzene	ND	0.100	mg/kg wet							
Methyl tert-Butyl Ether	ND	0.100	mg/kg wet							
Methylene Chloride	ND	0.200	mg/kg wet							
Naphthalene	ND	0.100	mg/kg wet							
n-Butylbenzene	ND	0.100	mg/kg wet							
n-Propylbenzene	ND	0.100	mg/kg wet							
sec-Butylbenzene	ND	0.100	mg/kg wet							
Styrene	ND	0.100	mg/kg wet							
tert-Butylbenzene	ND	0.100	mg/kg wet							
Tertiary-amyl methyl ether	ND	0.100	mg/kg wet							
Tetrachloroethene	ND	0.100	mg/kg wet							
Tetrahydrofuran	ND	0.500	mg/kg wet							
Toluene	ND	0.100	mg/kg wet							
trans-1,2-Dichloroethene	ND	0.100	mg/kg wet							
trans-1,3-Dichloropropene	ND	0.100	mg/kg wet							
Trichloroethene	ND	0.100	mg/kg wet							
Trichlorofluoromethane	ND	0.100	mg/kg wet							
Vinyl Chloride	ND	0.100	mg/kg wet							
Xylene O	ND	0.100	mg/kg wet							
Xylene P,M	ND	0.200	mg/kg wet							
Xylenes (Total)	ND	0.200	mg/kg							
Surrogate: 1,2-Dichloroethane-d4	4.44		mg/kg wet	5.000		89	70-130			
Surrogate: 4-Bromofluorobenzene	5.23		mg/kg wet	5.000		105	70-130			
Surrogate: Dibromofluoromethane	5.12		mg/kg wet	5.000		102	70-130			
Surrogate: Toluene-d8	5.46		mg/kg wet	5.000		109	70-130			

LCS

1,1,1,2-Tetrachloroethane	2.02	0.200	mg/kg wet	2.000		101	70-130			
1,1,1-Trichloroethane	1.93	0.200	mg/kg wet	2.000		97	70-130			
1,1,2,2-Tetrachloroethane	1.71	0.200	mg/kg wet	2.000		85	70-130			
1,1,2-Trichloroethane	1.97	0.200	mg/kg wet	2.000		98	70-130			
1,1-Dichloroethane	1.93	0.200	mg/kg wet	2.000		96	70-130			
1,1-Dichloroethene	2.07	0.200	mg/kg wet	2.000		104	70-130			
1,1-Dichloropropene	2.09	0.200	mg/kg wet	2.000		105	70-130			
1,2,3-Trichlorobenzene	2.08	0.200	mg/kg wet	2.000		104	70-130			
1,2,3-Trichloropropane	1.46	0.200	mg/kg wet	2.000		73	70-130			
1,2,4-Trichlorobenzene	2.10	0.200	mg/kg wet	2.000		105	70-130			
1,2,4-Trimethylbenzene	1.66	0.200	mg/kg wet	2.000		83	70-130			
1,2-Dibromo-3-Chloropropane	2.17	1.00	mg/kg wet	2.000		108	70-130			
1,2-Dibromoethane	2.09	0.200	mg/kg wet	2.000		105	70-130			
1,2-Dichlorobenzene	2.22	0.200	mg/kg wet	2.000		111	70-130			
1,2-Dichloroethane	1.96	0.200	mg/kg wet	2.000		98	70-130			



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

1,2-Dichloropropane	2.02	0.200	mg/kg wet	2.000		101	70-130			
1,3,5-Trimethylbenzene	1.52	0.200	mg/kg wet	2.000		76	70-130			
1,3-Dichlorobenzene	2.12	0.200	mg/kg wet	2.000		106	70-130			
1,3-Dichloropropane	2.14	0.200	mg/kg wet	2.000		107	70-130			
1,4-Dichlorobenzene	2.12	0.200	mg/kg wet	2.000		106	70-130			
1,4-Dioxane - Screen	86.4	40.0	mg/kg wet	40.00		216	44-241			
2,2-Dichloropropane	1.75	0.200	mg/kg wet	2.000		87	70-130			
2-Butanone	9.58	1.00	mg/kg wet	10.00		96	70-130			
2-Chlorotoluene	1.57	0.200	mg/kg wet	2.000		78	70-130			
2-Hexanone	9.20	1.00	mg/kg wet	10.00		92	70-130			
4-Chlorotoluene	1.55	0.200	mg/kg wet	2.000		78	70-130			
4-Isopropyltoluene	2.10	0.200	mg/kg wet	2.000		105	70-130			
4-Methyl-2-Pentanone	9.46	1.00	mg/kg wet	10.00		95	70-130			
Acetone	8.72	1.00	mg/kg wet	10.00		87	70-130			
Benzene	2.05	0.200	mg/kg wet	2.000		103	70-130			
Bromobenzene	1.65	0.200	mg/kg wet	2.000		82	70-130			
Bromochloromethane	2.09	0.200	mg/kg wet	2.000		105	70-130			
Bromodichloromethane	2.02	0.200	mg/kg wet	2.000		101	70-130			
Bromoform	1.90	0.200	mg/kg wet	2.000		95	70-130			
Bromomethane	1.63	0.200	mg/kg wet	2.000		82	70-130			
Carbon Disulfide	1.81	0.200	mg/kg wet	2.000		90	70-130			
Carbon Tetrachloride	1.88	0.200	mg/kg wet	2.000		94	70-130			
Chlorobenzene	2.06	0.200	mg/kg wet	2.000		103	70-130			
Chloroethane	1.55	0.200	mg/kg wet	2.000		77	70-130			
Chloroform	1.88	0.200	mg/kg wet	2.000		94	70-130			
Chloromethane	1.80	0.200	mg/kg wet	2.000		90	70-130			
cis-1,2-Dichloroethene	2.09	0.200	mg/kg wet	2.000		105	70-130			
cis-1,3-Dichloropropene	1.90	0.200	mg/kg wet	2.000		95	70-130			
Dibromochloromethane	2.09	0.200	mg/kg wet	2.000		104	70-130			
Dibromomethane	2.04	0.200	mg/kg wet	2.000		102	70-130			
Dichlorodifluoromethane	1.61	0.200	mg/kg wet	2.000		81	70-130			
Diethyl Ether	1.99	0.200	mg/kg wet	2.000		100	70-130			
Di-isopropyl ether	1.89	0.200	mg/kg wet	2.000		94	70-130			
Ethyl tertiary-butyl ether	1.91	0.200	mg/kg wet	2.000		96	70-130			
Ethylbenzene	1.94	0.200	mg/kg wet	2.000		97	70-130			
Hexachlorobutadiene	2.08	0.200	mg/kg wet	2.000		104	70-130			
Isopropylbenzene	1.64	0.200	mg/kg wet	2.000		82	70-130			
Methyl tert-Butyl Ether	1.98	0.200	mg/kg wet	2.000		99	70-130			
Methylene Chloride	2.01	0.400	mg/kg wet	2.000		100	70-130			
Naphthalene	2.23	0.200	mg/kg wet	2.000		111	70-130			
n-Butylbenzene	2.48	0.200	mg/kg wet	2.000		124	70-130			
n-Propylbenzene	1.61	0.200	mg/kg wet	2.000		80	70-130			
sec-Butylbenzene	2.18	0.200	mg/kg wet	2.000		109	70-130			
Styrene	1.92	0.200	mg/kg wet	2.000		96	70-130			



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

tert-Butylbenzene	1.95	0.200	mg/kg wet	2.000		98	70-130			
Tertiary-amyl methyl ether	2.01	0.200	mg/kg wet	2.000		100	70-130			
Tetrachloroethene	2.03	0.200	mg/kg wet	2.000		101	70-130			
Tetrahydrofuran	1.82	1.00	mg/kg wet	2.000		91	70-130			
Toluene	1.72	0.200	mg/kg wet	2.000		86	70-130			
trans-1,2-Dichloroethene	2.18	0.200	mg/kg wet	2.000		109	70-130			
trans-1,3-Dichloropropene	1.91	0.200	mg/kg wet	2.000		95	70-130			
Trichloroethene	2.07	0.200	mg/kg wet	2.000		103	70-130			
Trichlorofluoromethane	1.41	0.200	mg/kg wet	2.000		70	70-130			
Vinyl Chloride	1.90	0.200	mg/kg wet	2.000		95	70-130			
Xylene O	2.05	0.200	mg/kg wet	2.000		103	70-130			
Xylene P,M	3.96	0.400	mg/kg wet	4.000		99	70-130			
Xylenes (Total)	6.01	0.400	mg/kg							
Surrogate: 1,2-Dichloroethane-d4	4.97		mg/kg wet	5.000		99	70-130			
Surrogate: 4-Bromofluorobenzene	5.28		mg/kg wet	5.000		106	70-130			
Surrogate: Dibromofluoromethane	5.17		mg/kg wet	5.000		103	70-130			
Surrogate: Toluene-d8	5.21		mg/kg wet	5.000		104	70-130			

LCS Dup

1,1,1,2-Tetrachloroethane	1.85	0.200	mg/kg wet	2.000		93	70-130	8	25	
1,1,1-Trichloroethane	1.84	0.200	mg/kg wet	2.000		92	70-130	5	25	
1,1,2,2-Tetrachloroethane	2.23	0.200	mg/kg wet	2.000		112	70-130	27	25	D+
1,1,2-Trichloroethane	2.21	0.200	mg/kg wet	2.000		111	70-130	12	25	
1,1-Dichloroethane	2.07	0.200	mg/kg wet	2.000		104	70-130	7	25	
1,1-Dichloroethene	2.27	0.200	mg/kg wet	2.000		114	70-130	9	25	
1,1-Dichloropropene	2.11	0.200	mg/kg wet	2.000		105	70-130	0.6	25	
1,2,3-Trichlorobenzene	1.90	0.200	mg/kg wet	2.000		95	70-130	9	25	
1,2,3-Trichloropropane	2.11	0.200	mg/kg wet	2.000		106	70-130	36	25	D+
1,2,4-Trichlorobenzene	1.86	0.200	mg/kg wet	2.000		93	70-130	12	25	
1,2,4-Trimethylbenzene	2.01	0.200	mg/kg wet	2.000		100	70-130	19	25	
1,2-Dibromo-3-Chloropropane	1.90	1.00	mg/kg wet	2.000		95	70-130	13	25	
1,2-Dibromoethane	2.02	0.200	mg/kg wet	2.000		101	70-130	3	25	
1,2-Dichlorobenzene	2.07	0.200	mg/kg wet	2.000		104	70-130	7	25	
1,2-Dichloroethane	1.92	0.200	mg/kg wet	2.000		96	70-130	2	25	
1,2-Dichloropropane	2.18	0.200	mg/kg wet	2.000		109	70-130	8	25	
1,3,5-Trimethylbenzene	2.05	0.200	mg/kg wet	2.000		103	70-130	30	25	D+
1,3-Dichlorobenzene	2.08	0.200	mg/kg wet	2.000		104	70-130	2	25	
1,3-Dichloropropane	2.18	0.200	mg/kg wet	2.000		109	70-130	2	25	
1,4-Dichlorobenzene	2.12	0.200	mg/kg wet	2.000		106	70-130	0.4	25	
1,4-Dioxane - Screen	77.3	40.0	mg/kg wet	40.00		193	44-241	11	200	
2,2-Dichloropropane	1.81	0.200	mg/kg wet	2.000		90	70-130	3	25	
2-Butanone	10.3	1.00	mg/kg wet	10.00		103	70-130	8	25	
2-Chlorotoluene	2.13	0.200	mg/kg wet	2.000		106	70-130	30	25	D+
2-Hexanone	9.81	1.00	mg/kg wet	10.00		98	70-130	6	25	
4-Chlorotoluene	2.08	0.200	mg/kg wet	2.000		104	70-130	29	25	D+



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

4-Isopropyltoluene	1.92	0.200	mg/kg wet	2.000		96	70-130	9	25	
4-Methyl-2-Pentanone	10.3	1.00	mg/kg wet	10.00		103	70-130	8	25	
Acetone	9.48	1.00	mg/kg wet	10.00		95	70-130	8	25	
Benzene	2.19	0.200	mg/kg wet	2.000		110	70-130	6	25	
Bromobenzene	2.07	0.200	mg/kg wet	2.000		104	70-130	23	25	
Bromochloromethane	2.02	0.200	mg/kg wet	2.000		101	70-130	3	25	
Bromodichloromethane	2.01	0.200	mg/kg wet	2.000		100	70-130	0.3	25	
Bromoform	1.78	0.200	mg/kg wet	2.000		89	70-130	7	25	
Bromomethane	1.40	0.200	mg/kg wet	2.000		70	70-130	15	25	
Carbon Disulfide	2.15	0.200	mg/kg wet	2.000		108	70-130	17	25	
Carbon Tetrachloride	1.74	0.200	mg/kg wet	2.000		87	70-130	7	25	
Chlorobenzene	2.06	0.200	mg/kg wet	2.000		103	70-130	0.2	25	
Chloroethane	1.53	0.200	mg/kg wet	2.000		77	70-130	0.8	25	
Chloroform	1.93	0.200	mg/kg wet	2.000		97	70-130	3	25	
Chloromethane	1.51	0.200	mg/kg wet	2.000		75	70-130	17	25	
cis-1,2-Dichloroethene	2.24	0.200	mg/kg wet	2.000		112	70-130	7	25	
cis-1,3-Dichloropropene	2.04	0.200	mg/kg wet	2.000		102	70-130	7	25	
Dibromochloromethane	1.92	0.200	mg/kg wet	2.000		96	70-130	8	25	
Dibromomethane	2.10	0.200	mg/kg wet	2.000		105	70-130	3	25	
Dichlorodifluoromethane	1.81	0.200	mg/kg wet	2.000		91	70-130	12	25	
Diethyl Ether	2.14	0.200	mg/kg wet	2.000		107	70-130	7	25	
Di-isopropyl ether	2.01	0.200	mg/kg wet	2.000		100	70-130	6	25	
Ethyl tertiary-butyl ether	2.05	0.200	mg/kg wet	2.000		103	70-130	7	25	
Ethylbenzene	1.99	0.200	mg/kg wet	2.000		99	70-130	2	25	
Hexachlorobutadiene	2.04	0.200	mg/kg wet	2.000		102	70-130	2	25	
Isopropylbenzene	2.13	0.200	mg/kg wet	2.000		106	70-130	26	25	D+
Methyl tert-Butyl Ether	2.00	0.200	mg/kg wet	2.000		100	70-130	1	25	
Methylene Chloride	2.38	0.400	mg/kg wet	2.000		119	70-130	17	25	
Naphthalene	1.99	0.200	mg/kg wet	2.000		99	70-130	11	25	
n-Butylbenzene	2.16	0.200	mg/kg wet	2.000		108	70-130	14	25	
n-Propylbenzene	2.22	0.200	mg/kg wet	2.000		111	70-130	32	25	D+
sec-Butylbenzene	2.23	0.200	mg/kg wet	2.000		111	70-130	2	25	
Styrene	2.01	0.200	mg/kg wet	2.000		101	70-130	5	25	
tert-Butylbenzene	2.15	0.200	mg/kg wet	2.000		107	70-130	9	25	
Tertiary-amyl methyl ether	2.06	0.200	mg/kg wet	2.000		103	70-130	3	25	
Tetrachloroethene	1.99	0.200	mg/kg wet	2.000		99	70-130	2	25	
Tetrahydrofuran	2.08	1.00	mg/kg wet	2.000		104	70-130	13	25	
Toluene	1.83	0.200	mg/kg wet	2.000		92	70-130	6	25	
trans-1,2-Dichloroethene	2.30	0.200	mg/kg wet	2.000		115	70-130	6	25	
trans-1,3-Dichloropropene	1.97	0.200	mg/kg wet	2.000		98	70-130	3	25	
Trichloroethene	2.09	0.200	mg/kg wet	2.000		105	70-130	1	25	
Trichlorofluoromethane	1.46	0.200	mg/kg wet	2.000		73	70-130	3	25	
Vinyl Chloride	1.51	0.200	mg/kg wet	2.000		75	70-130	23	25	
Xylene O	2.07	0.200	mg/kg wet	2.000		104	70-130	1	25	



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
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ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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5035/8260B Volatile Organic Compounds / Methanol

Batch CB61939 - 5035

Xylene P,M	4.15	0.400	mg/kg wet	4.000		104	70-130	5	25	
Xylenes (Total)	6.22	0.400	mg/kg							
Surrogate: 1,2-Dichloroethane-d4	4.86		mg/kg wet	5.000		97	70-130			
Surrogate: 4-Bromofluorobenzene	5.27		mg/kg wet	5.000		105	70-130			
Surrogate: Dibromofluoromethane	5.14		mg/kg wet	5.000		103	70-130			
Surrogate: Toluene-d8	5.37		mg/kg wet	5.000		107	70-130			

8082A Polychlorinated Biphenyls (PCB)

Batch CB61809 - 3540C

Blank										
Aroclor 1016	ND	0.0500	mg/kg wet							
Aroclor 1221	ND	0.0500	mg/kg wet							
Aroclor 1232	ND	0.0500	mg/kg wet							
Aroclor 1242	ND	0.0500	mg/kg wet							
Aroclor 1248	ND	0.0500	mg/kg wet							
Aroclor 1254	ND	0.0500	mg/kg wet							
Aroclor 1260	ND	0.0500	mg/kg wet							
Aroclor 1262	ND	0.0500	mg/kg wet							
Aroclor 1268	ND	0.0500	mg/kg wet							

Surrogate: Decachlorobiphenyl	0.0187		mg/kg wet	0.02500		75	30-150			
Surrogate: Decachlorobiphenyl [2C]	0.0197		mg/kg wet	0.02500		79	30-150			
Surrogate: Tetrachloro-m-xylene	0.0199		mg/kg wet	0.02500		80	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	0.0173		mg/kg wet	0.02500		69	30-150			

LCS										
Aroclor 1016	0.433	0.0500	mg/kg wet	0.5000		87	40-140			
Aroclor 1260	0.462	0.0500	mg/kg wet	0.5000		92	40-140			

Surrogate: Decachlorobiphenyl	0.0212		mg/kg wet	0.02500		85	30-150			
Surrogate: Decachlorobiphenyl [2C]	0.0226		mg/kg wet	0.02500		90	30-150			
Surrogate: Tetrachloro-m-xylene	0.0206		mg/kg wet	0.02500		82	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	0.0198		mg/kg wet	0.02500		79	30-150			

LCS Dup										
Aroclor 1016	0.427	0.0500	mg/kg wet	0.5000		85	40-140	1	30	
Aroclor 1260	0.447	0.0500	mg/kg wet	0.5000		89	40-140	3	30	

Surrogate: Decachlorobiphenyl	0.0208		mg/kg wet	0.02500		83	30-150			
Surrogate: Decachlorobiphenyl [2C]	0.0222		mg/kg wet	0.02500		89	30-150			
Surrogate: Tetrachloro-m-xylene	0.0205		mg/kg wet	0.02500		82	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	0.0196		mg/kg wet	0.02500		78	30-150			

Batch CB62327 - 3540C

Blank										
Aroclor 1016	ND	0.0500	mg/kg wet							
Aroclor 1221	ND	0.0500	mg/kg wet							



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
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ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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8082A Polychlorinated Biphenyls (PCB)

Batch CB62327 - 3540C

Aroclor 1232	ND	0.0500	mg/kg wet							
Aroclor 1242	ND	0.0500	mg/kg wet							
Aroclor 1248	ND	0.0500	mg/kg wet							
Aroclor 1254	ND	0.0500	mg/kg wet							
Aroclor 1260	ND	0.0500	mg/kg wet							
Aroclor 1262	ND	0.0500	mg/kg wet							
Aroclor 1268	ND	0.0500	mg/kg wet							

Surrogate: Decachlorobiphenyl	0.0210		mg/kg wet	0.02500		84	30-150			
Surrogate: Decachlorobiphenyl [2C]	0.0206		mg/kg wet	0.02500		82	30-150			
Surrogate: Tetrachloro-m-xylene	0.0211		mg/kg wet	0.02500		85	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	0.0192		mg/kg wet	0.02500		77	30-150			

LCS

Aroclor 1016	0.444	0.0500	mg/kg wet	0.5000		89	40-140			
Aroclor 1260	0.443	0.0500	mg/kg wet	0.5000		89	40-140			

Surrogate: Decachlorobiphenyl	0.0217		mg/kg wet	0.02500		87	30-150			
Surrogate: Decachlorobiphenyl [2C]	0.0218		mg/kg wet	0.02500		87	30-150			
Surrogate: Tetrachloro-m-xylene	0.0215		mg/kg wet	0.02500		86	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	0.0206		mg/kg wet	0.02500		82	30-150			

LCS Dup

Aroclor 1016	0.430	0.0500	mg/kg wet	0.5000		86	40-140	3	30	
Aroclor 1260	0.434	0.0500	mg/kg wet	0.5000		87	40-140	2	30	

Surrogate: Decachlorobiphenyl	0.0215		mg/kg wet	0.02500		86	30-150			
Surrogate: Decachlorobiphenyl [2C]	0.0213		mg/kg wet	0.02500		85	30-150			
Surrogate: Tetrachloro-m-xylene	0.0211		mg/kg wet	0.02500		84	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	0.0200		mg/kg wet	0.02500		80	30-150			

8100M Total Petroleum Hydrocarbons

Batch CB61712 - 3546

Blank

Decane (C10)	ND	0.2	mg/kg wet							
Docosane (C22)	ND	0.2	mg/kg wet							
Dodecane (C12)	ND	0.2	mg/kg wet							
Eicosane (C20)	ND	0.2	mg/kg wet							
Hexacosane (C26)	ND	0.2	mg/kg wet							
Hexadecane (C16)	ND	0.2	mg/kg wet							
Hexatriacontane (C36)	ND	0.2	mg/kg wet							
Nonadecane (C19)	ND	0.2	mg/kg wet							
Nonane (C9)	ND	0.2	mg/kg wet							
Octacosane (C28)	ND	0.2	mg/kg wet							
Octadecane (C18)	ND	0.2	mg/kg wet							
Tetracosane (C24)	ND	0.2	mg/kg wet							



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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8100M Total Petroleum Hydrocarbons

Batch CB61712 - 3546

Tetradecane (C14)	ND	0.2	mg/kg wet							
Total Petroleum Hydrocarbons	ND	10.0	mg/kg wet							
Triacotane (C30)	ND	0.2	mg/kg wet							

<i>Surrogate: O-Terphenyl</i>	<i>4.03</i>		mg/kg wet	<i>5.000</i>		<i>81</i>	<i>40-140</i>			
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LCS

Decane (C10)	1.7	0.2	mg/kg wet	2.500		66	40-140			
Docosane (C22)	1.9	0.2	mg/kg wet	2.500		74	40-140			
Dodecane (C12)	1.8	0.2	mg/kg wet	2.500		73	40-140			
Eicosane (C20)	1.9	0.2	mg/kg wet	2.500		75	40-140			
Hexacosane (C26)	1.9	0.2	mg/kg wet	2.500		74	40-140			
Hexadecane (C16)	1.9	0.2	mg/kg wet	2.500		75	40-140			
Hexatriacontane (C36)	1.8	0.2	mg/kg wet	2.500		71	40-140			
Nonadecane (C19)	1.8	0.2	mg/kg wet	2.500		71	40-140			
Nonane (C9)	1.5	0.2	mg/kg wet	2.500		59	30-140			
Octacosane (C28)	1.8	0.2	mg/kg wet	2.500		72	40-140			
Octadecane (C18)	1.8	0.2	mg/kg wet	2.500		73	40-140			
Tetracosane (C24)	1.7	0.2	mg/kg wet	2.500		70	40-140			
Tetradecane (C14)	1.8	0.2	mg/kg wet	2.500		74	40-140			
Total Petroleum Hydrocarbons	22.9	10.0	mg/kg wet	35.00		65	40-140			
Triacotane (C30)	1.8	0.2	mg/kg wet	2.500		73	40-140			

<i>Surrogate: O-Terphenyl</i>	<i>3.58</i>		mg/kg wet	<i>5.000</i>		<i>72</i>	<i>40-140</i>			
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LCS Dup

Decane (C10)	1.7	0.2	mg/kg wet	2.500		68	40-140	3	25	
Docosane (C22)	2.0	0.2	mg/kg wet	2.500		80	40-140	8	25	
Dodecane (C12)	1.9	0.2	mg/kg wet	2.500		77	40-140	5	25	
Eicosane (C20)	2.0	0.2	mg/kg wet	2.500		81	40-140	8	25	
Hexacosane (C26)	2.0	0.2	mg/kg wet	2.500		80	40-140	7	25	
Hexadecane (C16)	2.0	0.2	mg/kg wet	2.500		82	40-140	8	25	
Hexatriacontane (C36)	1.9	0.2	mg/kg wet	2.500		76	40-140	7	25	
Nonadecane (C19)	1.9	0.2	mg/kg wet	2.500		77	40-140	9	25	
Nonane (C9)	1.5	0.2	mg/kg wet	2.500		59	30-140	0.9	25	
Octacosane (C28)	1.9	0.2	mg/kg wet	2.500		78	40-140	7	25	
Octadecane (C18)	2.0	0.2	mg/kg wet	2.500		79	40-140	8	25	
Tetracosane (C24)	1.9	0.2	mg/kg wet	2.500		75	40-140	8	25	
Tetradecane (C14)	2.0	0.2	mg/kg wet	2.500		79	40-140	6	25	
Total Petroleum Hydrocarbons	24.2	10.0	mg/kg wet	35.00		69	40-140	6	25	
Triacotane (C30)	2.0	0.2	mg/kg wet	2.500		79	40-140	7	25	

<i>Surrogate: O-Terphenyl</i>	<i>3.80</i>		mg/kg wet	<i>5.000</i>		<i>76</i>	<i>40-140</i>			
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8270D Semi-Volatile Organic Compounds

Batch CB61714 - 3546



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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8270D Semi-Volatile Organic Compounds

Batch CB61714 - 3546

Blank

1,2,4-Trichlorobenzene	ND	0.333	mg/kg wet							
1,2-Dichlorobenzene	ND	0.333	mg/kg wet							
1,3-Dichlorobenzene	ND	0.333	mg/kg wet							
1,4-Dichlorobenzene	ND	0.167	mg/kg wet							
2,4,5-Trichlorophenol	ND	0.333	mg/kg wet							
2,4,6-Trichlorophenol	ND	0.333	mg/kg wet							
2,4-Dichlorophenol	ND	0.333	mg/kg wet							
2,4-Dimethylphenol	ND	0.333	mg/kg wet							
2,4-Dinitrophenol	ND	1.67	mg/kg wet							
2,4-Dinitrotoluene	ND	0.333	mg/kg wet							
2,6-Dinitrotoluene	ND	0.333	mg/kg wet							
2-Chloronaphthalene	ND	0.333	mg/kg wet							
2-Chlorophenol	ND	0.333	mg/kg wet							
2-Methylnaphthalene	ND	0.333	mg/kg wet							
2-Methylphenol	ND	0.333	mg/kg wet							
2-Nitrophenol	ND	0.333	mg/kg wet							
3,3'-Dichlorobenzidine	ND	0.667	mg/kg wet							
3+4-Methylphenol	ND	0.667	mg/kg wet							
4-Bromophenyl-phenylether	ND	0.333	mg/kg wet							
4-Chloroaniline	ND	0.667	mg/kg wet							
4-Nitrophenol	ND	1.67	mg/kg wet							
Acenaphthene	ND	0.333	mg/kg wet							
Acenaphthylene	ND	0.333	mg/kg wet							
Acetophenone	ND	0.667	mg/kg wet							
Aniline	ND	1.67	mg/kg wet							
Anthracene	ND	0.333	mg/kg wet							
Azobenzene	ND	0.333	mg/kg wet							
Benzo(a)anthracene	ND	0.333	mg/kg wet							
Benzo(a)pyrene	ND	0.167	mg/kg wet							
Benzo(b)fluoranthene	ND	0.333	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.333	mg/kg wet							
Benzo(k)fluoranthene	ND	0.333	mg/kg wet							
bis(2-Chloroethoxy)methane	ND	0.333	mg/kg wet							
bis(2-Chloroethyl)ether	ND	0.167	mg/kg wet							
bis(2-chloroisopropyl)Ether	ND	0.167	mg/kg wet							
bis(2-Ethylhexyl)phthalate	ND	0.333	mg/kg wet							
Butylbenzylphthalate	ND	0.333	mg/kg wet							
Chrysene	ND	0.167	mg/kg wet							
Dibenzo(a,h)Anthracene	ND	0.167	mg/kg wet							
Dibenzofuran	ND	0.333	mg/kg wet							
Diethylphthalate	ND	0.333	mg/kg wet							
Dimethylphthalate	ND	0.333	mg/kg wet							
Di-n-butylphthalate	ND	0.333	mg/kg wet							



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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8270D Semi-Volatile Organic Compounds

Batch CB61714 - 3546

Di-n-octylphthalate	ND	0.333	mg/kg wet							
Fluoranthene	ND	0.333	mg/kg wet							
Fluorene	ND	0.333	mg/kg wet							
Hexachlorobenzene	ND	0.167	mg/kg wet							
Hexachlorobutadiene	ND	0.333	mg/kg wet							
Hexachloroethane	ND	0.333	mg/kg wet							
Indeno(1,2,3-cd)Pyrene	ND	0.333	mg/kg wet							
Isophorone	ND	0.333	mg/kg wet							
Naphthalene	ND	0.333	mg/kg wet							
Nitrobenzene	ND	0.333	mg/kg wet							
N-Nitrosodimethylamine	ND	0.333	mg/kg wet							
Pentachlorophenol	ND	1.67	mg/kg wet							
Phenanthrene	ND	0.333	mg/kg wet							
Phenol	ND	0.333	mg/kg wet							
Pyrene	ND	0.333	mg/kg wet							
Surrogate: 1,2-Dichlorobenzene-d4	2.78		mg/kg wet	3.333		84	30-130			
Surrogate: 2,4,6-Tribromophenol	3.93		mg/kg wet	5.000		79	30-130			
Surrogate: 2-Chlorophenol-d4	4.30		mg/kg wet	5.000		86	30-130			
Surrogate: 2-Fluorobiphenyl	2.95		mg/kg wet	3.333		89	30-130			
Surrogate: 2-Fluorophenol	4.29		mg/kg wet	5.000		86	30-130			
Surrogate: Nitrobenzene-d5	3.13		mg/kg wet	3.333		94	30-130			
Surrogate: Phenol-d6	4.47		mg/kg wet	5.000		89	30-130			
Surrogate: p-Terphenyl-d14	4.00		mg/kg wet	3.333		120	30-130			

LCS

1,2,4-Trichlorobenzene	2.00	0.333	mg/kg wet	3.333		60	40-140			
1,2-Dichlorobenzene	1.93	0.333	mg/kg wet	3.333		58	40-140			
1,3-Dichlorobenzene	1.94	0.333	mg/kg wet	3.333		58	40-140			
1,4-Dichlorobenzene	1.92	0.167	mg/kg wet	3.333		58	40-140			
2,4,5-Trichlorophenol	2.27	0.333	mg/kg wet	3.333		68	30-130			
2,4,6-Trichlorophenol	2.09	0.333	mg/kg wet	3.333		63	30-130			
2,4-Dichlorophenol	2.08	0.333	mg/kg wet	3.333		62	30-130			
2,4-Dimethylphenol	2.24	0.333	mg/kg wet	3.333		67	30-130			
2,4-Dinitrophenol	2.16	1.67	mg/kg wet	3.333		65	30-130			
2,4-Dinitrotoluene	2.14	0.333	mg/kg wet	3.333		64	40-140			
2,6-Dinitrotoluene	2.13	0.333	mg/kg wet	3.333		64	40-140			
2-Chloronaphthalene	1.93	0.333	mg/kg wet	3.333		58	40-140			
2-Chlorophenol	2.01	0.333	mg/kg wet	3.333		60	30-130			
2-Methylnaphthalene	2.01	0.333	mg/kg wet	3.333		60	40-140			
2-Methylphenol	2.14	0.333	mg/kg wet	3.333		64	30-130			
2-Nitrophenol	1.99	0.333	mg/kg wet	3.333		60	30-130			
3,3'-Dichlorobenzidine	1.79	0.667	mg/kg wet	3.333		54	40-140			
3+4-Methylphenol	4.49	0.667	mg/kg wet	6.667		67	30-130			
4-Bromophenyl-phenylether	2.34	0.333	mg/kg wet	3.333		70	40-140			
4-Chloroaniline	1.68	0.667	mg/kg wet	3.333		50	40-140			



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch CB61714 - 3546										
4-Nitrophenol	2.17	1.67	mg/kg wet	3.333		65	30-130			
Acenaphthene	2.19	0.333	mg/kg wet	3.333		66	40-140			
Acenaphthylene	2.00	0.333	mg/kg wet	3.333		60	40-140			
Acetophenone	2.13	0.667	mg/kg wet	3.333		64	40-140			
Aniline	1.55	1.67	mg/kg wet	3.333		46	40-140			
Anthracene	2.43	0.333	mg/kg wet	3.333		73	40-140			
Azobenzene	2.38	0.333	mg/kg wet	3.333		71	40-140			
Benzo(a)anthracene	2.51	0.333	mg/kg wet	3.333		75	40-140			
Benzo(a)pyrene	2.56	0.167	mg/kg wet	3.333		77	40-140			
Benzo(b)fluoranthene	2.38	0.333	mg/kg wet	3.333		71	40-140			
Benzo(g,h,i)perylene	2.21	0.333	mg/kg wet	3.333		66	40-140			
Benzo(k)fluoranthene	2.79	0.333	mg/kg wet	3.333		84	40-140			
bis(2-Chloroethoxy)methane	2.17	0.333	mg/kg wet	3.333		65	40-140			
bis(2-Chloroethyl)ether	2.03	0.167	mg/kg wet	3.333		61	40-140			
bis(2-chloroisopropyl)Ether	1.99	0.167	mg/kg wet	3.333		60	40-140			
bis(2-Ethylhexyl)phthalate	2.62	0.333	mg/kg wet	3.333		79	40-140			
Butylbenzylphthalate	2.21	0.333	mg/kg wet	3.333		66	40-140			
Chrysene	2.46	0.167	mg/kg wet	3.333		74	40-140			
Dibenzo(a,h)Anthracene	2.12	0.167	mg/kg wet	3.333		63	40-140			
Dibenzofuran	2.09	0.333	mg/kg wet	3.333		63	40-140			
Diethylphthalate	2.39	0.333	mg/kg wet	3.333		72	40-140			
Dimethylphthalate	2.25	0.333	mg/kg wet	3.333		68	40-140			
Di-n-butylphthalate	2.24	0.333	mg/kg wet	3.333		67	40-140			
Di-n-octylphthalate	2.32	0.333	mg/kg wet	3.333		70	40-140			
Fluoranthene	2.47	0.333	mg/kg wet	3.333		74	40-140			
Fluorene	2.24	0.333	mg/kg wet	3.333		67	40-140			
Hexachlorobenzene	2.19	0.167	mg/kg wet	3.333		66	40-140			
Hexachlorobutadiene	1.99	0.333	mg/kg wet	3.333		60	40-140			
Hexachloroethane	1.93	0.333	mg/kg wet	3.333		58	40-140			
Indeno(1,2,3-cd)Pyrene	2.18	0.333	mg/kg wet	3.333		65	40-140			
Isophorone	2.17	0.333	mg/kg wet	3.333		65	40-140			
Naphthalene	2.04	0.333	mg/kg wet	3.333		61	40-140			
Nitrobenzene	2.17	0.333	mg/kg wet	3.333		65	40-140			
N-Nitrosodimethylamine	1.94	0.333	mg/kg wet	3.333		58	40-140			
Pentachlorophenol	2.73	1.67	mg/kg wet	3.333		82	30-130			
Phenanthrene	2.34	0.333	mg/kg wet	3.333		70	40-140			
Phenol	2.06	0.333	mg/kg wet	3.333		62	30-130			
Pyrene	2.50	0.333	mg/kg wet	3.333		75	40-140			
Surrogate: 1,2-Dichlorobenzene-d4	2.16		mg/kg wet	3.333		65	30-130			
Surrogate: 2,4,6-Tribromophenol	3.73		mg/kg wet	5.000		75	30-130			
Surrogate: 2-Chlorophenol-d4	3.41		mg/kg wet	5.000		68	30-130			
Surrogate: 2-Fluorobiphenyl	2.36		mg/kg wet	3.333		71	30-130			
Surrogate: 2-Fluorophenol	3.34		mg/kg wet	5.000		67	30-130			
Surrogate: Nitrobenzene-d5	2.54		mg/kg wet	3.333		76	30-130			



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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8270D Semi-Volatile Organic Compounds

Batch CB61714 - 3546

Surrogate: Phenol-d6	3.54		mg/kg wet	5.000		71	30-130			
Surrogate: p-Terphenyl-d14	2.92		mg/kg wet	3.333		88	30-130			

LCS Dup										
1,2,4-Trichlorobenzene	2.42	0.333	mg/kg wet	3.333		72	40-140	19	30	
1,2-Dichlorobenzene	2.34	0.333	mg/kg wet	3.333		70	40-140	19	30	
1,3-Dichlorobenzene	2.35	0.333	mg/kg wet	3.333		70	40-140	19	30	
1,4-Dichlorobenzene	2.33	0.167	mg/kg wet	3.333		70	40-140	19	30	
2,4,5-Trichlorophenol	2.86	0.333	mg/kg wet	3.333		86	30-130	23	30	
2,4,6-Trichlorophenol	2.60	0.333	mg/kg wet	3.333		78	30-130	22	30	
2,4-Dichlorophenol	2.48	0.333	mg/kg wet	3.333		74	30-130	18	30	
2,4-Dimethylphenol	2.65	0.333	mg/kg wet	3.333		80	30-130	17	30	
2,4-Dinitrophenol	2.73	1.67	mg/kg wet	3.333		82	30-130	24	30	
2,4-Dinitrotoluene	2.76	0.333	mg/kg wet	3.333		83	40-140	25	30	
2,6-Dinitrotoluene	2.74	0.333	mg/kg wet	3.333		82	40-140	25	30	
2-Chloronaphthalene	2.30	0.333	mg/kg wet	3.333		69	40-140	17	30	
2-Chlorophenol	2.49	0.333	mg/kg wet	3.333		75	30-130	21	30	
2-Methylnaphthalene	2.36	0.333	mg/kg wet	3.333		71	40-140	16	30	
2-Methylphenol	2.61	0.333	mg/kg wet	3.333		78	30-130	20	30	
2-Nitrophenol	2.52	0.333	mg/kg wet	3.333		76	30-130	23	30	
3,3'-Dichlorobenzidine	2.01	0.667	mg/kg wet	3.333		60	40-140	12	30	
3+4-Methylphenol	5.55	0.667	mg/kg wet	6.667		83	30-130	21	30	
4-Bromophenyl-phenylether	2.81	0.333	mg/kg wet	3.333		84	40-140	18	30	
4-Chloroaniline	1.90	0.667	mg/kg wet	3.333		57	40-140	12	30	
4-Nitrophenol	2.84	1.67	mg/kg wet	3.333		85	30-130	27	30	
Acenaphthene	2.64	0.333	mg/kg wet	3.333		79	40-140	19	30	
Acenaphthylene	2.42	0.333	mg/kg wet	3.333		73	40-140	19	30	
Acetophenone	2.57	0.667	mg/kg wet	3.333		77	40-140	19	30	
Aniline	1.86	1.67	mg/kg wet	3.333		56	40-140	19	30	
Anthracene	2.99	0.333	mg/kg wet	3.333		90	40-140	21	30	
Azobenzene	2.84	0.333	mg/kg wet	3.333		85	40-140	17	30	
Benzo(a)anthracene	2.98	0.333	mg/kg wet	3.333		89	40-140	17	30	
Benzo(a)pyrene	3.15	0.167	mg/kg wet	3.333		94	40-140	21	30	
Benzo(b)fluoranthene	3.03	0.333	mg/kg wet	3.333		91	40-140	24	30	
Benzo(g,h,i)perylene	2.85	0.333	mg/kg wet	3.333		86	40-140	25	30	
Benzo(k)fluoranthene	3.10	0.333	mg/kg wet	3.333		93	40-140	11	30	
bis(2-Chloroethoxy)methane	2.55	0.333	mg/kg wet	3.333		76	40-140	16	30	
bis(2-Chloroethyl)ether	2.46	0.167	mg/kg wet	3.333		74	40-140	19	30	
bis(2-chloroisopropyl)Ether	2.41	0.167	mg/kg wet	3.333		72	40-140	19	30	
bis(2-Ethylhexyl)phthalate	3.15	0.333	mg/kg wet	3.333		94	40-140	18	30	
Butylbenzylphthalate	2.68	0.333	mg/kg wet	3.333		81	40-140	19	30	
Chrysene	2.99	0.167	mg/kg wet	3.333		90	40-140	20	30	
Dibenzo(a,h)Anthracene	2.62	0.167	mg/kg wet	3.333		79	40-140	21	30	
Dibenzofuran	2.54	0.333	mg/kg wet	3.333		76	40-140	20	30	



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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8270D Semi-Volatile Organic Compounds

Batch CB61714 - 3546

Diethylphthalate	3.00	0.333	mg/kg wet	3.333		90	40-140	23	30	
Dimethylphthalate	2.79	0.333	mg/kg wet	3.333		84	40-140	22	30	
Di-n-butylphthalate	2.70	0.333	mg/kg wet	3.333		81	40-140	19	30	
Di-n-octylphthalate	2.82	0.333	mg/kg wet	3.333		84	40-140	19	30	
Fluoranthene	3.04	0.333	mg/kg wet	3.333		91	40-140	21	30	
Fluorene	2.78	0.333	mg/kg wet	3.333		83	40-140	22	30	
Hexachlorobenzene	2.67	0.167	mg/kg wet	3.333		80	40-140	20	30	
Hexachlorobutadiene	2.35	0.333	mg/kg wet	3.333		70	40-140	17	30	
Hexachloroethane	2.33	0.333	mg/kg wet	3.333		70	40-140	19	30	
Indeno(1,2,3-cd)Pyrene	2.63	0.333	mg/kg wet	3.333		79	40-140	19	30	
Isophorone	2.53	0.333	mg/kg wet	3.333		76	40-140	15	30	
Naphthalene	2.44	0.333	mg/kg wet	3.333		73	40-140	18	30	
Nitrobenzene	2.62	0.333	mg/kg wet	3.333		79	40-140	19	30	
N-Nitrosodimethylamine	2.19	0.333	mg/kg wet	3.333		66	40-140	12	30	
Pentachlorophenol	3.36	1.67	mg/kg wet	3.333		101	30-130	21	30	
Phenanthrene	2.85	0.333	mg/kg wet	3.333		86	40-140	20	30	
Phenol	2.59	0.333	mg/kg wet	3.333		78	30-130	23	30	
Pyrene	3.01	0.333	mg/kg wet	3.333		90	40-140	18	30	
Surrogate: 1,2-Dichlorobenzene-d4	2.54		mg/kg wet	3.333		76	30-130			
Surrogate: 2,4,6-Tribromophenol	4.41		mg/kg wet	5.000		88	30-130			
Surrogate: 2-Chlorophenol-d4	4.02		mg/kg wet	5.000		80	30-130			
Surrogate: 2-Fluorobiphenyl	2.72		mg/kg wet	3.333		82	30-130			
Surrogate: 2-Fluorophenol	3.99		mg/kg wet	5.000		80	30-130			
Surrogate: Nitrobenzene-d5	2.93		mg/kg wet	3.333		88	30-130			
Surrogate: Phenol-d6	4.17		mg/kg wet	5.000		83	30-130			
Surrogate: p-Terphenyl-d14	3.20		mg/kg wet	3.333		96	30-130			

Classical Chemistry

Batch CB61804 - General Preparation

Blank

Conductivity	ND	5	umhos/cm							
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LCS

Conductivity	1370		umhos/cm	1411		97	90-110			
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Batch CB61914 - General Preparation

Reference

Flashpoint	81		°F	81.00		100	97.9-102.1			
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Batch CB61916 - General Preparation

Blank

Reactive Cyanide	ND	2.0	mg/kg							
Reactive Sulfide	ND	2.0	mg/kg							

LCS

Reactive Cyanide	4.0	2.0	mg/kg	100.3		4	0.68-5.41			
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CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
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Classical Chemistry

Batch CB61916 - General Preparation

Reactive Sulfide	0.2	2.0	mg/kg	10.00		2	0-44			
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CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

Notes and Definitions

- Z-10a Soil pH measured in water at 19.6 °C.
- Z-10 Soil pH measured in water at 19.2 °C.
- WL Results obtained from a deionized water leach of the sample.
- U Analyte included in the analysis, but not detected
- H Estimated value. Sample hold times were exceeded (H).
- D+ Relative percent difference for duplicate is outside of criteria (D+).
- D Diluted.
- CD+ Continuing Calibration %Diff/Drift is above control limit (CD+).
- > Greater than.
- ND Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
- dry Sample results reported on a dry weight basis
- RPD Relative Percent Difference
- MDL Method Detection Limit
- MRL Method Reporting Limit
- LOD Limit of Detection
- LOQ Limit of Quantitation
- DL Detection Limit
- I/V Initial Volume
- F/V Final Volume
- § Subcontracted analysis; see attached report
- 1 Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
- 2 Range result excludes concentrations of target analytes eluting in that range.
- 3 Range result excludes the concentration of the C9-C10 aromatic range.
- Avg Results reported as a mathematical average.
- NR No Recovery
- [CALC] Calculated Analyte
- SUB Subcontracted analysis; see attached report



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602379

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
<http://www.health.ri.gov/find/labs/analytical/ESS.pdf>

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutOfStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
<http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/documents/AllLabs.xls>

Massachusetts Potable and Non Potable Water: M-RI002
<http://public.dep.state.ma.us/Labcert/Labcert.aspx>

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
<http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm>

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
<http://www.wadsworth.org/labcert/elap/comm.html>

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.depweb.state.pa.us/portal/server.pt/community/labs/13780/laboratory_accreditation_program/590095

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPBTB/MM

ESS Project ID: 1602379

Date Received: 2/17/2016

Shipped/Delivered Via: ESS Courier

Project Due Date: 2/24/2016

Days for Project: 5 Day

1. Air bill manifest present? Yes

Air No.: NA

6. Does COC match bottles? Yes

2. Were custody seals present? No

7. Is COC complete and correct? Yes

3. Is radiation count <100 CPM? Yes

8. Were samples received intact? Yes

4. Is a Cooler Present? Yes

Temp: 2.9 Iced with: Ice

9. Were labs informed about short holds & rushes? Yes / No / NA

5. Was COC signed and dated by client? Yes

10. Were any analyses received outside of hold time? Yes / No

11. Any Subcontracting needed? Yes / No

ESS Sample IDs: _____

Analysis: _____

TAT: _____

12. Were VOAs received? Yes / No

a. Air bubbles in aqueous VOAs? Yes / No

b. Does methanol cover soil completely? Yes / No / NA

13. Are the samples properly preserved? Yes / No

a. If metals preserved in SR: Date: _____ Time: _____ By: _____

b. Low Level VOAs brought to freezer: Date: _____ Time: _____ By: _____

Sample Receiving Notes:

Was there a need to contact the client? Yes / No

Who was contacted? _____ Date: _____ Time: _____ By: _____

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
01	9352	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
01	9359	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
01	9373	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
01	9374	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
02	9354	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	9355	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	9358	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
03	9371	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
03	9372	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
04	9357	Yes	NA	Yes	8 oz. Jar - Unpres	NP	

2nd Review

Are barcode labels on correct containers? Yes / No

Completed By: [Signature]

Date & Time: 2/17/16 1605

Reviewed By: [Signature]

Date & Time: 2/17/16 1731

ESS Laboratory

Division of Thielsch Engineering, Inc.

185 Frances Avenue, Cranston RI 02910-2211
 Tel. (401)461-7181 Fax (401)461-4486
 www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time Standard Other _____
 Regulatory State: MA RI CT NH NJ NY ME Other _____
 Is this project for any of the following: (please circle)
 MA-MCP Navy USACE CT DEP Other Reed St Lowell

ESS Lab # 1602379

Reporting Limits - RCS-1

Project # L-0704-2 Project Name Lowell Dog Park
 Proj. Location Reed St Dog Park, Lowell PO# _____
 City, State WORCESTER MA Zip 01608

Co. Name TIGHC & BOND
 Contact Person TREVOR POORE
 Address 44C MAIN ST
 Tel. 508-471-9616 email: JAPOOLE@TIGHEBOND.COM

ESS Lab ID	Date	Collection Time	Grab-G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis
1	2/16/16	1030	G	S	B-S 12-14"	1/6	4	Ac/V	8oz/4	RCS-1 WCS SUOCs TPH Conductivity Resistivity PH Inhibitor
2	2/16/16	1045	G	S	B-S 16'-18"	1/6	1	Ac	8oz	
3	2/16/16	1300	G	S	B-G 6'-8"	1/6	4	Ac/V	8oz/4	
4	2/16/16	1320	G	S	B-G 15'-17"	1/6	1	Ac	2oz	

Container Type: P-Poly G-Glass AG-Ambly Glass S-Sterile V-VOA
 Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter
 Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-
 Sampled by: TAP
 Comments: TCLP 20X per T.P. mkm 02/18/16 updated project name per M.A. mkm 2/29/16

Cooler Present <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Seals Intact <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No NA: _____ Cooler Temperature: <u>7.9</u>	Internal Use Only <input checked="" type="checkbox"/> Pickup <input type="checkbox"/> Technician	Received by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50 Relinquished by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50
Received by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50 Relinquished by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50	Received by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50 Relinquished by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50	Received by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50 Relinquished by: (Signature, Date & Time) <u>[Signature]</u> 2/16/16 17:50

ESS Laboratory

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CHAIN OF CUSTODY

Turn Time Standard Other _____
 Regulatory State: MA RI CT NH NJ NY ME Other _____
 Is this project for any of the following: (please circle)
 MA-MCP Navy USACE CT DEP Other _____

ESS Lab # 1602379

Reporting Limits - RCS-1

Electronic Deliverables Excel Access PDF

Project # L-0704-2 Project Name Zowell Dog Park
 Proj. Location Reed St Dog Park, Lowell PO# _____
 City, State WORCESTER MA Zip 01608
 email: JA.POOLE@tykeball.com

Co. Name TIGHC & BOND
 Contact Person TREVOR POORE
 Address 44C MAIN ST
 Tel. 508-471-9616

ESS Lab ID	Date	Collection Time	Grab-G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis
1	2/16/16	1030	G	S	B-S 12-14	1/6	4	Ac/V	8oz/4	RCS-1 WCS SUOCs TPH Conductivity Resistivity PH Inhibitor
2	2/16/16	1045	G	S	B-S 16-18	1/6	1	Ac	8oz	
3	2/16/16	1300	G	S	B-G 6-8	1/6	4	Ac/V	8oz/4	
4	2/16/16	1320	G	S	B-G 15-17	1/6	1	Ac	2oz	

Container Type: P-Poly G-Glass AG-Ambly Glass S-Sterile V-VOA
 Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter
 Cooler Present Yes No
 Seals Intact Yes No NA: _____
 Cooler Temperature: 7.9
 Relinquished by: (Signature, Date & Time) [Signature] 2/16/16
 Relinquished by: (Signature, Date & Time) [Signature] 1750

Internal Use Only
 M Pickup
 Comments: TAP

Received by: (Signature, Date & Time) [Signature] 2/17/16 17:50
 Relinquished by: (Signature, Date & Time) [Signature] 2/17/16

Received by: (Signature, Date & Time) [Signature] 2/17/16
 Relinquished by: (Signature, Date & Time) _____



CERTIFICATE OF ANALYSIS

Matt Abraham
 Tighe & Bond
 446 Main Street #23
 Worcester, MA 01608

RE: Reed Street Lowell (L-0704)
ESS Laboratory Work Order Number: 1602612

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
 Laboratory Director

REVIEWED
 By ESS Laboratory at 3:47 pm, Mar 10, 2016

Analytical Summary

The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with NELAC Standards, A2LA and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses

Microvision Laboratories, Inc. - Chelmsford, MA Coal/Wood Ash Determination



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

SAMPLE RECEIPT

The following samples were received on February 29, 2016 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has performed and reviewed all QA/QC Requirements and Performance Standards listed in each method. Holding times and preservation have also been reviewed. All CAM requirements have been achieved unless noted in the project narrative.

Each method has been set-up in the laboratory to reach required MCP standards. The methods for aqueous VOA and Soil Methanol VOA have known limitations for certain analytes. The regulatory standards may not be achieved due to these limitations. In addition, for all methods, matrix interferences, dilutions, and %Solids may elevate method reporting limits above regulatory standards. ESS Laboratory can provide, upon request, a Data Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Question I: All samples for EPH were analyzed for a subset of the required MCP list per the client's request.

<u>Lab Number</u>	<u>Sample Name</u>	<u>Matrix</u>	<u>Analysis</u>
1602612-01	B-5 12-14ft	Soil	§, 1311, 1311/6010C, EPH8270, MADEP-EPH



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

[Definitions of Quality Control Parameters](#)

[Semivolatile Organics Internal Standard Information](#)

[Semivolatile Organics Surrogate Information](#)

[Volatile Organics Internal Standard Information](#)

[Volatile Organics Surrogate Information](#)

[EPH and VPH Alkane Lists](#)



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

- 1010A - Flashpoint
- 6010C - ICP
- 6020A - ICP MS
- 7010 - Graphite Furnace
- 7196A - Hexavalent Chromium
- 7470A - Aqueous Mercury
- 7471B - Solid Mercury
- 8011 - EDB/DBCP/TCP
- 8015D - GRO/DRO
- 8081B - Pesticides
- 8082A - PCB
- 8100M - TPH
- 8151A - Herbicides
- 8260B - VOA
- 8270D - SVOA
- 8270D SIM - SVOA Low Level
- 9014 - Cyanide
- 9038 - Sulfate
- 9040C - Aqueous pH
- 9045D - Solid pH (Corrosivity)
- 9050A - Specific Conductance
- 9056A - Anions (IC)
- 9060A - TOC
- 9095B - Paint Filter
- MADEP 04-1.1 - EPH / VPH

Prep Methods

- 3005A - Aqueous ICP Digestion
- 3020A - Aqueous Graphite Furnace / ICP MS Digestion
- 3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
- 3060A - Solid Hexavalent Chromium Digestion
- 3510C - Separatory Funnel Extraction
- 3520C - Liquid / Liquid Extraction
- 3540C - Manual Soxhlet Extraction
- 3541 - Automated Soxhlet Extraction
- 3546 - Microwave Extraction
- 3580A - Waste Dilution
- 5030B - Aqueous Purge and Trap
- 5030C - Aqueous Purge and Trap
- 5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1602612-01**

Matrices: () Ground Water/Surface Water Soil/Sediment () Drinking Water () Air () Other: _____

CAM Protocol (check all that apply below):

- | | | | | | |
|---|--|---|---|---|--|
| <input type="checkbox"/> 8260 VOC
CAM II A | <input type="checkbox"/> 7470/7471 Hg
CAM III B | <input type="checkbox"/> MassDEP VPH
CAM IV A | <input type="checkbox"/> 8081 Pesticides
CAM V B | <input type="checkbox"/> 7196 Hex Cr
CAM VI B | <input type="checkbox"/> MassDEP APH
CAM IX A |
| <input type="checkbox"/> 8270 SVOC
CAM II B | <input type="checkbox"/> 7010 Metals
CAM III C | <input checked="" type="checkbox"/> MassDEP EPH
CAM IV B | <input type="checkbox"/> 8151 Herbicides
CAM V C | <input type="checkbox"/> 8330 Explosives
CAM VIII A | <input type="checkbox"/> TO-15 VOC
CAM IX B |
| <input type="checkbox"/> 6010 Metals
CAM III A | <input type="checkbox"/> 6020 Metals
CAM III D | <input type="checkbox"/> 8082 PCB
CAM V A | <input type="checkbox"/> 6860 Perchlorate
CAM VIII B | <input type="checkbox"/> 9014 Total Cyanide/PAC
CAM VI A | |

Affirmative responses to questions A through F are required for Presumptive Certainty'status

- | | | |
|---|---|--|
| A | Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times? | Yes <input checked="" type="checkbox"/> No () |
| B | Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed? | Yes <input checked="" type="checkbox"/> No () |
| C | Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances? | Yes <input checked="" type="checkbox"/> No () |
| D | Does the laboratory report comply with all the reporting requirements specified in the CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"? | Yes <input checked="" type="checkbox"/> No () |
| E | a. VPH, EPH, APH and TO-15 only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications). | Yes <input checked="" type="checkbox"/> No () |
| | b. APH and TO-15 Methods only: Was the complete analyte list reported for each method? | Yes () No () |
| F | Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)? | Yes <input checked="" type="checkbox"/> No () |

Responses to Questions G, H and I below are required for Presumptive Certainty'status

- | | | |
|---|--|--|
| G | Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocols(s)?
Data User Note: Data that achieve Presumptive Certainty'status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350. | Yes <input checked="" type="checkbox"/> No ()* |
| H | Were all QC performance standards specified in the CAM protocol(s) achieved? | Yes <input checked="" type="checkbox"/> No ()* |
| I | Were results reported for the complete analyte list specified in the selected CAM protocol(s)? | Yes () No <input checked="" type="checkbox"/> * |

*All negative responses must be addressed in an attached laboratory narrative.

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Signature: Laurel Stoddard
Printed Name: Laurel Stoddard

Date: March 10, 2016
Position: Laboratory Director



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12-14ft
Date Sampled: 02/16/16 00:00
Percent Solids: 74

ESS Laboratory Work Order: 1602612
ESS Laboratory Sample ID: 1602612-01
Sample Matrix: Soil
Units: mg/L

Extraction Method: 3005A TCLP

TCLP Extraction Date: 2/29/16 16:00

1311 TCLP Metals

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>TCLP Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>I/V</u>	<u>F/V</u>	<u>Batch</u>
Lead	3.38 (0.050)		1311/6010C		1	KJK	03/02/16 15:22	50	50	CC60104



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12-14ft
Date Sampled: 02/16/16 00:00

ESS Laboratory Work Order: 1602612
ESS Laboratory Sample ID: 1602612-01
Sample Matrix: Soil

Classical Chemistry

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>Units</u>	<u>Batch</u>
Coal/Wood Ash Determination	See Attached (N/A)								



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12-14ft
Date Sampled: 02/16/16 00:00
Percent Solids: 74
Initial Volume: 24.1
Final Volume: 2
Extraction Method: 3546

ESS Laboratory Work Order: 1602612
ESS Laboratory Sample ID: 1602612-01
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 2/29/16 18:35

MADEP-EPH Extractable Petroleum Hydrocarbons

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>Sequence</u>	<u>Batch</u>
C9-C18 Aliphatics1	ND (42.1)		MADEP-EPH		1	ZLC	03/03/16 15:13	CZC0028	CB62922
C19-C36 Aliphatics1	196 (42.1)		MADEP-EPH		1	ZLC	03/03/16 15:13	CZC0028	CB62922
C11-C22 Unadjusted Aromatics1	447 (42.1)		EPH8270		1	JXS	03/03/16 20:45	CZC0065	CB62922
C11-C22 Aromatics1,2	271 (42.1)		EPH8270			JXS	03/04/16 17:48		[CALC]

	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>
<i>Surrogate: 1-Chlorooctadecane</i>	59 %		40-140
<i>Surrogate: 2-Bromonaphthalene</i>	93 %		40-140
<i>Surrogate: 2-Fluorobiphenyl</i>	97 %		40-140
<i>Surrogate: O-Terphenyl</i>	66 %		40-140



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell
Client Sample ID: B-5 12-14ft
Date Sampled: 02/16/16 00:00
Percent Solids: 74
Initial Volume: 100
Final Volume: 2000
Extraction Method: 1311

ESS Laboratory Work Order: 1602612
ESS Laboratory Sample ID: 1602612-01
Sample Matrix: Soil
Units: °C
Analyst: LAB
Prepared: 2/29/16 16:00

TCLP Extraction by 1311

<u>Analyte</u>	<u>Results (MRL)</u>	<u>MDL</u>	<u>Method</u>	<u>Limit</u>	<u>DF</u>	<u>Analyst</u>	<u>Analyzed</u>	<u>Batch</u>
Temperature (Min C)	19.8 (N/A)		1311		1	LAB	03/01/16 9:51	CB62941
Temperature (Max C)	22.0 (N/A)		1311		1	LAB	03/01/16 9:51	CB62941
Temperature (Range)	Temperature is not within 23 +/-2 °C. (N/A)							



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
---------	--------	-----	-------	-------------	---------------	------	-------------	-----	-----------	-----------

1311 TCLP Metals

Batch CC60104 - 3005A_TCLP

Blank

Lead	ND	0.050	mg/L							
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LCS

Lead	0.473	0.050	mg/L	0.5000		95	80-120			
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LCS Dup

Lead	0.477	0.050	mg/L	0.5000		95	80-120	1	20	
------	-------	-------	------	--------	--	----	--------	---	----	--

MADEP-EPH Extractable Petroleum Hydrocarbons

Batch CB62922 - 3546

Blank

C19-C36 Aliphatics1	ND	15.0	mg/kg wet							
C9-C18 Aliphatics1	ND	15.0	mg/kg wet							
Decane (C10)	ND	0.5	mg/kg wet							
Docosane (C22)	ND	0.5	mg/kg wet							
Dodecane (C12)	ND	0.5	mg/kg wet							
Eicosane (C20)	ND	0.5	mg/kg wet							
Hexacosane (C26)	ND	0.5	mg/kg wet							
Hexadecane (C16)	ND	0.5	mg/kg wet							
Hexatriacontane (C36)	ND	0.5	mg/kg wet							
Nonadecane (C19)	ND	0.5	mg/kg wet							
Nonane (C9)	ND	0.5	mg/kg wet							
Octacosane (C28)	ND	0.5	mg/kg wet							
Octadecane (C18)	ND	0.5	mg/kg wet							
Tetracosane (C24)	ND	0.5	mg/kg wet							
Tetradecane (C14)	ND	0.5	mg/kg wet							
triacontane (C30)	ND	0.5	mg/kg wet							

<i>Surrogate: 1-Chlorooctadecane</i>	<i>1.51</i>		mg/kg wet	<i>2.000</i>		<i>76</i>	<i>40-140</i>			
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Blank

2-Methylnaphthalene	ND	0.20	mg/kg wet							
Acenaphthene	ND	0.40	mg/kg wet							
Acenaphthylene	ND	0.20	mg/kg wet							
Anthracene	ND	0.40	mg/kg wet							
Benzo(a)anthracene	ND	0.40	mg/kg wet							
Benzo(a)pyrene	ND	0.40	mg/kg wet							
Benzo(b)fluoranthene	ND	0.40	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.40	mg/kg wet							
Benzo(k)fluoranthene	ND	0.40	mg/kg wet							
C11-C22 Aromatics1,2	ND	15.0	mg/kg wet							
C11-C22 Unadjusted Aromatics1	ND	15.0	mg/kg wet							
Chrysene	ND	0.40	mg/kg wet							
Dibenzo(a,h)Anthracene	ND	0.20	mg/kg wet							
Fluoranthene	ND	0.40	mg/kg wet							
Fluorene	ND	0.40	mg/kg wet							



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
---------	--------	-----	-------	-------------	---------------	------	-------------	-----	-----------	-----------

MADEP-EPH Extractable Petroleum Hydrocarbons

Batch CB62922 - 3546

Indeno(1,2,3-cd)Pyrene	ND	0.40	mg/kg wet							
Naphthalene	ND	0.40	mg/kg wet							
Phenanthrene	ND	0.40	mg/kg wet							
Pyrene	ND	0.40	mg/kg wet							

Surrogate: 2-Bromonaphthalene	1.57		mg/kg wet	2.000		79	40-140			
Surrogate: 2-Fluorobiphenyl	1.60		mg/kg wet	2.000		80	40-140			
Surrogate: O-Terphenyl	1.61		mg/kg wet	2.000		80	40-140			

LCS

C19-C36 Aliphatics1	15.2	15.0	mg/kg wet	16.00		95	40-140			
C9-C18 Aliphatics1	10.8	15.0	mg/kg wet	12.00		90	40-140			
Decane (C10)	1.1	0.5	mg/kg wet	2.000		53	40-140			
Docosane (C22)	1.6	0.5	mg/kg wet	2.000		82	40-140			
Dodecane (C12)	1.2	0.5	mg/kg wet	2.000		58	40-140			
Eicosane (C20)	1.6	0.5	mg/kg wet	2.000		81	40-140			
Hexacosane (C26)	1.7	0.5	mg/kg wet	2.000		83	40-140			
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		74	40-140			
Hexatriacontane (C36)	1.3	0.5	mg/kg wet	2.000		63	40-140			
Nonadecane (C19)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Nonane (C9)	0.8	0.5	mg/kg wet	2.000		41	30-140			
Octacosane (C28)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Octadecane (C18)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Tetracosane (C24)	1.6	0.5	mg/kg wet	2.000		78	40-140			
Tetradecane (C14)	1.3	0.5	mg/kg wet	2.000		66	40-140			
Triacontane (C30)	1.5	0.5	mg/kg wet	2.000		77	40-140			

Surrogate: 1-Chlorooctadecane	1.51		mg/kg wet	2.000		76	40-140			
-------------------------------	------	--	-----------	-------	--	----	--------	--	--	--

LCS

2-Methylnaphthalene	1.68	0.20	mg/kg wet	2.000		84	40-140			
Acenaphthene	1.63	0.40	mg/kg wet	2.000		82	40-140			
Acenaphthylene	1.71	0.20	mg/kg wet	2.000		85	40-140			
Anthracene	1.73	0.40	mg/kg wet	2.000		87	40-140			
Benzo(a)anthracene	1.66	0.40	mg/kg wet	2.000		83	40-140			
Benzo(a)pyrene	1.69	0.40	mg/kg wet	2.000		85	40-140			
Benzo(b)fluoranthene	1.71	0.40	mg/kg wet	2.000		85	40-140			
Benzo(g,h,i)perylene	1.74	0.40	mg/kg wet	2.000		87	40-140			
Benzo(k)fluoranthene	1.75	0.40	mg/kg wet	2.000		88	40-140			
C11-C22 Aromatics1,2	ND	15.0	mg/kg wet							
C11-C22 Unadjusted Aromatics1	29.7	15.0	mg/kg wet	34.00		87	40-140			
Chrysene	1.73	0.40	mg/kg wet	2.000		87	40-140			
Dibenzo(a,h)Anthracene	1.67	0.20	mg/kg wet	2.000		84	40-140			
Fluoranthene	1.73	0.40	mg/kg wet	2.000		87	40-140			
Fluorene	1.70	0.40	mg/kg wet	2.000		85	40-140			
Indeno(1,2,3-cd)Pyrene	1.70	0.40	mg/kg wet	2.000		85	40-140			
Naphthalene	1.60	0.40	mg/kg wet	2.000		80	40-140			
Phenanthrene	1.78	0.40	mg/kg wet	2.000		89	40-140			



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB62922 - 3546										
Pyrene	1.75	0.40	mg/kg wet	2.000		88	40-140			
<i>Surrogate: 2-Bromonaphthalene</i>	1.63		mg/kg wet	2.000		82	40-140			
<i>Surrogate: 2-Fluorobiphenyl</i>	1.66		mg/kg wet	2.000		83	40-140			
<i>Surrogate: O-Terphenyl</i>	1.70		mg/kg wet	2.000		85	40-140			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS Dup										
C19-C36 Aliphatics1	15.3	15.0	mg/kg wet	16.00		96	40-140	0.7	25	
C9-C18 Aliphatics1	10.5	15.0	mg/kg wet	12.00		88	40-140	3	25	
Decane (C10)	1.0	0.5	mg/kg wet	2.000		52	40-140	1	25	
Docosane (C22)	1.7	0.5	mg/kg wet	2.000		85	40-140	3	25	
Dodecane (C12)	1.1	0.5	mg/kg wet	2.000		57	40-140	1	25	
Eicosane (C20)	1.7	0.5	mg/kg wet	2.000		84	40-140	3	25	
Hexacosane (C26)	1.7	0.5	mg/kg wet	2.000		86	40-140	4	25	
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		74	40-140	0.3	25	
Hexatriacontane (C36)	1.4	0.5	mg/kg wet	2.000		69	40-140	8	25	
Nonadecane (C19)	1.7	0.5	mg/kg wet	2.000		83	40-140	4	25	
Nonane (C9)	0.8	0.5	mg/kg wet	2.000		40	30-140	1	25	
Octacosane (C28)	1.6	0.5	mg/kg wet	2.000		82	40-140	4	25	
Octadecane (C18)	1.6	0.5	mg/kg wet	2.000		81	40-140	2	25	
Tetracosane (C24)	1.6	0.5	mg/kg wet	2.000		81	40-140	3	25	
Tetradecane (C14)	1.3	0.5	mg/kg wet	2.000		64	40-140	2	25	
Triacontane (C30)	1.6	0.5	mg/kg wet	2.000		81	40-140	5	25	
<i>Surrogate: 1-Chlorooctadecane</i>	1.56		mg/kg wet	2.000		78	40-140			
LCS Dup										
2-Methylnaphthalene	1.60	0.20	mg/kg wet	2.000		80	40-140	4	30	
Acenaphthene	1.60	0.40	mg/kg wet	2.000		80	40-140	2	30	
Acenaphthylene	1.66	0.20	mg/kg wet	2.000		83	40-140	3	30	
Anthracene	1.71	0.40	mg/kg wet	2.000		86	40-140	1	30	
Benzo(a)anthracene	1.69	0.40	mg/kg wet	2.000		84	40-140	2	30	
Benzo(a)pyrene	1.67	0.40	mg/kg wet	2.000		84	40-140	1	30	
Benzo(b)fluoranthene	1.67	0.40	mg/kg wet	2.000		83	40-140	2	30	
Benzo(g,h,i)perylene	1.70	0.40	mg/kg wet	2.000		85	40-140	2	30	
Benzo(k)fluoranthene	1.72	0.40	mg/kg wet	2.000		86	40-140	2	30	
C11-C22 Aromatics1,2	ND	15.0	mg/kg wet							
C11-C22 Unadjusted Aromatics1	28.8	15.0	mg/kg wet	34.00		85	40-140	3	25	
Chrysene	1.72	0.40	mg/kg wet	2.000		86	40-140	0.6	30	
Dibenzo(a,h)Anthracene	1.71	0.20	mg/kg wet	2.000		85	40-140	2	30	
Fluoranthene	1.73	0.40	mg/kg wet	2.000		87	40-140	0.2	30	
Fluorene	1.68	0.40	mg/kg wet	2.000		84	40-140	1	30	
Indeno(1,2,3-cd)Pyrene	1.64	0.40	mg/kg wet	2.000		82	40-140	4	30	
Naphthalene	1.59	0.40	mg/kg wet	2.000		79	40-140	1	30	



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB62922 - 3546										
Phenanthrene	1.76	0.40	mg/kg wet	2.000		88	40-140	1	30	
Pyrene	1.74	0.40	mg/kg wet	2.000		87	40-140	0.7	30	
<i>Surrogate: 2-Bromonaphthalene</i>	<i>1.57</i>		mg/kg wet	<i>2.000</i>		<i>78</i>	<i>40-140</i>			
<i>Surrogate: 2-Fluorobiphenyl</i>	<i>1.65</i>		mg/kg wet	<i>2.000</i>		<i>82</i>	<i>40-140</i>			
<i>Surrogate: O-Terphenyl</i>	<i>1.64</i>		mg/kg wet	<i>2.000</i>		<i>82</i>	<i>40-140</i>			
LCS Dup										
2-Methylnaphthalene Breakthrough	0.0		%				0-5		200	
Naphthalene Breakthrough	0.0		%				0-5		200	



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

Notes and Definitions

- Z18 Temperature is not within 23 +/-2 °C.
- Z-08 See Attached
- U Analyte included in the analysis, but not detected
- D Diluted.
- ND Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
- dry Sample results reported on a dry weight basis
- RPD Relative Percent Difference
- MDL Method Detection Limit
- MRL Method Reporting Limit
- LOD Limit of Detection
- LOQ Limit of Quantitation
- DL Detection Limit
- I/V Initial Volume
- F/V Final Volume
- § Subcontracted analysis; see attached report
- 1 Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
- 2 Range result excludes concentrations of target analytes eluting in that range.
- 3 Range result excludes the concentration of the C9-C10 aromatic range.
- Avg Results reported as a mathematical average.
- NR No Recovery
- [CALC] Calculated Analyte
- SUB Subcontracted analysis; see attached report



CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Reed Street Lowell

ESS Laboratory Work Order: 1602612

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179

<http://www.health.ri.gov/find/labs/analytical/ESS.pdf>

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750

http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutOfStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002

<http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/documents/AllLabs.xls>

Massachusetts Potable and Non Potable Water: M-RI002

<http://public.dep.state.ma.us/Labcert/Labcert.aspx>

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424

<http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm>

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313

<http://www.wadsworth.org/labcert/elap/comm.html>

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006

http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752

http://www.depweb.state.pa.us/portal/server.pt/community/labs/13780/laboratory_accreditation_program/590095



ESS Laboratory

MicroVision Labs Coal Ash Report, Job # 9474
Client Project #: 1602612

Scope of Work:

This report covers the methods and findings of the Coal/Coal Ash analysis that MicroVision Laboratories, Inc. conducted on one (1) soil sample submitted for testing from project number 1602612. The purpose of this analysis was to detect and document any coal, coal ash or wood ash that may be present in the submitted soil sample by use of a combination of microscopy techniques including SEM/EDS, PLM, and macroscopic inspection.

Methods:

The sample was dried and examined by eye and under the stereomicroscope for any suspect dark components to the soil. Dark suspect particles were separated from the soil sample and prepared for examination by Polarized Light Microscopy (PLM) and Scanning Electron Microscopy with Energy Dispersive X-Ray Spectroscopy (SEM/EDS).

For the PLM examination, the suspect particle types detected in the sample were ground in a mortar and pestle, mounted on glass slides in immersion oil ($n=1.515$) and covered with glass cover slips. These sample particles were then examined at various magnifications and digital images were taken.

For the SEM examination, the suspect particle types were mounted on an aluminum analysis stub with double sided adhesive tape, coated with evaporated graphite and examined under the SEM by EDS to obtain elemental data in the form of EDS spectra. Digital images were taken of the sample particles at various magnifications with the SEM.

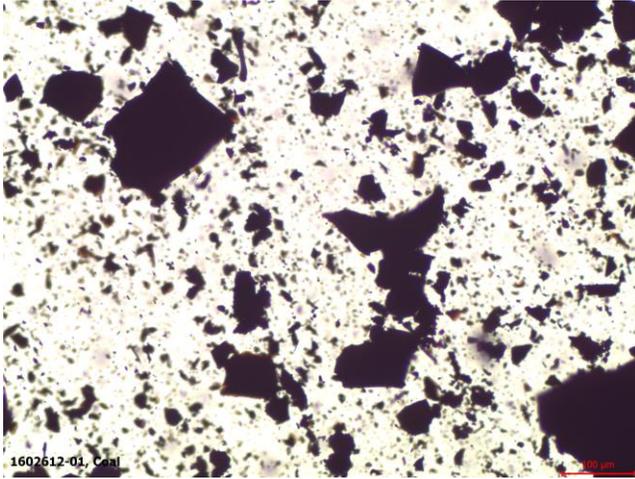
Findings:

The following pages display the data for each particle type detected in the sample for this project. Each page contains a PLM image, SEM image, and EDS spectrum for the particle types detected for this sample as well as particle type descriptions and observations.

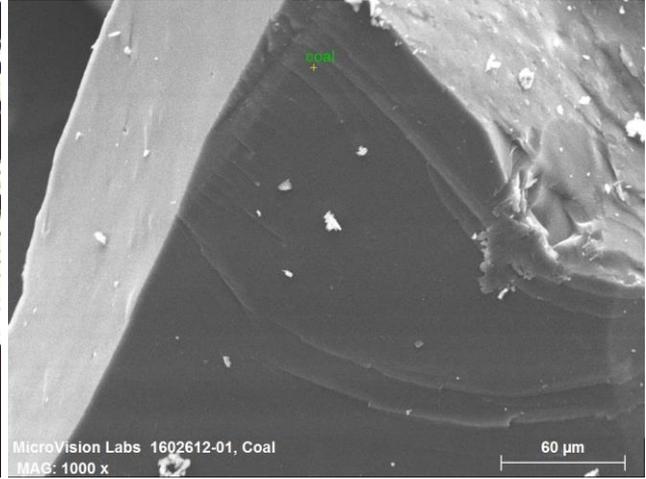
Sample: 1602612-01

Number of Suspect Particle Types: Two (2)

Coal: This particle type consisted of thirty-five to forty (35-40) shiny, black grains approximately 1-3mm in diameter. The PLM examination indicated this particle type to be consistent with coal. The PLM and SEM images of this particle type show the angular edges and typical conchoidal fractures found in coal.

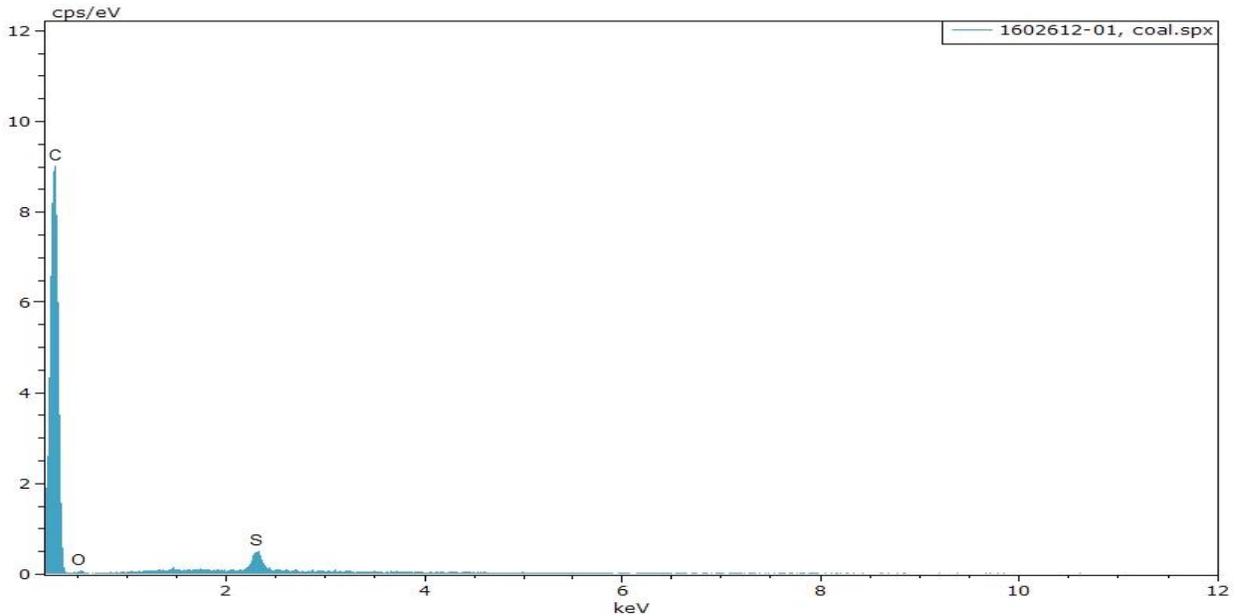


PLM Image



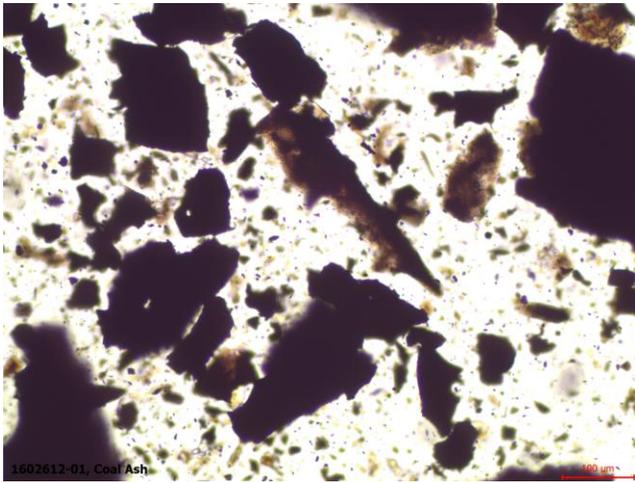
SEM Image

The EDS spectrum, shown below, confirms that this particle type is coal. The analysis for this particle shows concentrations of carbon, oxygen and sulfur.

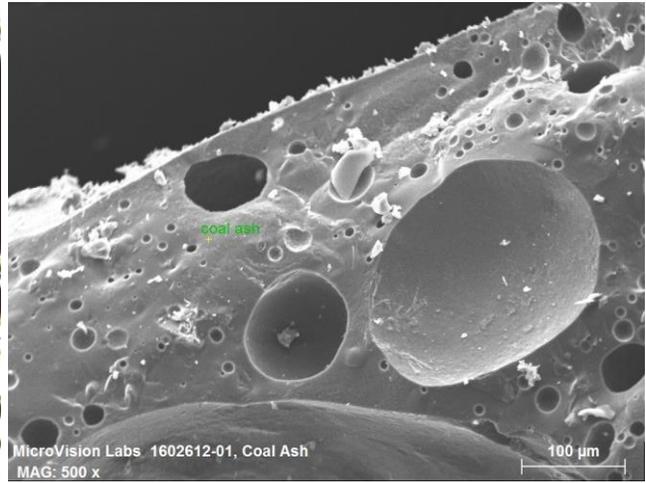


MicroVision Laboratories, Inc. 187 Billerica Road, Chelmsford, MA 01824
Phone: (978) 250-9909 Fax: (978) 250-9901 Email: Sales@MicroVisionLabs.com
www.MicroVisionLabs.com

Coal Ash: This particle type consisted of fifteen (15) dark, porous grains approximately 1-6mm in diameter. The PLM examination indicated this particle type to be consistent with coal ash. The PLM and SEM images show the spherical gas voids that formed during combustion.

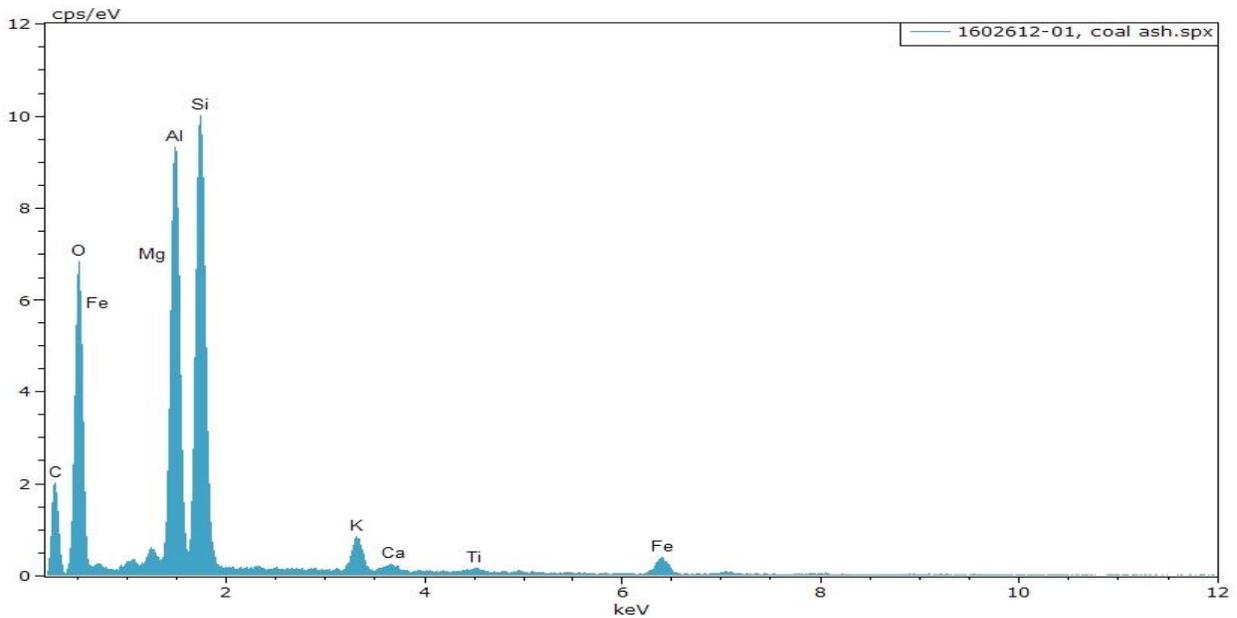


PLM Image



SEM Image

The EDS spectrum, shown below, indicates this particle type is coal ash. The analysis for this particle shows concentrations of carbon, oxygen, magnesium, aluminum, silicon, potassium, calcium, titanium, and iron.



MicroVision Laboratories, Inc. 187 Billerica Road, Chelmsford, MA 01824
Phone: (978) 250-9909 Fax: (978) 250-9901 Email: Sales@MicroVisionLabs.com
www.MicroVisionLabs.com

Results Summary Table:

Sample Name	Material Detected
1602612-01	Coal (moderate), Coal Ash (light)

The concentrations of the particle types detected in this sample are listed in parenthesis in the table above and are based on the number of particles found and the relative difficulty in finding them. The concentration information is listed for informational purposes only and has no bearing on exemption status.

Please let us know if you have any questions about this analysis or if there is anything else we can do for you.

Sincerely,



Denise Bergstrom
Analytical Microscopist

WR 2/29/16
1602379 1602612

CHAIN OF CUSTODY

ESS Lab # 1602612 ^{WR} 2/29/16

Turn Time Standard Other _____
 Regulatory State MA RI CT NH NJ NY ME Other _____
 Is this project for any of the following: (please circle)
 MA-MCP Nav USACE CT DEP Other _____

ESS Lab # 1602612 ^{WR} 2/29/16
 Reporting Limits - RCS-1
 Electronic Deliverables Excel Access PDF

Project # L-0704 Project Name Reed St, Lowell
 Proj. Location Reed St, Lowell PO # L-0704

City, State Worcester MA Zip 01608
 email: _____

Co. Name Tighe + Bond
 Contact Person Matt Abraham
 Address 446 Main St
 Tel. _____

ESS Lab ID	Date	Collection Time	Grab-G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis
W 2/29/16	2/16/16		G	S	B-5 (12-14')	1	2	AB	4/8	FISH CARBON PARTS COH/CORR TEST Lead TCLP
					END					

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA
 Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Ascorbic Acid, 8-ZnAct, 9- _____

Cooler Present Yes No NA: X
 Seals Intact Yes No NA: X

Cooler Temperature: 2.6 106 2/29/16 [] Technician _____
 Sampled by: Trever Poole

Comments: Added volume to existing sample (see Michelle)

Received by: (Signature, Date & Time) [Signature] 2/29/16 12:05
 Relinquished by: (Signature, Date & Time) [Signature] 2/29/16 15:32

Received by: (Signature, Date & Time) [Signature] 2/29/16 1550
 Relinquished by: (Signature, Date & Time) [Signature]

* By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results